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Technical report: The development of Ethiopia's furniture and joinery industry in the PTA context*

Prepared for the Preferential Trade Area for Eastern and Southern African States (PTA)
by the United Nations Industrial Development Organization,
associated agency of the Food and Agriculture Organization of the United Nations, which acted as executing agency for the United Nations Development Programme

Based on the work of Pietro Borretti,
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ABSTRACT

Pietro Borretti, The Development of Ethiopia's Furniture and Joinery Industry in the PTA Context - FAO/PTA/UNIDO, May 1990

The report reviews the status of Ethiopia's secondary woodprocessing industry with respect to market conditions, level of technology, product development and supply and utilization of plantation-based materials, in cross-reference with the situation in the PTA subregion. It outlines opportunities for (1) import of raw materials from other PTA countries, pending the development of Ethiopia's own plantation forests; and (2) exchange of applied research work with respect to the utilization of plantation species. The report also provides terms of reference of proposed technical assistance activities to be undertaken at subregional and national level aimed at increasing the operative efficiency of the sector. Annexed is a check list of woodworking factories in other PTA countries whose operation and/or products could be of interest to Ethiopian manufacturers.

INTRODUCTION

1. Title of mission:	Survey of Ethiopia's secondary woodprocessing industry in the PTA context.
2. Mission carried out by:	Pietro Borretti Consultant in Secondary Wood Industry
3. Period of mission:	22 Nov. to 7 Dec. 1990
4. Title and number of project:	Intra-regional Cooperation in Development of Plantation-based Forest Industries - RAF/87/117 UNDP funded Regional Project), P.O.Box 30563, Lusaka, Zambia.
5. Executing Agency:	Food and Agricultural Organization of the United Nations (FAO)
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7. Sub-regional Institutional relationship:	Secretariat of the Preferential Trade Area for Eastern and Southern African States (PTA). Headquarters: P.O.Box 30051 Lusaka, Zambia
8. Objectives of the mission:	(a) To undertake a survey of existing furniture manufacturing enterprises; (b) To collate information on supply and demand of furniture, (c) To recommend how rationalization and future investment plans in the sector can be implemented, (d) To evaluate priorities for rehabilitation, modernization, and expansion.

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CHAPTER I - SUMMARY AND CONCLUSIONS

1 The market for furniture and joinery products is rapidly increasing in urban centres due to an average annual 4.6 per cent population growth in those areas. Assuming a continuation of this trend, the capacity of furniture and joinery production shall have to satisfy the needs related to the formation of about 700,000 new household family units in urban areas in this decade.

2 The effective furniture demand in urban centres was estimated at Birr 27.9 million in 1986 (lowest estimate), as compared to an apparent consumption of only Birr 18.6 million. The demand was forecasted to grow to Birr 50 million in 1990 and to Birr 102 million by the year 2000.

3 The main constraint faced by the furniture and joinery manufacturing sector is a severe, ever increasing shortage of raw materials, both sawn wood and wood-based panels. As a result, the utilization of installed capacity of the main furniture manufacturing enterprises does not exceed 60 per cent.

4 The bulk of the primary and secondary wood processing industries in Ethiopia consists of public enterprises generally grouped under corporations administered by the Ministry of Industry, Ministry of

Construction and Ministry of Agriculture. The main and more modern furniture and joinery enterprises are located in Addis Ababa.

5 Ethiopia operates some of the earliest mechanized factories established in developing Africa for the production of standard furniture; with one particular plant having introduced in the early 1950's modern designs of typical Scandinavian inspiration. Some of these designs have retained to date their marketing validity. On the other hand, the industry has remained behind in the introduction of the modern type of panel furniture of modular-design type which allows to optimize the advantages of industrialized production.

6 One particular general-purpose woodworking plant has developed designs of standard furniture incorporating traditional wood carving feature, which could serve as useful reference to other PTA countries with a wood-carving tradition.

7 Throughout the years, the main furniture plants have upgraded their facilities by introducing new equipment. This effort, however, has not always proved satisfactory, because it has led to the introduction of machinery not suitable for local conditions. On the positive side, some appropriate technologies have been adopted, such as the use of clamp carriers and of a machine attachment for the production of round-end tenons on standard spindle

moulders; whose utilization should also be encouraged in other PTA countries.

8 From the stand point of plant operation, productivity and cost efficiency are hampered by a low level of interchangeability of component parts, resulting in excessive remedial work done by hand subsequent to wood machining and prior to assembly.

9 The secondary wood-processing sector as a whole lacks an adequate appreciation of appropriate tool and machine maintenance techniques. In fact, with the exception of two particular plants it lacks proper tool maintenance equipment. It is recommended that one of these plants, together with the WUARC sawdoctoring servicing centre, be utilized for conducting tool maintenance courses for the benefit of the PTA sub-region as a whole.

10 The Government has put great emphasis on the development of micro-scale woodworking workshops and woodworking cooperatives of both producer and service type, especially in the context of helping develop smaller urban centres. It would be very useful in this context for those in charge of the promotion of co-operative enterprises in Ethiopia to observe the operation of the BEDCO woodworking coperative established in Maseru, for the benefit of 15 micro-scale furniture and joinery manufacturing units. Because the development

of coperative enterprises is also a priority in other PTA countries, it is recommended that a seminar of sub-regional scope be conducted in Lesotho to cover this subject.

11 The secondary wood-processinn sector so far has almost exclusively relied on natural forests for its wood supply. Such forests are now considered as a dvindling resource, having dropped from 40 per cent of the total land area less than a century ago to the present 3.6 per cent, disappearing at a rate of 100,000 to 200,000 ha annually. On the other hand, industrial plantations are not old enough to yield any saw logs of importance of clear-cutting age. Moreover, the level of planting is low and stagnating. In fact, of the total sawn wood production capacity, only about 10 per cent derives from planted forests.

12 The current sawn wood demand-supply gap and the progressive increase in sawn wood demand are such that there is no prospect in the foreseeable future to solve the accumulating sawn wood shortage by relying entirely on local supply. Therefore, while the plantation resources are gradually built up, Ethiopia should investigate the possibility of importing sawn wood from PTA countries, such as Kenya, with a surplus of sawn wood production capacity of plantation species.

13 A similar situation is experienced with respect to the utilization of particleboard (whose supply is estimated at only 39 per cent of the effective demand), as well as of hardboard and plywood. Here again, other PTA countries, such as Kenya, might help fill the supply-demand gap. In the meantime, it is important to study the possibility of increasing the supply of wood-based panels to the furniture industry by introducing the manufacture of blockboard, a panel-board material whose raw material inputs can be derived from plymill and sawmill residues. The operation of the ITG blockboard unit in Blantyre, Malawi, could serve as a useful reference in this respect.

14 Unlike other PTA countries, Ethiopia has yet to utilize plantation species as raw material in the secondary wood processing industry. Reference should be made in this respect to plants in Kenya, Malawi, Swaziland, Zimbabwe, etc., which are engaged in the manufacture of furniture, joinery and structural building components, both for local consumption and export, using exclusively pine, cypress, or eucalyptus as raw material inputs. A list of such plants is given in the Annexes of the report.

15 On the other hand, the technique adopted in Ethiopia for the efficient utilization of eucalyptus poles in the fabrication of roof-trusses, in nearly all formal housing projects, could be of interest to other PTA member

states. Exchange of experience would also be auspicable since Ethiopia is the only PTA country which utilizes exclusively eucalyptus in the manufacture of particleboard and hardboard.

16 The serious shortage in raw material supply underscores the need to improve wood processing efficiency so as to arrive at a more rational utilization of scarce wood inputs. Moreover, as with the secondary wood-processing in the PTA sub-region as a whole, the furniture and joinery industry in Ethiopia is seriously affected by the lack of appropriate training programmes - at formal, institutional level - to generate the necessary know-how at both skilled-worker and production supervisor levels.

17 The consultant recommends that a series of "Eye opener" seminars and specialized courses be conducted by the FAO/PTA/UNIDO project on a sub-regional basis with the participation of technicians and managers from furniture and joinery plants. In addition to dealing with critical topics of wood-processing techniques, product development and production management, the seminars will serve to:

(a) provide a forum for exchange of experience,

(b) provide a basis for co-ordinated applied research work on the utilization of fast-growing plantation species, and

(c) provide a basis for the preparation of training manuals to serve as permanent reference for both training institutions and factory managerial staff.

18 Details of objectives, outputs and activities of Recommended Follow-up components are given in Chapter III of the report.

1. Demand and supply

1.1 Present status

Ethiopia's urban population, which provides market scope for furniture and joinery produced by the formal manufacturing sector, represented in 1987 12 per cent (5.4 million) of the total population of 44.8 million, as estimated by the 1989 World Bank Development Report. According to the report, the urban population grew at an average annual rate of 4.9 and 4.6 per cent in the periods 1965-80 and 1980-87 respectively. About half of the total urban area consists of centres with a population of over 20,000; the major cities being the capital, Addis Ababa (1.412,275), Asmara (275,385) and Diredawa (98,000).

Assuming a continuation of the 4.6 per cent growth rate trend, the country's urban population can be projected to 6.1 million in 1990 and 9.6 million by the year 2000, corresponding to about 1.3 million and 2 million household units, respectively; meaning an estimated formation of about 700,000 new household family units (each consisting of an average of 4.6-4.7 members) in urban areas in this decade. The market for furniture also includes the demand from the large foreign community related to the presence in Addis Ababa of the Headquarters of the Economic Commission for Africa (ECA) of the United Nations, the Headquarters of the Organization of Africa Unity (OAU) and numerous foreign aid projects.

According to the Industrial Project Services (IPS), the cumulative supply of furniture in the last ten years has risen sharply with no sign of saturation, indicating a growing market demand and a large backlog of unsatisfied demand. In fact, the apparent consumption of furniture was estimated to be Birr 18. 58 million in 1986; whereas the lowest estimate of effective demand was set at about 27.9 million.

The main reason for the unfulfilled demand is the shortage of raw materials (both sawn wood and wood-based panels). Delivery waiting periods of up to 8 months are the current situation in the supply of furniture.

1.2 Future development:

According to projections made by IPS on the basis of construction plans of housing units to be built by both the private and the public sectors, the demand for furniture is expected to double, at constant 1986 prices, from a value of Birr 50.36 million in 1990 to Birr 102.2 million by the year 2000, and to nearly quadruple from Birr 8.11 million to Birr 21.4 million as regards joinery, in particular flush doors, in the same period.

The projected demand covers the needs of housing units in urban areas with a population of over 20,000 and includes standard furniture and joinery, as well as low-cost furniture and joinery.

With respect to institutional furniture, the bulk of demand is expected to consist mainly in school furniture

based on the projected need, for the period 1990-2000, for about 58,500 new primary school classrooms and 48,600 secondary school classrooms country-wide, each classroom having a capacity for 40 pupils. By applying the total-population/urban population ratio of 12 per cent estimated for 1987 by the World Bank, the total demand for school furniture in urban areas would correspond to the need in this decade for about 13,000 new classrooms.

PTA context: The possibility of the Ethiopian furniture industry being able to fill the accumulating demand-supply gap and fulfil the projected medium-term demand appears very problematic. The main constraints being the severe shortage of local raw material inputs and when and how this situation can be corrected by relying exclusively on local natural and plantation forests resources. The opportunity should therefore be investigated of either importing finished/semi-finished furniture or sawn wood and wood-based panels from other PTA countries, such as Kenya, with current surplus of these products.

1.3 External trade

Imports and exports in wood products are negligible. Imports are limited to pulp and paper, sliced veneer (mainly teak wood and mahogany) and office furniture imported by international organizations. Export is limited to natural gums.

CHAPTER II - FINDINGS

2 Review of production facilities

2.1 General status of the industry

The country's secondary wood processing sector consists of a wide number of artisanal workshops whose operation is based on the utilization of hand tools, and a limited number of semi-mechanized and mechanized enterprises 65 of which are located in the capital city of Addis Ababa. All the main secondary woodworking plants, in terms of mechanization and level of employment, are public enterprises. In particular, Addis Ababa's four furniture and joinery-making public enterprises under the National Metal Work Corporation (NMWC), total 925 employees and a production value of Birr 13.6 million, compared to a total manpower of 800 and a production value of Birr 3.8 million of the 61 workshops and plants in the private sector.

The main and more modern furniture plants of Warka, Blue Nile and Finfine in Addis Ababa and Barka in Asmara have been operated since 1984 under the NMWC of the Ministry of Industry. The plants had been established in the early 1950's by foreign residents and were subsequently nationalized in 1977 under the National Wood Work Corporation, of the same ministry, now no longer in existence. Throughout the years new equipment has been added to the plants now under the NMWC,but, unfortunately, no guide-line specifications have been developed so far as a guide to proper selection and standardization of machinery for those furniture and joinery plants.

The main and most modern joinery plant is Wanza Wood Work with a work force of 283, also located in Addis Ababa. It is under the responsibility of the Ethiopian Construction Materials Corporation of the Ministry of Construction which also administers some sawmills, equipped for occasional production of furniture and joinery, and all the wood-based panel plants (particleboard, plywood and fibreboard) in the country.

Some joinery and furniture is also produced by the sawmills of the Sawmills and Joineries Enterprises (SJE) of the Natural Resources Conservation and Development Main Department (NRC and DMD) under the Ministry of Agriculture.

Furniture and joinery are also produced by the Ministry of Education and the Prison Administration of the Ministry of Interior.

A woodworking shop is operated under the Handicraft and Small Scale Industry Agency (HASIDA) of the Ministry of Industry, which is entrusted, inter alia, with the promotion of producer and service cooperatives.

Finally, furniture is produced in the woodworking plant of the Ethiopian Tourist Trading Corporation (ETTC), the only manufacturers of wood-carved furniture in Ethiopia.

2.2 The Warka furniture plant

Established in 1952 as the Mosvold Furniture Factory by resident Norwegian entrepreneurs, Warka remains to date the most diversified furniture plant in Ethiopia, catering for the needs of medium and high-income groups.

Warka is the main furniture factory in the country and the second largest secondary wood processing plant after the Wanza joinery plant. Its turnover in 1988-89 amounted to Birr 3.9 million and it provides employment to a total of 250 people.

Its product range includes complete lines of standard household furniture - dining, living and bedroom furniture - as well as standard office furniture. In fact, it also produces one of the cheapest general-purpose wooden chairs available on the market. Office furniture includes an entire range of desks and chairs from top executive to secretarial types.

The plant is equipped with a range of traditional types of machinery for the processing of both solid wood and wood-based panels, including veneer preparation and veneer pressing on particleboard panels. Some new pieces of equipment have been acquired in the last ten years to replace older machines and add new ones for the purpose of expanding production. Warka is also equipped with machinery for the processing of steel tubing which is utilized as a complementary material in some of its furniture.

Practically all structural panel components are made of veneered particleboard while cabinet backs and drawer bottoms are generally made of hardboard. The plant is the most affected by the raw material shortage because of its relatively high sawn wood requirements. The required and actual supply of raw materials per year is indicated as follows:

	required	actual
- solid wood	1,000 m3	300 to 400 m3
- particleboard	600 m3	200 m3
- plywood	3,000 sheets	800 sheets
- hardboard	2,200 sheets	1,000 sheets

Most of the furniture items produced are of designs introduced during the initial period of factory operation in the 1950's and reflect typical Scandinavian trends based on functionality, simplicity of lines, lightness of structures and matt, natural finish. Because of these characteristics, most designs of dining chairs, easy chairs, tables, beds and most desks produced by Warka have retained their marketing validity and could serve as an appropriate reference to furniture manufacturers in other PTA countries. Whereas, storage cabinet designs for bedrooms, dining rooms, living rooms and office end uses are now superseded because they are based on the traditional concept of individual, isolated units (sideboards, cupboards, wardrobes) of fixed storage function and capacity; as against the contemporary concept of storage cabinets based on the flexible modular system, whereby panel components of various standard sizes can be assembled together by means of dowels or knock-down fittings according to size and function requirements of individual customers. See Annex IV.

PTA context: because the absence of the modular type of panel furniture is a problem shared by the furniture industry of most PTA member states, it is recommended that the subjects of modular storage system and of selection of related production equipment be dealt with in the proposed

sub-regional seminars to be organized by the FAO/PTA/UNIDO project. (See objective 1 in Recommended Follow-up chart).

The efficiency of Warka's chair and table structures has been facilitated by the utilization of the round-end-tenon type of joints performed with the aid of an ingenious spindle-moulder attachment of German make.

This jointing technique is typical of the industrial system as compared with the traditionally square-end tenons inherited from the artisanal system.

Another of Warka's operative assets is represented by the utilization of clamp carriers for the purpose of edge banding solid wood strips on to the particleboard panels. The clamp carrier is based on manual operation and should be used in preference to automatic edge banding machines which require a special type of glue and are not suitable for the production of panel furniture in small batches. Moreover, the clamp carrier is more versatile in that it can be utilized for gluing narrow strips of wood into large boards, and for assembling wooden frames. PTA context: Operating problems have been encountered in Kenya and in Malawi in the introduction of automatic edge banding machines and board-laminating presses. The clamp carrier used by Warka could serve as a useful reference to other furniture manufacturers in other PTA member states involved in small series production of panel furniture.

Another example of efficient construction methods utilized by Warka is the dovetail tongue-and-groove joint adopted for the assembly of drawer fronts and made on a very

versatile type of dovetailing/routing machine. PTA context: Again, this technique could be singled out for adoption in other furniture factories in the PTA instead of the prevalent system of nailing drawer sides to drawer fronts.

Warka's tool maintenance workshop is equipped with the most comprehensive set of machinery in Ethiopia's secondary woodprocessing sector. It includes, among others, a manual sharpener for carbide-tipped circular saws. PTA context: Although there is much scope for improvement of its tool sharpening techniques, this particular workshop can be considered as representative in the PTA as regards to proper, within-plant tool maintenance services and could therefore be utilized for hosting a sub-regional short-term training course conducted by an expert under the FAO/PTA/UNIDO project (see Objective 4 in Recommended Follow-up Charts).

Warka's main needs for additional equipment: double-blade circular saw; multi-spindle boring machine, router, manual turning lathe, in that order. New equipment which is not being utilized: small edge banding machine with hot-melt gluing system; wide-belt sander.

2.3 The Finfine Furniture/Joinery Factory

The plant was established in the mid 1960's as the 3 F Furniture Factory and it was nationalized in 1975 together with the other woodworking plants now under the National Metalwork Corporation (NMWC). It is the second largest furniture plant in the country with a manpower of 215, a factory building area of 2118 m2 and a turnover of

Birr 3.5 million in 1988-89. The main product line includes fully-upholstered sofas and easy chairs, and mattresses. It also produces on an individual order basic items such as built-in furniture, kitchen cabinets, shelving, interior panelling and shutter frames. Finfine is also one of the three major plants, with the Barca factory in Asmara and the Wanza factory in Addis Ababa, producing flush doors.

Due to raw material shortage, the Finfine plant operates at around 60 per cent of installed capacity. The delivery waiting list ranges from 4 to 8 months. Consumption of material for the year 1988-89 includes: 460 m3 sawnwood; 5836 sheets of particleboard, 1240 sheets of hardboard. Also utilized is both locally - made and imported sliced veneer.

The Finfine plant is equipped, as the Warka and Blue Nile furniture factories, with equipment for the processing of both solid wood and wood-based panels. Compared to the other two plants, it also utilizes a four-side moulder and a heavy-duty panel sizing machine with overhead blades. In addition, Finfine is the only plant in Ethiopia equipped with a multi-spindle boring machine. This asset, however, is not appropriately utilized because of two constraints:

- The absence of panel-furniture specifically designed to take advantage of the dowel - joint system; and

- The difficulty in controlling the quality and diameter of the factory-produced dowels.

2.4 The Blue Nile Furniture Plant

Established in the mid 1960's as the Telfenson Furniture Factory, the Blue Nile plant was nationalized in 1975. It is the third largest furniture manufacturer, after the Warka and Finfine plants, with a total manpower of 200 and a building area of 2098 m2.

The Blue Nile specializes in the production of standard office furniture, mainly desks. It also produces on order kitchen cabinets, other household furniture and school furniture. The main raw materials are veneered particleboard for panel components and square steel tubing for leg structures. The Blue Nile is in fact the NMWC furniture plant with the greatest consumption of steel tubing. In view of the fact that the Blue Nile makes little use of sawn wood, the scarcest raw material, its production has not been as severely affected as the Warka furniture factory. However, of its annual particleboard intake capacity of 5000 sheets, it can obtain only around 3000 sheets.

The plant is equipped for the processing of both solid wood and wood-based panels. The original set of equipment included only basic woodworking machinery. The line for the production of panel furniture was introduced some seven years ago. It includes the entire range of equipment for veneer preparation, veneer-pressing onto particleboard panels, cutting to size, sanding on a wide-belt sander and automatic edge-banding. This particular investment, however, has not brought about the expected benefits due to the following drawbacks:

(a) A gap in the production line due to the absence of a multi-spindle boring machine which is an essential component for the efficient manufacture of modern types of panel furniture,

(b) The non-utilization of two major items of machinery: the automatic edge banding machine and the wide-belt sander. The problems with the former being the difficulty to obtain spare parts, and the special type of glue (hot-melt), and the unsuitability to edge banding of small batches of panels. The problems with the latter being the difficulty to sand veneered furniture panels made of locally-produced particleboard of uneven thickness (variation of over 3mm over the length of the board), and the difficulty to import and upkeep wide sanding belts. The sanding of veneered panels is currently carried out by means of two stroke belt-sanding machines, one of which was fabricated in the factory itself.

The investment in new wood processing machinery has not been matched by the introduction/renewal of essential tool maintenance machinery. What is lacking, for example, is a universal sharpener for moulding cutters, which are currently ground by hand, while the existing planer-knife sharpener is too obsolete to be of much use.

The management of the Blue Nile has assigned great importance to the utilization of jigs as a means of increasing productivity and facilitating the

interchangeability of component parts. Interesting work has been carried out in this respect for assembling and band sawing operations. Much has still to be done, however, in order to expand this initial experimentation into a systematic effort. The technical department is also experimenting with the fabrication of a round-end tenoning attachment of the type in operation at the Warka Furniture Factory.

PTA context: An opportunity will be provided to expand the jig-related know-how, in conjunction with the introduction of appropriate quality control methods, as part of the "Eye opener" seminars proposed for implementation under the FAO/PTA/UNIDO project(see Objective 1 in Recommended Follow-up chart).

2.5 The Wanza Joinery Factory

Wanza is the most modern and largest joinery plant in Ethiopia. It is a component of the Wanza group of public woodworking enterprises, with a total of 446 workers, under the Ethiopian Construction Materials Corporation. Of the other two plants, one is located in Awassa and is also engaged in joinery manufacture, while the second is a sawmill with a small joinery section located in Jimma. The Addis plant is the largest one of the group and in the secondary wood-processing sector as a whole, having a total of 283 workers and a turnover of about Birr 5.4 million. All the new factory buildings have been newly built. The total capital investment amounts to Birr 4.3 million.

The range of Wanza products includes solid wood doors, flush doors, interior joinery work (such as panelling), built-in cabinets etc.. The plant also produces utility furniture for particular requirements, and is equipped for the tanalith treatment of eucalyptus poles for building construction purpose (33,000 poles treated in 1988 - 89). In general, the plant serves to fulfill the woodworking requirements of the Corporation's own building activities.

Unlike most of the other secondary wood processing factories, Wanza is less affected by the shortage of sawn wood in that its supply derives from the sawmill of the Wanza group of enterprises. In fact the Ethiopian Construction Material Corporation is studying the possibility of developing a plantation area to satisfy the raw material requirements of its woodworking plants including Wanza, ECAFCO (particleboard), ETHARSO (fibreboard) and the plywood manufacturing factories.

The Wanza plant is equipped with a total of 47 woodworking machines of which 16 are as old as 25 years and 31 of modern type which were recently acquired as part of the plant renewal programme. The total investment in production equipment amounts to Birr 1.5 million. Of the 4 automatic machines among the new equipment none is being utilized. They include: a new-generation automatic machine (type SAC F 6) for the simultaneous tenoning and moulding of door and window components; automatic slot mortiser for louvre shutters (type OMG, EPM/70); automatic dowel-inserting machine (type BROVIND, O B 500); wide-belt sander (type STETON CL 2-110). The causes of this problem are: lack of experience in the

operation of complex automatic equipment (simpler equipment could have been supplied to perform the same type of operation), complex maintenance requirements and difficulty in obtaining spare parts. An additional problem consists in the lack of experience in designing joinery items in such a way as to optimize the advantages of mechanized production.

In view of the specific and urgent need on the part of the Wanza plant to develop the capabilty to utilize profitably its recent investment in new machinery, it is recommended that ad-hoc technical assistance be provided at national level to this particular joinery plant (see Objective 3 in Recommended Follow-up Charts).

2.6 The ETTC woodworking plant

The woodworking plant of the Ethiopian Tourist Trading Corporation (ETTC) is engaged in general woodworking activities related to interior decoration projects, such as shop furnishing, promotional displays, trade fairs, etc. In addition, the ETTC plant is the only furniture-making enterprise in Ethiopia to have designed and produced wood-carved furniture reflecting Ethiopian traditional design features. Recently, ETTC has been experimenting with chair designs of modern lines also based on the interpretation of traditional design aspects.

PTA context: Since ETTC is possibly the only woodworking plant in PTA to have developed furniture based on the utilization of traditional wood-carving features, it is recommended that their experience be shared by furniture

manufacturers of other PTA member states, through holding a furniture exhibition of sub-regional scope, where each member state would display a representative selection of their furniture production.

2.7 Woodworking cooperatives

2.7.1 The role of HASIDA

Within its scope of promoting handicrafts and small scale industries, the Handicraft and Small-scale Industries Agency (HASIDA) of the Ministry of Industry, supports and assists in the establishment of woodworking cooperatives. There are at present 21 of them, 8 of which are producer cooperatives and the remaining service cooperatives. Through HASIDA these cooperatives can obtain loans from the Agricultural and Industrial Development Bank (AIDB) and the Commercial Bank of Ethiopia (CBE). HASIDA plans to cooperate with international banking institutions in developing a credit and saving scheme in connection with organizing potential micro-scale enterprises beneficiaries in service cooperatives. The services provided by the cooperatives include, among others: administration of loans; purchase of raw materials at wholesale prices; finding market channels; securing workshop premises and making contractual agreements and other forms of representations on the behalf of members.

2.7.2 Tabborut Producer Co-operative

(United Wood and Metal Work Co-operative)

The Tabborut furniture/joinery cooperative workshop was established 30 years ago as a private enterprise and transformed into a producer cooperative in 1975. It includes 31 member co-workers. Its range of utility wood products includes sideboards, wardrobes, beds, chairs, fully upholstered easy chairs and sofas, shutters, solid wood doors and flush doors. The main raw materials are sawn wood (about 300m^3/year), particleboard (300 sheets), plywood, formica and steel tubing. Most panel furniture produced consist of components made of particleboard panels faced with formica on one side and .4mm plywood on the other, resulting in wasteful use of materials. This problem could be overcome by the particleboard plant making available to the micro-scale workshops ready-veneered particleboard panels for cutting to size as required.

The Tabborut workers have gained experience in the operation of a wide range of basic woodworking machinery including bandsaw, spindle moulder, combined thicknesser and surface planer, combined three-side planer, and slot mortiser. All the equipment is however obsolete, having been in use for the past 30 years, resulting in very high wastage rate of raw material input, high maintenance cost and very serious safety hazards. Furthermore, the workshop is housed in very cramped premises.

2.7.3 The Wood Products Service Co-operatives

Established in 1985, this service cooperative is housed in a compound consisting of a small timber yard and a number of working rooms where individual artisans process and assemble their wares entirely by hand. The cooperative specializes in the manufacture of wooden chests, widely used in dwellings of lower income groups, donkey saddles for carrying merchandise, and low-cost chairs. The main service provided by the cooperative to its members is the supply on credit of sawn wood at wholesale prices of Birr 200 to 300 / m3. It is the modest profit charged on the timber sale that covers the operating expenses of the cooperative.

The cooperative has asked for HASIDA assistance in the purchasing of basic woodworking equipment so as to combine hand-processing with basic wood-machining operations.

2.7.4 The development of woodworking cooperatives in the PTA context

The promotion of small-scale workshops and cooperative enterprises of both servicing and manufacturing type is a development priority adopted by other PTA member states such as, for example, in Kenya and Uganda, in view of their labour-intensive production techniques, suitability to help develop smaller urban centres, and employment of simple technologies which are easy to adopt. It is therefore recommended that technical assistance be provided by the FAO/PTA/UNIDO project to help develop the efficiency of the micro-scale furniture/joinery industry in the PTA sub-region as a whole (see Objective 5 in Recommended Follow-up Charts).

A particularly interesting cooperative woodworking project, which could serve as a useful reference to HASIDA in rehabilitating the producer and service cooperatives in Ethiopia, is the cooperative operated in Maseru, Lesotho with the assistance of the Basotho Enterprise Development Cooperation (BEDCO). The project was established to serve the needs of 15 micro-scale furniture and joinery-making units located in the Bedco industrial compound in Maseru. One of the main services provided by the BEDCO woodworking centre consists in making available to the woodworking entrepreneurs in the compound the use of machinery placed in a common workshop.

2.8 Future development of the furniture and joinery industry

An ambitious plan was prepared by IFS in 1986 to expand and rehabilitate the furniture manufacturing facilities of the NMWC in Addis Ababa and Asmara - representing about 73 per cent of the total furniture production capacity in the formal manufacturing sector - whereby, working on a double-shift basis, such plants would have increased their furniture output from about Birr 13.56 million in 1986 to around Birr 37.8 million in 1990-91 and to about 85 million by the year 2000.

However, the serious worsening in the supply of sawn wood and wood-based panels has resulted in the indefinite postponement in the implementation of the plan. Instead, the IFS has been entrusted with the responsibility

of preparing a feasibility study of an entirely new plant. The recommendation of this consultant is to give priority to the streamlining and strengthening of one of the existing NMWC furniture plants to become a pilot ground for the development of the furniture manufacturing sector as a whole. While Wanza, the most modern joinery plant in the country, could be assisted in leading the way in the development of the joinery manufacturing sector as a whole.

3 Wood research institutions and activities

The Wood Utilization and Research Centre (WUARC) is the only institution in Ethiopia engaged in applied research on all main wood properties, including physical, mechanical, seasoning, durability, treatability and working properties. Originally set up in 1978 under the Natural Resources Conservation and Development Main Department of the Ministry of Agriculture, WUARC later expanded its activity to trial production of sliced veneer, sawdoctoring services, furniture prototype work and promotion of the use of plantation species in construction. The latter was undertaken in the framework of the regional programme "Promotion of the Rational Utilization of Plantation Timber in Building construction" which was initiated in 1985 by the FAO/ECA/UNIDO Forest Industries Advisory Group for Africa (FIAG).

The plantation species studied with regards to building construction applications are Cupressus lusitanica, Pinus patula and Pinus radiata. Typical roof-truss designs

were developed in this connection with the assistance of The Orgut-Swedforest Consortium. Truss prototypes were then made and tested.

A Roof Construction Manual is now being prepared on the use of the species selected with the purpose of introducing the plantation species to the construction market. The manual is meant for builders and carpenters. In addition, data sheets are also being prepared for each species for the reference of structural engineers. They will provide details on timber properties, most important allowable stress values, and grading guidelines. Since there is no Ethiopian Code for Structural Timber, Swedish Norms on similar timber will be given as an example.

WUARC also plans to carry out a programme for the design and prototype testing of doors and windows made of plantation species. The project is to be carried out in connection with the implementation of a low-cost housing project of the Ministry of Housing, Research Department. Different door and window designs will be evaluated from cost, production and user points of view.

In addition to the wood testing facilities at WUARC, the Building College of the Faculty of Building Technology is equipped to carry out tests on full-size timber components.

PTA context: A number of research activities have been carried out in various PTA countries in connection with the utilization of plantation species in building construction as well as in furniture and joinery production. To date, however, no exchange or comparison has been made of experience gained individually by each country in this

respect. It is recommended that a review be made under the FAO/PTA/UNIDO project of the various research activities conducted so far in the PTA and overseas on the utilization of main fast-growing plantation species - such as Pinus spp., Cupressus spp., and Eucalyptus spp. - as a basis for the preparation of reference manuals and further co-ordinated research work (see Objective 6 in Recommended Follow-up chart).

4 Availability and utilization of raw materials

4.1 Natural forests

In Ethiopia, as in the PTA sub-region in general, natural forests are a dwindling resource. Less than a century ago, forests represented 40 per cent of the land area. According to the third Five-year Development Plan (1963-68), the percentage had dropped to 16 per cent in the early 1950's and further down to 7 per cent. It has been estimated that forests disappear at a rate of 100,000 to 200,000 ha annually as more land is cleared to expand cultivation and to meet fuelwood and charcoal needs.

At present, there is a very limited knowledge of the regeneration capacity of the natural forests, which still

constitute the main timber supply source. The remaining undisturbed natural forests are, in the main, inaccessible and will require considerable investment in infrastructural development to carry out a regeneration programme.

According to the only country- wide inventory of the closed natural forests, carried out between 1974 and 1979*, the area of undisturbed closed high forest in the mid 1970's was 2.34 million hectares of which 0,8 ha is accessible. Part of this area has since been disturbed and other areas have suffered further deterioration.

The majority of species in the natural forests consists of hardwoods. The main species utilized in the furniture and joinery industry are the hardwood Aningeria adolfi-friederici (Keraro), considered as the best indigenous species for furniture making, and the softwoods Podocarpus gracilor (Zigba) and Juniperous procera (Thid).

Natural forests include 500 ha of bamboo consisting of Arundinaria alpina occurring in the form of scattered but large and compact concentrations at high elevations (250-3400 meters) of the Shewa region, while extensive stands of Oxytenanthera abyssinica occur at lower elevations in other areas.

4.2 Plantation Forests

The first plantation forests areas were established in the 1950's. Industrial plantation includes both coniferous and eucalyptus species. A rough estimate of the total

* carried out by FAWDA in cooperation with the Land Resources Division, UK.

industrial plantation areas with respect to identified areas is given below:

- Conifers (Pinus patula, Pinus radiata, and Cupressus lusitanica)	13,900 ha
- Eucalyptus	3,200 ha
- Indigenous and trial plots not included above	250 ha
total	17,350 ha

Table 1 Total planting area in identified areas

Source: Industrial Forestry Development in Ethiopia, by Akejarvholm Anderstivell, 1987.

The majority of the exotic species have a rotation varying from 15 to 25 years compared to 30 to 60 years for indigenous trees. In addition to industrial plantations, it has been estimated that prior to 1974 about 40,000 ha of Eucalyptus globulus were planted primarily for fuelwood production. The present total of peri-urban fuelwood and polewood plantations is approximately 80,000 hectares (2).

PTA context: Ethiopia is one of the PTA member states with the smallest area of industrial forest plantations. Kenya is the most endowed in this respect with 165,000 ha followed by Zimbabwe (100,000 ha), Swaziland (99,000 ha), Malawi (91,500 ha), Tanzania (65,300 ha), Ethiopia (14,000 ha), Seychelles (10,600 ha), Mauritius (9,000 ha), Rwanda (5,500 ha) and Somalia (1,000 ha).

4.3 Prospects for the supply of sawn wood to the secondary wood processing industry

In spite of increased demand in wood products, the industrial forestry has not shown any major development in the 1980's. According to a FAO/ECA survey carried out in 1972, the production of sawn wood amounted to about 97,000 m3. In 1985-86, instead, logging permits were given for a total of 104,000 m3 (round) indicating a processed volume of only 50,000 m3. A 1987 WUARC/Swedforest report 1/ estimated as 120,000 m3 of logs (60,000 m3 of sawn wood) the production capacity of Ethiopian forests, but projected to only around 38,000 m3 of sawn wood the output of sawmills in 1988. The main reasons given for this predicted poor performance were stated as the long distances from the remaining natural forests to the sawmills and the poor state of repair of the sawmilling facilities.

1/ Plantation Timber in Construction, WUARC/Orgut-Swedforest Consortium, 1987

In so far as the natural forests are concerned, it has been assumed in a 1987 report 1/ that they constitute a dwindling resource with limited potential for expansion in terms of saw-log supply. The reason given in the report for this assumption is that much information is still to be provided, such as:

(a) How could natural forests be regenerated and managed in a way which will give more industrial wood, while taking also into account conservation requirements;

(b) Will the cost of exploiting inaccessible forest areas not be higher than the income, even with a substantial increase in prices unless other sectors in the society contribute to the development of these areas in order to justify the investment.

On the other hand it is difficult to envisage when plantation forests will be able to become a major supply source of sawn wood, taking into account the following:

(a) In 1987 it was estimated 2/ that of the 60,000 m3 of sawn wood production capacity of the forests in Ethiopia, only 10 per cent could derive from planted forests; and

(b) By another 1987 estimate 1/ the consumption of sawn wood under prevailing market prices would have been

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Industrial Forestry Development in Ethiopia, by Akejarvholm Anderstivell, 1987

Plantation Timber in Construction, WUARC/Orgut/Swedforest Consortium, 1987

around 200,000 m3 if that had been made available, meaning a 140,000 m3 demand-supply gap.

The same source projects to around 500,000 m3 the demand for sawn wood by the year 2000 and recommends an increase of the annual planting from the present level of 2,000 ha to 5,000 ha during the first 5 years and later to 8,000 ha per year. This expansion of plantation area would, however, involve consideration of competition with other land use requirements, mainly for agriculture and fuelwood, resulting from an estimated population increase from 44.8 million in 1987 to 65 million by the year 2000.

From the foregoing, it can be observed that there is no prospect in the foreseeable future to solve the problem of sawn wood shortage in the secondary wood-processing industry by relying entirely on local supply. The situation in this respect is aggravated by the fact that the furniture/joinery plants have made no efforts so far to complement the use of the traditional species, Kerare, with Pinus spp. from planted forests. This approach would have allowed to reserve Kerare for the production of furniture with high added value for the large foreign community, thus helping earn hard currency. As for Eucalyptus, the only use made of this plantation species in the secondary wood-processing industry consists in the manufacture of boxes and

crates for fruits, vegetables and beverages by sawmills in Eritrea.

However, a widespread use is made of Eucalyptus poles in the construction of roof trusses in the formal building construction sector. A WUARC/Swedforest report recommends that this practice be maintained so as to spare sawn wood for the production of windows, doors and furniture.

Scope also exists to complement the use of sawn wood by utilizing bamboo in the production of low-cost utility furniture in smaller urban areas and in rural areas.

4.4 PTA context in the utilization of plantation species in furniture and joinery production

In view of the fact that Kenya is expected to maintain a surplus of plantation timber (Pinus spp.), it is recommended that, while developing its plantation resources, Ethiopia investigate the possibility of importing sawn wood or semi-processed furniture parts from that country, in order to correct the short and medium term deficit in sawn wood supply.

Unlike Ethiopia, other PTA member states are already utilizing plantation species such as Pinus spp and Cupressus for the production of standard furniture and joinery. In this context, it would be worthwhile for the technical managers of the main furniture and joinery plants in Ethiopia to visit the following plants in the sub-region specializing in the utilization of plantation species:

- the Economic Housing Group (EHG) Furniture Factory in Kenya,

- the Kist Production Unit of the Kiambu Institute of Science and Technology in Kenya,

- the furniture factory of the Wood Industries Corporation (WIDCO), Malawi (exporting part of their products overseas), and

- the Swazi Pine Furniture Factory in Malawi (exporting overseas 100 per cent of its output).

With regards to the promotion of an expanded use of Eucalyptus in the secondary wood processing industry (on account of its much greater growth rate than that of other plantation species), it is recommended that reference be made to the integrated woodworking plant of the International Timber Group (ITG) in Malawi which produces furniture panels, structural building components and solid-wood doors made of laminated eucalyptus.

The promotion of the use of bamboo as a substitute for sawn wood in the production of low-cost furniture in the informal manufacturing sector is a matter of common interest to Ethiopia as well as to other PTA member states, such as Kenya, with bamboo forest resources. It is recommended that this topic be dealt with at a proposed seminar to be carried out by the FAO/PTA/UNIDO project for the development of

small-scale woodworking enterprises (see Objective 5 in Recommended Follow-up Charts).

4.5 Utilization of particleboard

Ethiopia is one of the first countries to have introduced particleboard manufacture in developing Africa. In fact, the particleboard plant of the Ethiopian Chipwood and Furniture Company (ECAFCO) was established 25 years ago and converted into a state enterprise in 1977. At present the ECAFCO plant produces particleboard panels and a limited volume of prefab building units, whose panels are made of particleboard and asbestos sheets.

Eucalyptus globulus used to be the only species processed until very recently. At present, however, because of an insufficient supply of this species, the raw materials include also a small proportion of sugar cane bagasse and other Eucalyptus spp.

Particleboard output amounted to 6,157 m3 in the operating year 1988-89, an increase of around 1,300 m3 compared to 1984-85. The output of prefab buildings reached 13,000 m2 floor area in 1985, but the system has never gained widespread utilization because of its high cost. Some 65 per cent of particleboard supply is absorbed by the building construction sector, which is given priority over the requirements of the furniture industry.

According to the ECAFCO management, the present supply of particleboard meets only about 39 per cent of the demand - with the furniture industry being the most affected

sector. Furthermore, the Industrial Projects Service has estimated that the furniture plants under NMWC, which represent about 73 per cent of the formal furniture manufacturing sector, once rehabilitated and expanded, would require an annual intake of nearly 9000 m3 by the year 2000 as compared to a current input of about 1000 m3. There is no prospect, therefore, of re-establishing the particleboard demand-supply balance in the foreseeable future, without the introduction in the market of imported particleboard panels.

A further problem in the utilization particleboard in the furniture industry is its low quality which is reflected in the high reject rate of particleboard inputs and the difficulty in controlling the quality of finished products.

PTA context: Kenya is expected to maintain a surplus of plantation resources and an excess of particleboard production capacity in the years to come. The possibility should therefore be investigated of Ethiopia importing particleboard from that country. In this context, it would be of particular interest to the development of the small scale furniture industry in Ethiopia to import ready veneered particleboard which is currently available as a standard product in Kenya. On the other hand, Ethiopia is the only PTA country producing particleboard with Eucalyptus as a raw material. Since Eucalyptus has a much faster growth rate than other plantation species, such as Pinus patula, the Ethiopian experience in this respect might be found of interest by other particleboard-producing PTA countries.

4.6 Utilization of hardboard

Established in 1969, the ETHARSO fibreboard plant produced 172,277 sheets in the operating year 1988-89, down from 250,423 sheets in 1987-88. Over 80 per cent of production consists of hardboard and the remaining of softboard. The plant operates at around 60 per cent of its capacity due to the obsolete equipment as well as problems in the supply of raw material which consists of eucalyptus species. Furthermore, the quality of the hardboard panels is very low, resulting in a very high reject rate.

As with sawn wood and particleboard, there seems to be little chance that the hardboard demand-supply balance can be corrected in the foreseeable future by relying exclusively on the supply of locally-produced hardboard.

PTA context: The Ethiopian hardboard plant is one of the only three such facilities in the PTA, the other two operating in Kenya and Tanzania. The ETHARSO plant is, however, the only one to utilize eucalyptus as a raw material. The plant in Kenya, operated by the Timsales company, is now in the process of modernizing and expanding its facilities by about 25 per cent of its present capacity of 10 tons a day, and might therefore be in a position to help fill the demand-supply gap for hardboard in Ethiopia considering the stagnating demand in Kenya. The availability of good grade hardboard could, inter alia, considerably expand the utilization of this material for the manufacture of low-cost furniture and joinery. For instance, flush doors

could be made with outer skins and core grids of hardboard. Another rationale for the promotion of this material is that its manufacture, unlike plywood, does not require expensive imported adhesives.

5 Priorities in the modernization of the furniture/joinery sector

5.1 Selection of machinery

The main priorities for expanded know-how in the selection of equipment are listed as follows:

(a) Standardization of specifications of machines, accessories and cutting tools for use by all public enterprises in the secondary wood processing sector, so as to:

- provide a permanent reference in ordering equipment and evaluating bids, and

- facilitate the interchangeability of cutting tools and spare parts among machinery installed in the various public woodworking plants;

(b) Development of specifications of power tools and basic machines for the introduction of an initial degree of mechanization in micro-scale workshops;

(c) Development of specifications for the introduction of machinery of more advanced type but also appropriate to local conditions and requirements.

The main aspects of machinery selection to be considered are, among others: versatility and availability of accessories; output requirements; co-ordinated relationship with other equipment in given process flows; easy maintenance; and introduction of modern processing methods, such as the use of dowel-jointing at various degrees of sophistication.

5.2 Selection of cutting tools

The need also exists for the introduction of machining cutting tools of modern design as a means to increase the quality of machined surfaces, simplify tool sharpening requirements and reduce safety hazards. A particular need in this respect is the adoption of tools of appropriate cutting edge geometry to help overcome surface quality problems encountered in the processing of plantation timber.

5.3 Interchangeability of parts

So far as the actual manufacturing process is concerned, the major challenge faced by the formal furniture/joinery sector in attaining a truly industrial

basis - that is in fully benefiting from the economy of the industrial system - is to develop a capability to produce fully interchangeable wood-machined parts, thus avoiding the time consuming and costly practice of adapting machined parts one by one by hand to fit them together during assembly. The essential know-how to be mastered in this connection includes: engineering of products as applicable to industrial production; preparation of appropriate product/process documentation as a reference in manufacturing; adoption of appropriate quality control methods and instrumentation; design and utilization of jigs as a means for attaining accuracy of work as well as for ensuring safety of operation.

5.4 Product design

The development priority with respect to product design refers to capability of designing furniture by taking into account the requirements and potential of industrialized production. In particular, a radical shift is to be attained in the design of storage cabinets (wardrobes, bookcases, sideboards, etc.) from the current fixed-purpose concept followed in Ethiopia, to the modern, versatile modular system,[1/] whereby panel components of various standard sizes are assembled together according to various end uses as required by individual customers. The modular cabinet system serves to:

(a) Cut down on the excessive number of standard cabinet designs now in production;

1/ See ANNEX IV

(b) Increase the size of production batches so as to optimize the benefit of serial production; and

(c) Increase the utilization of the more advanced types of machining already in the industry - such as the automatic edge-banding machine at the Blue Nile factory and the multi-spindle boring machine at the Finfine factory.

A similar product development capability is also to be acquired with regards to the utilization of the two idle advanced types of machines at the Wanza joinery plant.

5.5 Product costing

The current conditions of production output below installed capacity underscore the need not only for increased productivity but also for the adoption of appropriate costing methods as a basis to rational setting of furniture selling prices, which in the case of state enterprises have been frozen since 1982 as a matter of government policy. Of particular importance with respect to product costing is the capability of calculating with accuracy standard times of individual wood processing operations and comparing them with actual time spent on such operations.

5.6 Tool and machine maintenance

Although the Warka furniture factory has already established some basis for proper tool maintenance, and the Wanza joinery factory is in the process of rationalizing preventive machine maintenance, the operational cost efficiency of the sector as a whole could be significantly improved by the introduction of systematic and appropriate tool and machine maintenance methods.

Regular and proper maintenance of machine cutting tools serves not only to extend their life span - thus reducing foreign exchange requirements for tool replacement - but also to improve the quality of processed parts and to help reduce safety hazards in the operation of machinery. The main concern with regards to preventive machine maintenance should focus on the introduction of proper lubrication methods. In fact, the replacement cycle of critical machine parts such as high-speed bearings is sharply accelerated unless they are lubricated at given frequencies varying from machine to machine and with the appropriate amount and grade of lubricant, according to the requirements of each individual lubricating point. Rapid wear of bearings can also result from cutting tools, such as moulding cutters, made unbalanced by improper sharpening.

5.7 Other modernization requirements

Other areas of required modernization include:

(a) Plant layout as a means of facilitating handling materials at given work stations, obtain a rational flow

of work-in-progress, and ensure an organic relationship between manufacturing and service facilities.

(b) Introduction of Quality Standard Specification with regards to selected durability and performance requirements (as applicable to furniture, joinery and structural building components made of main plantation species) such as choice and strength of joints, toughness and wear of surface coating, wood treatment, selection of adhesives, minimum cross section of components as related to structural strength, dimensioning of furniture according to function, etc. The standards would provide consumers in local and regional markets, especially government institutions, with specification reference when placing orders and accepting products on delivery.

(c) Plant organization applicable to various sizes of furniture and joinery enterprises, as a means of defining essential functions, responsibilities and their organic relationship, and of facilitating production control and overall operating efficiency.

6.7 Training services

One of the main constraints faced in the development of the secondary wood-processing sector is that existing training institutions are not geared towards conducting training programmes, either for skilled labour or supervisory personnel, based on the actual operative needs of the industry.

PTA context: as the training gap is shared by most PTA member states, it is recommended that besides conducting "Eye opener" Seminars and Specialized Short-term Courses, the FAO/PTA/UNIDO project also help develop — in co-operation with the relevant training institutions — a set of training manuals dealing with those critical topics of furniture and joinery manufacture not adequately covered in current curricula. This would serve to gear existing formal training institutions to fulfill on a long term basis the needs of the industry for skilled labour and supervisory personnel, without having to set up ad-hoc training institutions. The expanded curricula would also allow part-time, in-service training of personnel already employed in the industry. (see Objective 2 in Recommended Follow-up Charts)

OBJECTIVES	OUTPUTS	MAIN ACTIVITIES	INPUTS
Objective 1 To expand the manufacturing know-how of an initial group of managerial staff in the furniture and joinery industry sector from Ethiopia and the other PTA countries aimed at optimising the benefits of industrialized wood processing. (Refer to Modernization Priorities, pages 40 to 45)	Output 1.1 60 plant managers and production supervisors gained an appreciation of all critical aspects involved in the serial production of standard furniture and joinery, towards increasing productivity, quality standards and overall operative efficiency. The areas of expanded know-how include: selection of machinery; selection of cutting tools; inter-changeability of parts and quality control; product costing; tool and machine maintenance; general techniques of surface staining and coating; plant layout; product design as applied to industrialized production; quality standard specifications; plant organization.	Activity 1.1 To survey proposed host facilities in Kenya and Malawi 1/ in order to discuss Seminar arrangements, prepare a tentative Work Programme and specifications of production supply items (such as quality control instruments, jig accessories, special cutting tools, etc.) to be purchased under the project for seminar demonstration work. Activity 1.2 To prepare terms of reference for the Lecturers and final Work Programmes Activity 1.3 To conduct 2 General Seminars of two weeks each with 30 participants at each seminar in Kenya and Malawi respectively.	
Objective 2 To provide a basis for: (a) An increasingly relevant role on the part of Polytechnics and Technical Schools in Kenya and the other PTA countries in stimulating a proper transition of the furniture and joinery sector from artisan methods to the industrial system; and (b) A permanent reference source on plant operation for the management of furniture and joinery plants. (Refer to page 46)	Output 2.1 Produced a set of woodworking Training/Reference Manuals covering the main topics dealt with in Output 1 above.	Activity 2.1 Collect and review woodworking text books dealing with industrial techniques, in use in Polytechnics and Technical Schools in the PTA. Activity 2.2 Adaptation of existing UNIDO woodworking manuals and preparation of new ones, as required, to cover the topics in Output 1.1 1/ Proposed hosting furniture plants: (1) IST Production Unit, in Kiambu, Kenya; and (2) WIDCO Furniture Plant, in Blantyre, Malawi	

OBJECTIVES	OUTPUTS	MAIN ACTIVITIES	INPUTS
Objective 3 To enable the Wanco joinery plant to make full use of its equipment - and in particular of its special types of machinery - and to introduce standard joinery items engineered for industrial production. (Refer to pages20-22)	Output 3.1 Report on the status of all production and ancillary equipment with details of repair and spare part requirements and related cost. Output 3.2 Rehabilitated four machines: automatic tenoning and moulding machine; automatic louvre mortising machine; automatic dowel inserting machine; and wide belt sander. Output 3.3 Handbook with working drawings and flow process charts for the manufacture of typical standard joinery items: solid wood doors, flush doors, windows, and shutters. Output 3.4 Produced prototypes of the above joinery items Output 3.5 Trained two senior technicians in the activities carried out under the project	Activity 3.1 To survey conditions of all plant equipment including production machinery, tool maintenance equipment and other ancillary equipment. Activity 3.2 To prepare specification of spares and supplies for necessary repair work Activity 3.3 To purchase spares and supplies for the rehabilitation of four selected machines (as indicated in Output 3.2) Activity 3.4 To prepare detailed drawings and specifications of standard joinery items (as indicated in Output 3.3) Activity 3.5 To rehabilitate, and demonstrate the operation of, the four machines (as indicated in Output 3.2) Activity 3.6 To carry out trial production of the joinery items designed under the project.	

OBJECTIVES	OUTPUTS	MAIN ACTIVITIES	INPUTS
Objective 4 To provide the basis for the improvement of tool maintenance methods of the furniture and joinery industry in Ethiopia and in the other PTA countries in order to attain: longer life span of costly imported machine cutting tools; quality improvement of machined parts; reduced safety hazards in the use of machinery; and reduced material reject rate. (Refer to page 44)	Output 4.1 Three Project Profiles on the setting up of tool maintenance units within small- and medium-scale furniture/joinery plants, or as self-contained Tool Maintenance Centres. The Profiles include: workshop layout; specifications and estimate cost of machinery, accessories and supplies for a two-year operation; specifications of storage arrangement for tools and supplies; lighting requirements, etc. (Activity 4.5 applies) Output 4.2 Trained 24 senior technicians in carrying out the maintenance of machine cutting tools in use in the furniture/joinery industry such as; planing knives, moulding cutters, routing cutters, standard circularsaw blades, carbide tipped circular saw blades, narrow bandsaw blades, blades for band resawing, mortising chains, square chisel mortiser bits, and boring bits. The participants would subsequently act as counterparts in similar courses to be conducted at a national level. (Activities 4.1, 4.2, 4.3, and 4.4 refer) Output 4.3 Extended the utilization of the Project Profiles and Data Sheets prepared for the training course for the benefit of the PTA furniture/joinery industry as a whole. (Activity 4.6 refers)	Activity 4.1 To survey the tool maintenance workshop of the Warca Furniture Factory and the WUARC Tool Maintenance Centre in Addis Ababa which, being representatives in the PTA of well-equipped tool maintenance facilities for the furniture and joinery industry, qualify for hosting the Tool Maintenance Training Courses. Activity 4.2 To prepare specifications of supplies and accessories to be purchased for the purpose of conducting the training courses. Activity 4.3 To prepare training Data Sheets and visual aids as a basis for conducting the maintenance courses. Activity 4.4 To conduct 3 training courses on Tool Maintenance Techniques of one month duration each for 8 PTA trainees at a time. Activity 4.5 To prepare Project Profiles as a reference on the setting up of tool maintenance units. Activity 4.6 To reproduce and distribute widely, in the secondary woodprocessing industry, the Project Profiles and Data Sheets prepared under the project.	

OBJECTIVES	OUTPUTS	MAIN ACTIVITIES	INPUTS
Objective 5 To provide a sound basis for the establishment and operation, in Ethiopia and the PTA, of micro-scale furniture and joinery workshops and service cooperatives. (Refer to pages 22 to 26)	Output 5.1 Produced 3 Project Profiles for the establishment of two typical micro-scale furniture/joinery enterprises and a typical service cooperative as follows: (a) Micro-scale workshop equipped with power tools and basic multipurpose woodworking machinery; (b) Wood-machining cooperative service workshop, of the type operated by BEDCO in Lesotho, with a full range of basic woodworking machinery for use by a number of micro-scale entrepreneurs. (c) Micro-scale workshop equipped with basic machinery for the production of bamboo furniture. The profiles include: detailed specifications and cost of equipment; details of workshop facilities; workshop layout; specifications of typical low-cost dining room, living room and bedroom furniture. (Activities 5.1 and 5.2 refer) Output 5.2 Produced a set of simple Reference Data Sheets on basic technologies as applicable to the operation of micro-scale woodworking enterprises, such as proper adjustment of machines, basic requirements in the sharpening of cutting tools, use of simple jigs and machine accessories, basic costing methods, etc. (Activity 5.3 refers)	Activity 5.1 Survey of Seminar host facilities (BEDCO Woodworking Service Unit at Maseru, Malawi) in order to: - prepare detailed programme of Seminar and terms of reference of Lectures - select furniture/joinery items already produced by BEDCO entrepreneurs, and adapt them as required to serve for production demonstration sessions during the Seminar - to prepare specifications of supplies to be purchased for the Seminar. Activity 5.2 To prepare 3 Project Profiles for the establishment of typical micro-scale enterprises for presentation and discussion at the Seminar, and for permanent reference of entrepreneurs and institutions concerned with the development of the sector Activity 5.3 To prepare Reference Data Sheets on basic woodworking technologies as applicable to micro-scale woodworking enterprises, for utilization at the Seminar and for permanent reference of entrepreneurs and training institutions. Activity 5.4 To conduct a two-week seminar at BEDCO for 30 PTA entrepreneurs of micro-scale woodworking enterprises and government officials responsible for the promotion of the sector.	

OBJECTIVES	OUTPUTS	MAIN ACTIVITIES	INPUTS
- Objective 5 continued -	Output 5.3 30 government officials and entrepreneurs of the PTA member states gained an appreciation of critical factors to be considered in the promotion, establishment, and operation of micro-scale furniture/joinery enterprises and woodworking service cooperatives. Gain also derived from exchanging experience on the development of micro-scale enterprises. (Activities 5.1, 5.2, 5.3, and 5.4 refer) Output 5.4 Extended the utilization of the Project Profiles and the Data Sheets prepared for the Seminar for the benefit of the PTA furniture/joinery sector as a whole. (Activity 5.5 refers)	Activity 5.5 Reproduction of Project Profiles and Reference Data Sheets for wide distribution in the PTA.	
Objective 6 To expand the capability of efficiently utilizing, in Ethiopia and in the other PTA countries, fast growing plantation timber species (such as Pinus patula, Eucalyptus spp. and Cupressus Lusitanica) in the furniture and joinery industry as well as in building construction. (Refer to pages 35 to 39)	Output 6.1 Report on the use of Eucalyptus in the PTA and overseas for the production of furniture, joinery, structural building components and wood-based panels. (Activities 6.1, 6.2, 6.3, 6.7 refer) Output 6.2 Manual on standard wood treatment and wood processing requirements of Eucalyptus, Pine, and Cypress, to cover subjects such as: kiln drying; cutting speeds; cutting-tool geometry with respect to main wood machining operations; choice of surface coating material and methods; dipping against blue stain and pressure treatment of Pine; choice of adhesives for standard and structural applications; choice and dimensioning of joints in chair manufacture. The manual shall also propose a set of minimum quality standards for furniture intended for intra-Pta trade and for government contracts. (Activities 6.4 and 6.6 refer)	Activity 6.1 Review the experience gained by the International Timber Group in Blantyre, Malawi, in the manufacture of furniture components, joinery and structural building components made of laminated Eucalyptus. Activity 6.2 Review the experience gained by ETHARSO and ECAFCO plants in Addis Abeba, Ethiopia in the manufacture of fibreboard and particle board made of Eucalyptus. Activity 6.3 Compile information on overseas experience in the utilization of Eucalyptus in the primary and secondary wood processing industry.	

OBJECTIVES	OUTPUTS	MAIN ACTIVITIES	INPUTS
- Objective 6 continued -	Output 6.3 Reference Manual on the design of standard roof trusses made of Pine and Cypress, and on the design and fabrication of roof trusses made of Eucalyptus poles as practiced in Ethiopia (Activities 6.5 and 6.6 refer)	Activity 6.4 Compile information from African and overseas research institutions, including Bureaus of Standards, on woodprocessing requirements and durability and performance standards as applicable to the use of Eucalyptus, Pine and Cypress in furniture and joinery production and structural building applications. Activity 6.5 Compile information from African research institutions and ministries of works on the use of Pine, Cypress, and Eucalyptus in the design and fabrication of roof trusses. Activity 6.6 To reproduce the report and manuals under outputs 6.1, 6.2, and 6.3 for wide distribution to the industry, wood research institutions, and ministries of work in the PTA.	

LIST OF PERSONS MET AND OF
PLANTS/INSTITUTIONS VISITED

1.	Mr. Ousmane Silla Representative to OAU and Chief, Liason Office with ECA	United Nations Development Programme P.O.Box 5580
2.	Mr JORGEN BRISSON Assit. Senior Industrial Development Field Adviser	UNIDO/UNDP P.O.Box 5580 Addis Ababa Tel. 514245
3.	Mr Girma Zewadie	Office of the National Committee for Foreign Economic Relations (OSCFER) P.O.Box 23121 Addis Ababa Tel. 157971
4.	Mr Debebe Yayehyirad	Office of the National Committee for Foreign Economic Relations(OSCFER) P.O.Box 23121 Addis Ababa Tel. 157971
5.	Mr Solomon Wole Division Head	Projects Studies and Follow-up Division, Ministry of Industry Addis Ababa Tel. 154406
6.	Miss Saba K. Mariam Project Officer	Projects Studies and Follow-up Division, Ministry of Industry Addis Ababa Tel. 154406
7.	Mr Getachew Degefu Head, Planning and Projects Dept.	National Metalwork Corp., Ministry of Industry, P.O.Box 2447 Addis Ababa Tel. 150703
8.	Mr Netsanet Wondirad Senior Economist	National Metalwork Corp., Ministry of Industry, P.O.Box 2447 Addis Ababa Tel. 150703
9.	Mr Tedla Getachew Department Head	Planning and Project Dept., Ethiopian Construction Materials Corporation P.O.Box 5516 Addis Ababa Tel.

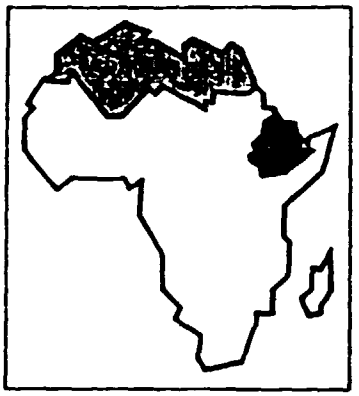
10.	Mr Mengistu Alemu Manager	WARKA Furniture Plant P.O.Box 3086 Addis Ababa Tel. 159227
11.	Mr Abera Ababe Technical Head	WARKA Furniture Plant P.O.Box 3086 Addis Ababa Tel. 159227
12.	Mr Kassabun Tarekegn Assit. Technical Head	"
13.	Mr Girma Getachew Designer	"
14.	Mr Seifu Meshesha General Manager	Blue Nile Furniture Factory P.O.Box 1525 Addis Ababa
15.	Mr Eshetu Abebe Production Head	"
16.	Mr Babo Mekisa Technical Dept. Head	"
17.	Mr Solomon Fekadu Wood machining Foreman	"
18.	Mr Solomon Gebre Selassie General Manager	Finfine Furniture & Joinery Factory P.O.Box 1998 Addis Ababa Tel. 160427
19.	Mr Mammo Production Manager	"
20.	Mr Daniel Adera Department Head	Cooperative Department, Handicraft and Small-Scale Industry Dev. Agency (HASIDA), Ministry of Industry Addis Ababa P.O.Box 5758 Tel. 153883
21.	Mr Johannes Solomon Region Head	Cooperative Enterprises, Addis Ababa Region HASIDA P.O.Box 100144 Addis Ababa Tel. 159397
22.	Mr Eshetu W/Tsadik Woodworking Officer	
23.	Mr Feckrea Abbeba	Tabborout Woodworking

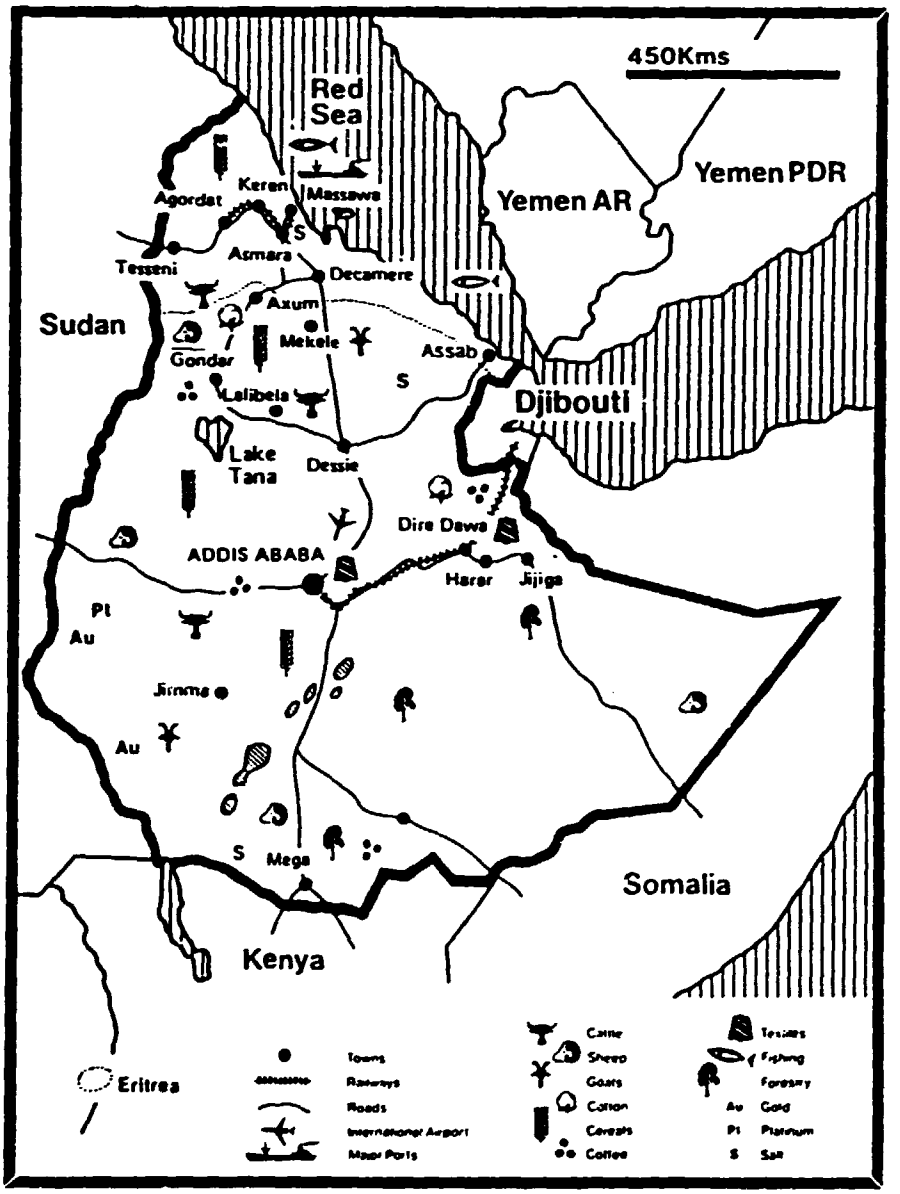
	Factory Manager	Cooperative Collfea Region P.O.Box 25715 Tel. 792609
24.	Mr Ketema Mulatu Business Manager	Wood Products Service Cooperative H 5 K 06 Addis Ababa Tel. 139053
25.	Mr Aschenik Kebede General Manager	WANZA Wood Works (joinery plant) P.O.Box 3419 Addis Ababa Tel. 517999
26.	Mr Haile Mariam H. Georgis Technical Head	"
27.	Mr Solomon Tefera Production Head	"
28.	Mr Jacques Dubois Production & Technical Division Head	Woodworking Unit, Ethiopian Tourist Trading Corporation P.O.Box 5640 Addis Ababa Tel. 1820 61 Telex 21411 ETTCO
29.	Mr Mammo Mangistu Product Development Head	"
30.	Mr Befekadu Senior Project Officer	"
31	Mr Berhanu Hailu Manager	Ethiopian Chipwood Company (ECAFCO) P.O.Box 2730 Addis Ababa Tel. 160675 Telex. ECAFCO Addis 21063
32.	Mr Gizaw T. Mariam Operation Dept. Head	"
33.	Mr Kifle Hundesa Operation Manager	Fibreboard Factory (ETHAFSO) P.O.Box 5516, Addis Ababa Tel. 201488
34.	Mr Melaku Abegaz Director	Wood Utilization and Research Centre (WUARC), Ministry of Agriculture

		P.O.Box 2322, Addis Ababa Tel. (01) 167250
35.	Mr Hailu W. Selassie Wood Technologist	"
36.	Mr Addis Tsehaye Research & Production Expert	"
37.	Mr Kiflemariam Zerom Deputy Manager	Industrial Project Service (IPS) P.O.Box 2569 Addis Ababa Tel. 159188, Telex 21437 IPSET
38.	Mr Negash Tekeste Deputy Manger	"
39.	Mr Fekade Lakew Senior Engineer	"
40.	Mr Seifu Awash Senior Analyst	"

MAP OF ETHIOPIA

ETHIOPIA





Area: 1,221,900 sq. km.

Population: 44.8 million (1987)

Capital: Addis Ababa

ncipal Towns: Asmara, Dire Dawa, Dessie, Harar.

Head of State: Colonel Mengistu Haile ariam, chairman of the Provisional Military Administrative Council (PMAC).

overnment: Military. The PMAC, or Dergue, dominated by Mengistu, controls all power but its internal operations are secret. No olitical parties are recognised by the Dergue and there is no constitution.

Languages: The national language is mharic, while English is the second official language. Over a hundred languages are spoken.

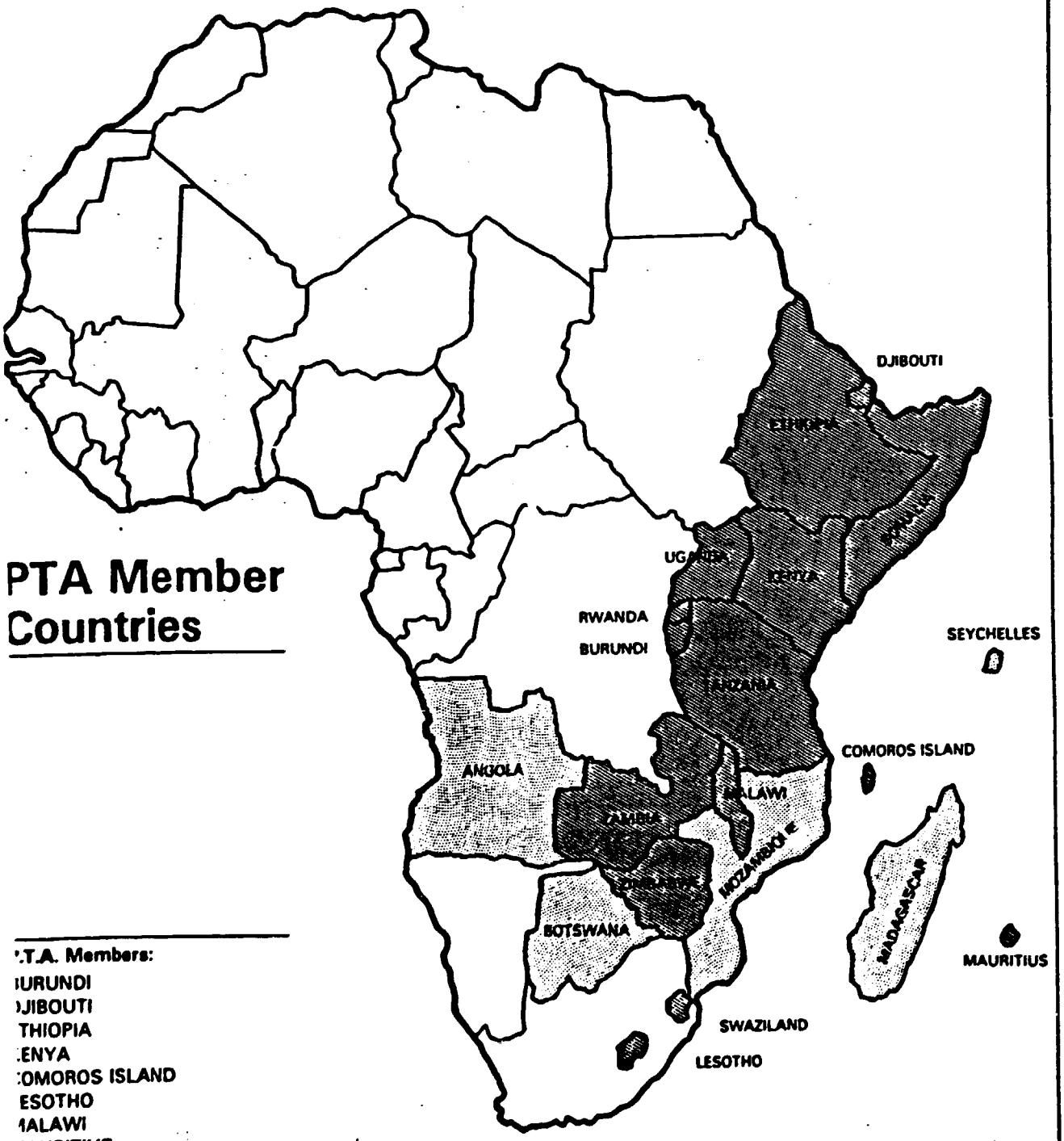
eligions: The majority of the population are ither Christian or Muslim. A small minority follow animist or other local beliefs. The dominant church is the Ethiopian Orthodox Union Church, which upholds Ethiopia's ancient Coptic Christianity. There are also some Falasha Jews.

Currency: 1 Ethiopian Birr = 100 cents.

GENERAL INFORMATION

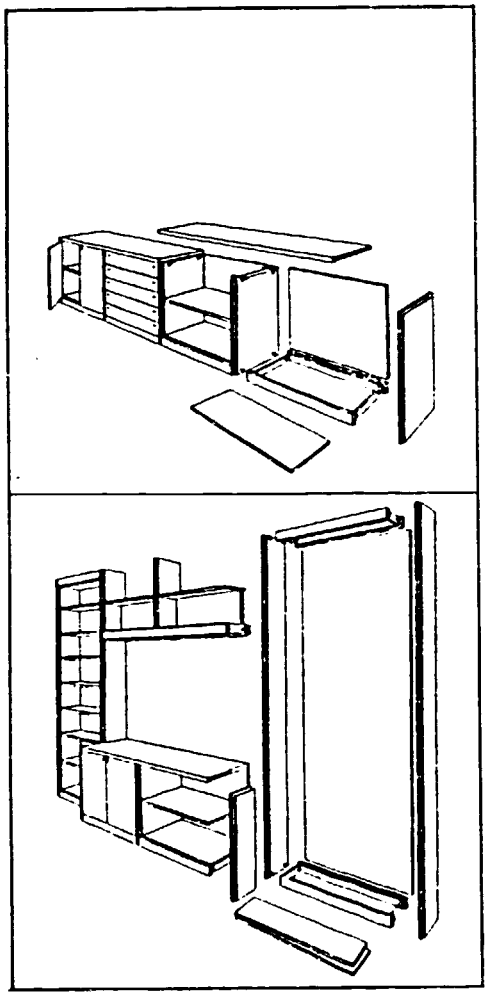
Geography: The central part of Ethiopia consists of a vast plateau region of faulted volcanic rocks. The southern half of the country is bisected by the great Rift Valley which crosses East Africa. High mountain peaks are found in the escarpments. Ras Dashen, the highest, rises to 4,620 m. There are also hot, inhospitable deserts. Soil erosion has been severe on the slopes and in the more densely populated rural areas; it reaches an extreme in Tigre and Eritrea. Natural forest cover has been denuded over much of the country.

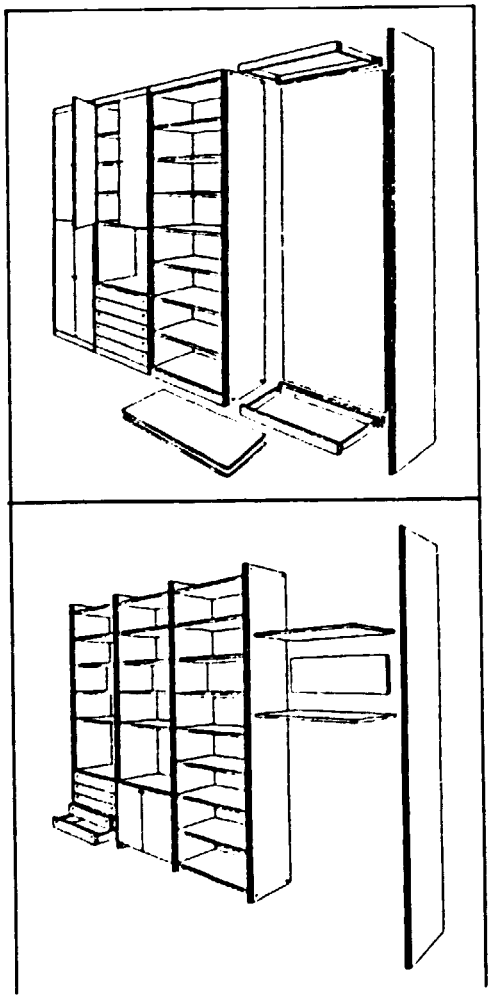
MAP OF THE PTA MEMBER STATES



The boundaries shown on this map do not imply official endorsement or acceptance by the United Nations Industrial Development Organization.

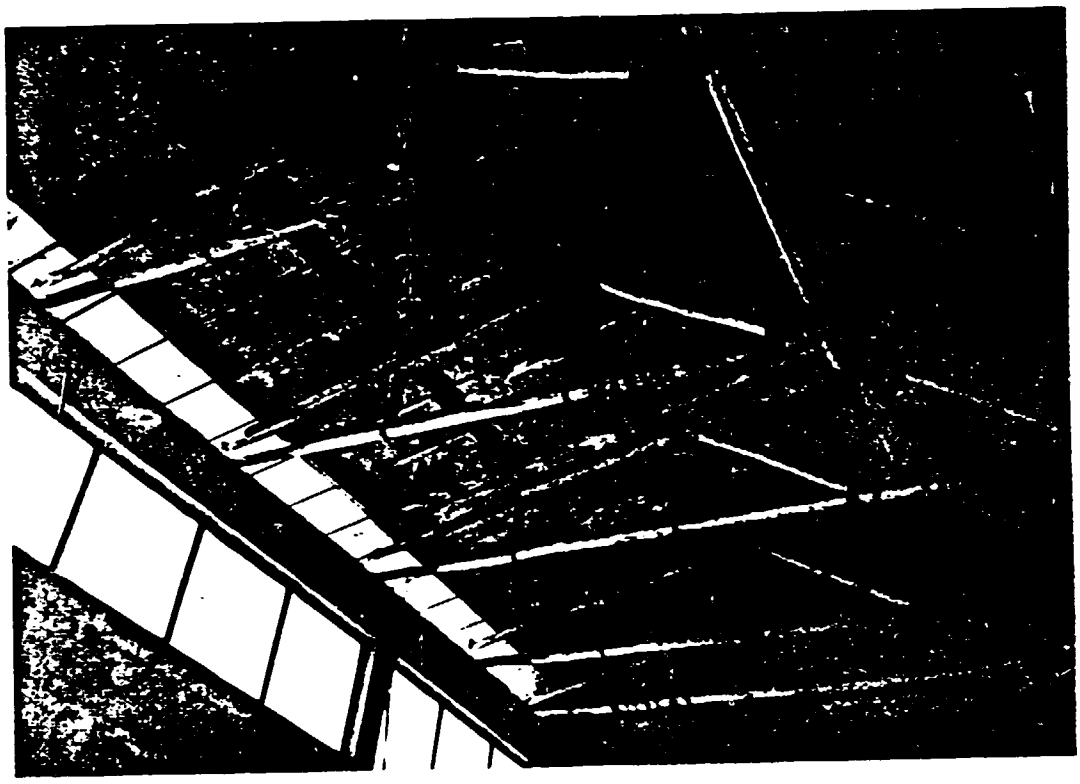
MODULAR TYPE OF STORAGE CABINET SYSTEM WHICH SHOULD BE INTRODUCED IN ETHIOPIA

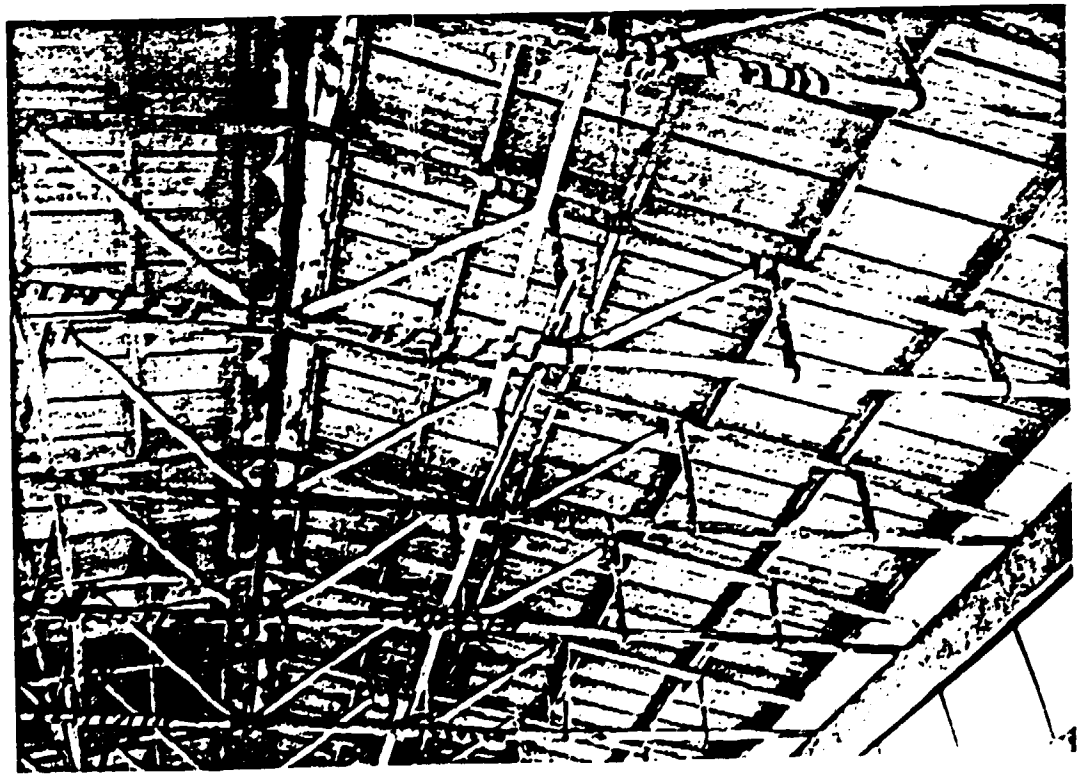


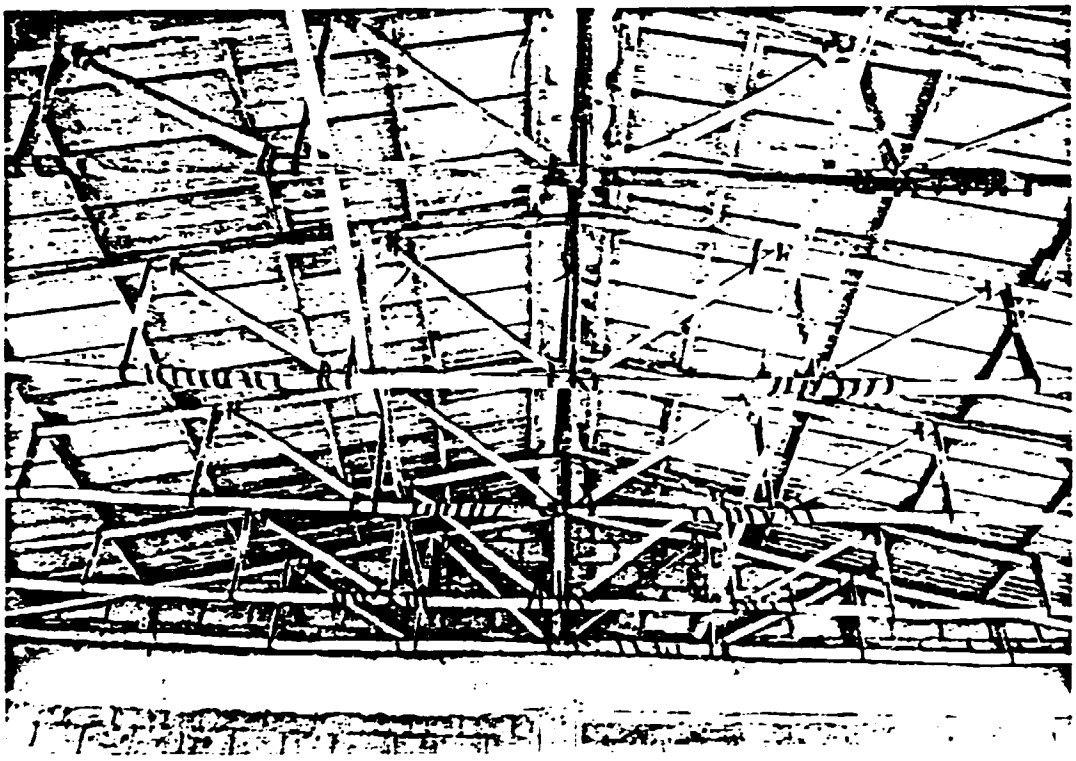


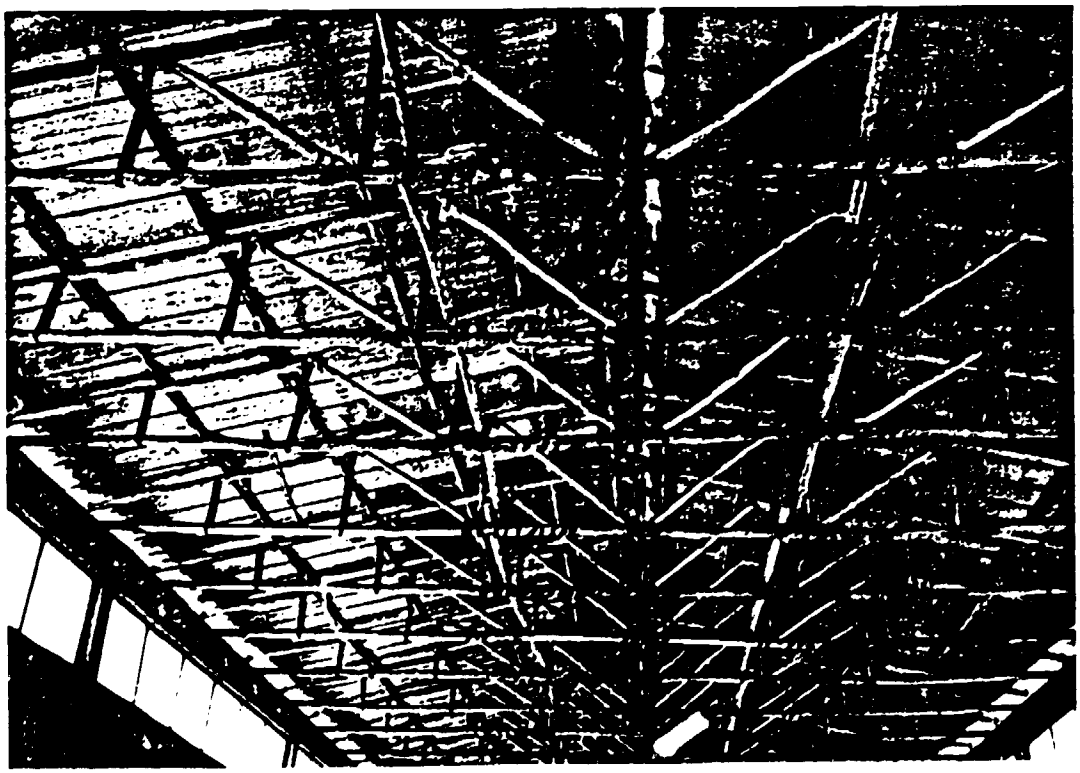
ANNEX V

ILLUSTRATION OF ROOF TRUSSES MADE OF EUCALYPTUS POLES









Check list of woodworking factories in PTA countries whose operation and products could be of interest to Ethiopian manufacturers

1 MAURITIUS

1.1 Reunion Ltd & Partner (Panache)
Products: High class furniture of Louis XV type manufactured by combining hand-carved with efficient woodmachining methods.
Address: Industrial zone - Saint Pierre, Mauritius
Telex 4246 DIVIDEN IW, Tel: 534111

1.2 Mauricarvers Ltd
Products: Reproduction furniture of Louis XV and Victoria type. High labour intensive.
Address: P.O.Box 744, Bell Village, Mauritius

2 LESOTHO

2.1 BEDCO Servicing Centre for micro-scale furniture enterprises
Services: Common woodmachining shop; provison of timber supply at wholesale prices and on credit; marketing of products
Address: BEDCO Industrial Estate, Maseru

2.2 Fali Furniture Ltd
Products: Innovative type of contemporary furniture made of glue-laminated components.
Address: BEDCO Industrial Estate, Maseru

2.3 Lesotho Furniture Manufacturers Ltd
Products: Pine furniture. The most modern furniture plant in Lesotho.

3 Malawi

3.1 Wood Industries Co-operation Ltd (WICO)
Products: Pine furniture manufactured in a plant equipped with new, modern machinery. Exports pinewood shelving components to the U.K.
Address: P.O.Box 30359, Blantype 3

3.2 International Timber Group (ITG)
Products: Furniture panels and structural building components made of finger-jointed and laminated eucalyptus with modern processing methods; plywood; blockboard (eucalyptus); flush doors; pallets; etc.
Address: P.O.Box 5050, Limbe

4 Zimbabwe

4.1 Adam Bede Furniture Ltd

Products: High class solid wood and upholstered furniture of reproduction type manufactured with modern methods and machinery. Exports.
Address: 9 Edison Crescent, Salisbury
Tel: 760198

4.2 Harlequin Furniture Manufacturers Ltd
Products: High class solid wood/upholstered furniture of reproduction type. Good use made of stained pinewood. Exports.
Address: P.O.Box 3809, Harare
Tel: 63495/6

4.3 J.W. Wilson Ltd
Products: Modern type of furniture hand carved with traditional design features. Exports
Address: New Ardbeunie, Salisbury

4.4 KLEKO Ltd
Products: Pinewood kitchen furniture; pine batten boards, for export; pallets crating; prefab units of temporary type; etc.
Address: P.O.Box 2304, Salisbury
Tel: 760551

4.5 MIRCO Ltd
Products: Elaborate occasional type of furniture such as bar cabinets. Exports to the USA.
Address: P.O.Box 542, Bulawayo
Tel: 60242

4.6 Laminating Plant (Forestry Commission)
Products: Structural building components made of finger jointed and laminated pine. Output of over 6,000 m3 per year. Exports
Address: P.O.Box 322, Mutare

4.7 Border Timbers Ltd
Products: Plywood, blockboard, batten doors, flush doors, blockboard shelving.
Address: P.O.Box 2037, Harare
Tel: 6781

4.8 Bakke Industries Ltd
Products: Mass-produced low-cost furniture in pine; crating; pallets; etc. Exports.

5 Swaziland

5.1 Swazi Pine Industries
Products: Pinewood chairs of "Captain type" mass-produced in a modern plant for export to Europe and Australia. Furniture is shipped individually packed in knock-down form, either unfinished or polyurethane -coated for glueing up by the customers themselves.

6 KENYA

6.1 Kist production Unit

Kimabu Institute of Science and Technology

Products: Standard furniture and joinery made entirely of pinewood in a recently established modern plant.

Address: P.O.Box 414, Kiambu
Tel. Karuri 22236

6.2 EHG Furniture and Prefab Factory

Products: It specializes in standard cypress furniture and prefab building units in pinewood.

Address: P.O.Box 18128, Nairobi
Tel. 20174

6.3 Timsales Co. Ltd. (Integrated Woodworking Enterprises)

Products: Sawnwood, plywood, hardboard (produced mainly from plymill and sawmill residues), blockboard, flush doors, window frames, chair components of moulded plywood.

Address: P.O.Box 18080, Nairobi
Tel. 559511
Telex. 24059 TIMSALES

6.4 Rai Plywood (Kenya) Ltd

Products: Plywood, particleboard, blockboard, flush doors and made-to- order furniture

Address: P.O.Box 241 Eldoret
Tel. 33811/2/3
Telex. 35093

LIST OF MACHINERY AT THE WANZA JOINERY FACTORY

No.	Description	Make	Mod. No
1	Four-side moulder	Bottcher & Gessner	
2	Multi-rip saw	Steton	SCA-320
3	Thickness planer	SCM	S 63 B
4	Thickness planer	SCM	S 63 B
5	"	"	"
6	Pendulum saw	STROMAB	PS/45/F
7	"	"	"
8	Panel saw (with spindle moulder)	SCM	SI-16-TWNF
9	"	"	"
10	Radial arm saw	OMGA	RAD 900
11	Pendulum saw		PS-45-F
12	Panel saw (with spindle moulder)	SCM	SI-16-TWNF
13	Double-blade panel saw	STETON	TI-2500 SUPER
14	Tenoning machine	Bottcher & Gessner	
15	Pendulum saw		PS-45-F
16	Circular saw bench	Bottcher & Gessner	
17	"	"	
18	Band saw	IMA	10994-63
19	Band saw	Bottcher & Gessner	
20	Surface planer		
21	Surface planer	SCM	F4L
22	Spindle moulder	SCM	
23	Surface planer	Bottcher & Gessner	
24	Spindle moulder		

25	Surface planer	SCM	F41
26	Stroke belt sander		
27	Slot mortiser	BAUERLE	
28	Slot mortiser (automatic)	STETON	MSO
29	Chain mortiser	SAMCO	OMA 360
30	Wide belt sander (automatic)	STETON	CL2-110
31	Edge belt sander	SAMCO	UNILEV-15
32	Dowel making machine	MEZ MOHELNICE	
33	Dowel inserting machine	BROVIND	OB-500
34	Louvre slotting machine (automatic)	OMG	EPM-70
35	Veneering press (manual)	Bottcher & Gessner	
36	Veneering press (hydraulic)	ITAL PRESS	S-6F
37	Frame press	STETON	S-300
38	"	"	"
39	Hot press	STETON	P-120
40	Spindle moulder	SAC	TS-110
41	Automatic tenoning & Moulding M/C	SAC	F-6
42	Circular saw bench	MINI-MAX	SI-10
43	Airless spray unit		FM/B/78
44	"	"	"
45	"	"	"
46	Tenon scraping machine	CAGNOLI MACCHINE	OM-RI