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ASSISTANCE IN THE ESTABLISHMENT OF A PILOT FURNITURE PLANT

DP/DRK/86/011

THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

Technical report: Development of the Pilot Furniture Plant*

Prepared for the Government of the Democratic People's Republic of Korea
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of Radmilo Malis,
Expert in furniture production

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Vienna

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* This document has not been edited.

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EXPLANATORY NOTES:

- A full stop (.) is used to indicate decimals.
- A comma (,) is used to distinguish thousands and millions.
- The General Bureau for Building Materials (GBBM) in Pyongyang is considered as the Government's Implementing Agency.
- The Pyongyang Wood Processing Complex (PWPG) is considered by the Government as the project site.
- Reference to dollars ($) is to United States Dollars, unless otherwise stated.
- The monetary unit of the Democratic People's Republic of Korea is the Won. During the period covered by this report, the official exchange rate was 2.16 Wons to 1 US$. The conversion value of the currencies used for the purchase of the machines, equipment and tools at the time of the mission, was as follows:

  Austrian Schilling (A.S.) 12.90 = US$ 1
  Deutsch Mark (D.M.) 1.84 = US$ 1
  Italian Lire (Lit.) 1350 = US$ 1

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INTRODUCTION

The expert assigned to the project as Chief Technical Adviser carried out his second mission from 29 January to 28 May 1989. His duties are given in the Job Description (Annex I). The project document for this project was signed on 11 November 1987 by the Government of the Democratic People's Republic of Korea (DPR Korea), the United Nations Development Programme (UNDP) and the United Nations Industrial Development Organization (UNIDO) who is the executing agency.

During the expert's first mission, the Government decided to establish the Pilot Furniture Plant with only one line specialized for case (corpus) furniture, mainly made of veneered particle boards and plywood.

In accordance with the Government's decision, a technological process was designed, and equipment was selected for the Pilot Furniture Plant. The orders were placed for the equipment to be purchased either by UNIDO or the Government.

For the simple equipment, which were to be produced locally, the technical specifications were drawn to allow their design and production in the DPR of Korea.

At the first Tripartite Review Meeting, held in Pyongyang on 8 June 1988, the project document was amended to conform with the Government's actual requirements in this project, and the modified workplan was accepted. This workplan lists all the required activities to complete the project, showing what must be done, by whom and when.

The missions of the experts foreseen for the project were modified. The duration of the furniture design expert's mission was reduced from 3 to 1 m/m, whereas the Chief Technical Adviser's contract duration was increased from 8 to 10 m/m (in split missions).

The Government authorities wanted to see the project completed by the middle of 1989 - about half a year earlier than planned in the original project document. The workplan was thus designed in such a way that all the activities (relating to product preparation, building reconstruction, industrial installations, internal transport and to local production of equipment) be completed by the time the imported equipment was delivered.

Unfortunately, not all the deadlines were met, and the project will most likely be completed as per the terms set in the original project document.

A big delay in the delivery of the equipment purchased by UNIDO occurred. Another delay occurred in the fielding of the furniture design expert. The tool sharpening expert had not yet been fielded at the time of this mission due to delays in the delivery of the tools and of the tool sharpening machine ordered.

The local production of equipment is proceeding, but will probably also suffer unpredictable delays.

The expert collaborated with the specialist in design of furniture during her one-month mission on the proposed design for the product line. He then supervised the production of prototypes.

After obtaining the basic technical data for the machines which were purchased by UNIDO the tools required for the woodworking machines were determined and requisitions for their purchase were forwarded to UNIDO.

In order to speed up the design and completion of the industrial installations, the technical documentation of all the machines were studied and technical specifications were drawn up and given to the counterpart. These specifications related to the electric wiring, heating, water supply, compressed air and dust exhaustion systems.

All the technical documentation for the machines purchased abroad were translated into Korean and are being used by the counterpart.

During this mission, all the machines purchased by UNIDO were received at the project site, inspected, mounted on their foundations and installed - to the extent possible - i.e. with no connection to the: electrical wiring, compressed air, steam, water supply and sawdust extraction installations, since these were not yet available.

The standard tools for the woodworking machines were received, while special tools will be received shortly.

The programme to train machine operators, assemblers and managerial staff was prepared.

The project's coordinator and a few engineers are prepared to conduct, together with the expert, the training of the workers of the Pilot Furniture Plant. The training manuals will be issued as separate UNIDO documents.

The expert's work was channelled through the Chief of the Technical Department of the Pyongyang Wood Processing Complex. The expert met with the Director of the project approximately once a week.

An English interpreter, a driver and a guide were always at the disposal of the expert. Typing assistance was not provided by the counterpart nor by the UNDP office. The list of counterparts is given in Annex II.

PURPOSE OF THE MISSION

During his first mission (March to June 1988), the expert's attention was focused on the definition of the production programme, design of technology, selection and ordering of equipment, organization and conducting of a study tour and group training abroad, training in the quality of products, in the preparation of a detailed workplan for the execution of the project, as well as training the counterpart's designers in product development procedures etc.

The second mission had originally been scheduled to start in January 1989, but due to delays in the delivery of the equipment, it started one month later. The expert's major duties focused mainly on receiving and installing the equipment, and to perform the training activities according to the project document and its outputs.

It had originally been planned that the expert would cover the topics of standardization and preparation of production in the Pilot Furniture Plant during the current mission, but because of the non-existence of production suitable for serial production, this had to be delayed.

The Chief Technical Adviser prepared the Project Progress Report for the Tripartite Review Meeting which was held at the end of his mission.

The activities carried out by the expert during this mission are described in the following chapters, as follows:

1. Design of products and work preparation.
2. Delivery of equipment purchased by UNIDO.
3. Purchase of tools for the woodworking machines.
4. Purchase of measuring instruments.
5. Situation regarding the equipment to be provided by the Government.
6. Situation of the industrial installations.
7. Training programme for the Pilot Furniture Plant.
8. Training machine operators.
9. Basic principles of the organization of production.
10. Updated project workplan

He also drew up conclusions and made recommendations.

ACTIVITIES

The complete situation of the project will thus be described and the views of the expert with regard to the work remaining will be expressed hereunder.

1. Design of products and work preparation

During his first mission the CTA instructed the counterpart's designers, some other technicians and the managerial staff on how to develop a product line for a furniture factory, and on how to set the criteria of the new products. At the same time, they were taught on how to evaluate the design and prototypes of a new product. It was agreed that the product line for the Pilot Furniture Plant should be a modular system with interchangeable parts.

Since the designer's mission was reduced to one month only, the CTA devoted a great deal of attention to the design work in order to fully utilize the designer's capacity at the site once he was fielded.

Mrs. Galicic, the furniture designer, proposed the design of a modular system of case furniture which meets most of the criteria set with respect to market demand and production requirements.

The counterparts appreciated the design and accepted it, and resumed with the production of prototypes.

Although the counterpart's designers were involved in the design work, they were trained for too short a period to fully understand the principles of a modular system. This created many obstacles during the production of the prototypes. Disregarding the modular system, they attempted to make some elements their own way, and the CTA had to intervene from time to time.

As a consequence, there was almost a two months' delay in the production of the prototypes, which, in turn, delayed all work preparation activities.

In conclusion, it could be stated that the reduction in duration of the designer's mission caused unexpected problems.

It was agreed that work preparation would proceed with the counterparts preparing the following production documents:

- detailed drawings of all parts,
- material standards for all parts,
- operational lists with time standards for all parts.

The technicians of the work preparation unit of the Pyongyang Wood Processing Complex were instructed on how to carry out these tasks.

Other production documents will be prepared upon receipt of job orders, during the expert's next mission.

2. Delivery of equipment purchased by UNIDO

All the machines purchased by UNIDO for the project were delivered to the site during March/April 1989. They were received in good condition, fully in accordance with the purchase orders.

Hereunder is the list of machines bought by UNIDO with their characteristics.

1. **Hydraulic hot press**, purchase order No. 15-8-E0698
   Italpress Model SCF/S
   6 daylights,
   7 platens, dimensions 2,500 x 1,300 mm
   Loading through long side (2,500 mm)
   Daylight opening 100 mm
   Stroke of cylinders 600 mm

Platens heated by steam at 110°C, 6 bars, without heating generator
8 pressure pistons, diameter 85 mm
Oleodynamic group power 7.5 HP, total pressure 150 t.
1 manometer for pressure control
Automatic recovery of the pressure
Automatic mechanism for opening of platens (with timer)
Voltage 380 V, 60 Hz, 3-phase
Spare parts for 2-year operation delivered
Price, C&F Nampo, DPR Korea DM 80,304 or approx. US$ 45,130

2. **Four roller glue spreading machine, purchase order No. 15-8-E0698**
Italpress Model R4/130
Working width 1,300 mm
Maximum working thickness 100 mm
Working speed 20 m/min.
Two spreading rollers, diameter 210 mm
Two doctor rollers, diameter 180 mm
Rubber thickness of spreading rollers 13 mm
Coaxial motor reductor 1 HP
Glue mixer Model M/30, capacity 16.5 l
Voltage 380 V, 60 Hz, 3-phase
Spare parts for 2-year operation delivered
Price, C&F Nampo, DPR Korea DM 21,776 or approx. US$ 12,280

3. **Universal woodworking tool grinder, purchase order No. 15-8-E0712**
Grifo Union (Italy), Version "C"
For grinding circular sawblades, cutters, router bits, drilling tools, short knives, including TCT tools.
Voltage 380 V, 60 Hz, 3-phase
Spare parts for 2-year operation delivered
Price C&F Nampo, DPR Korea Lit. 9,571,680 or approx. US$ 7,285

4. **Veneer zig-zag joining machine, purchase order No. 15-8-E0724**
Zagfilo (Italy), Model 900
Voltage 380 V, 60 Hz, 3-phase
Spare parts for 2-year operation delivered
Price, C&F Nampo, DPR Korea Lit. 7,000,000 or approx. US$ 5,350

5. **Universal belt sanding machine, purchase order No. 15-8-E0784**
Samco (Italy, Model UNILEV 15C
2-speed belt motor 3/4HP
Overload switch protection
Voltage 380 V, 60 Hz, 3-phase
Spare parts for two-year operation delivered
Price, C&F Nampo, DPR Korea Lit. 4,250,000 or approx. US$ 3,460

6. **Horizontal belt sanding machine, Purchase order No. 15-8-E0785**
Sicar (Italy), Model L3
With one dust extraction filter
Voltage 380 V, 60 Hz, 3-phase
Overload switch protection
Price, C&F Nampo, DPR Korea Lit. 3,938,400 or approx US$ 3,000

7. **Single side edge banding machine, Purchase order No. 15-8-E0786**
SCM (Italy), Model B5L
Gluing group tilting up to 6 degrees,
2 independent end cutting units (for 0.4 to 12.5 mm edging thickness
0.4 HP motors and 170 mm diameter blades.
Top and bottom edge trimming units both with 2 HP motor
complete with T.C.T. cutters
Two-feed speed: 10 and 15 m/min.
Maximum panel height 60 mm
Infeed preheating fence
Coil magazine and shear device for PVC
Sanding group for flat surfaces, 1.5 HP motor Voltage 380 V,
60 Hz, 3-phase Spare parts for two-year operation delivered
Price, C&F Nampo, DPR Korea Lit.36,804,720 or approx. US$ 27,614

8. Automatic multi-spindle drilling machine, Purchase Order No. 15-8-E0786
SCM (Italy), Model MB 57
Centre distance between spindles 32 mm
Maximum panel thickness 60 mm
Maximum boring depth 75 mm
Spindle speed 2800 rpm
Motor power 6 HP
Horizontal head with 21 chucks
Two vertical revolving heads with 18 chucks each
Voltage 380 V, 60 Hz, 3-phase
Spare parts for two-year operation delivered
Price, C&F Nampo, DPR Korea Lit. 17,523,150 or approx. US$ 13,555

9. High speed router, Purchase order No. 15-8-E0786
SCM (Italy), Model R8
Table clearance 750 mm
Spindle speed 10,000-20,000 rpm
Motor 3/4.5 HP
Tilting table
Adjustable table guide fence
Voltage 380 V, 60 Hz, 3-phase
Spare parts for two-year operation delivered
Price, C&F Nampo, DPR Korea Lit 9,051,130 or approx. US$ 7,520

During the expert's mission, the above machines were received, unpacked, inspected and fixed to the foundations on the factory floor.

Since the electric wiring, the compressed air system and the other installations were not yet finished, the expert could not try the machines nor train operators on the machines themselves.

It would be best if the machines were not used before the operators receive the practical training foreseen.

3. Purchase of tools for woodworking machines

Tools for machining wood and tool grinding wheels were purchased by UNIDO for the amount allocated for expendable equipment (on budget line 41). The specifications of all the tools purchased for the Pilot Furniture Plant are given hereunder:

I. Standard tools (Purchase Order No. 15-9-0259N)	Quantity (pieces)	Total amount A.S.
TOOLS FOR AUTOMATIC SINGLE EDGE BANDING MACHINE SCM, ITALY, TYPE B5L		
Edge trimming cutters	4	4,980
Blades for double end cutting unit	4	2,124
TOOLS FOR AUTOMATIC MULTIPLE BORING MACHINE SCM, ITALY, TYPE MB-57		
ADAPTERS FOR 10 MM SHANK DOWEL DRILLS AND HINGE BORING BITS		
Left-hand pieces	30	1,950
Right-hand pieces	30	1,950
Grub screws	60	330
Allen keys	4	30
BUSHES FOR TWIST DRILLS 2 TO 4 MM		

I. Standard tools (Purchase Order No. 15-9-0259N)	Quantity (pieces)	Total amount A.S.
d-2 mm, GL-38 mm	6	483
d-3 mm, GL-38 mm	6	483
d-4 mm, GL-38 mm	6	483
Allen screws M 5 x 10	20	110
Allen screws M 6 x 5	20	170
Allen keys	4	30
COUNTERSINK DOUBLE-FLUTED LOOSE 90°, SHANK SIZE 10 X 30 MM		
d-3 mm, D-16 mm, SP	6	702
d-4 mm, D-16 mm, SP	6	702
DOWEL DRILLS WITH SHANK 10 MM, WITH TWO FLUTES AND CENTRE POINTS TEFLON COATED		
D-6, NL-25, GL-56, shank 10 x 27 mm, left-hand	10	1,440
D-6, NL-25, GL-56, shank 10 x 27 mm, right-hand	10	1,440
D-8, NL-25, GL-55.5, left-hand, T.C.T.	30	4,530
D-8, NL-25, GL 55.5, right-hand, T.C.T.	30	4,530
D-10, NL-25, GL-55.5, left-hand, T.C.T.	10	1,710
D-10, NL-25, GL-55.5, right-hand, T.C.T.	10	1,710
THROUGH HOLE DRILLS WITH SHANK 10 MM, 2 FLUTES AND V POINT, TEFLON COATED		
D-5, NL-44, GL-77, shank 10 x 24 mm, left-hand	5	1,090
D-5, NL-44, GL-77, shank 10 x 24 mm, right-hand	5	1,090
D-8, NL-44, GL-77, shank 10 x 24 mm, left-hand, T. C. T.	5	1,240
D-8, NL-44, GL-77, shank 10 x 24 mm, right-hand, T.C.T.	5	1,240
TWIST DRILLS 2-4 MM WITH 2 FLUTES AND V POINT		
D-2, NL-16, GL-40 mm, left-hand	10	970
D-2, NL-16, GL-40 mm, right-hand	10	970
D-3, NL-16, GL-40 mm, left-hand	10	1,310
D-3, NL-16, GL-40 mm, right-hand	10	1,310
D-4, NL-16, GL-40 mm, left-hand	10	1,710
D-4, NL-16, GL-40 mm, right-hand	10	1,710
HINGE BORING BITS WITH TWO CUTTING EDGES, 2 SPURS AND CENTRE POINTS		
D-30, NL-54.5, shank 10 x 26 mm, left-hand	2	704
D-30, NL-54.5, shank 10 x 26 mm, right-hand	2	704

I. Standard tools (Purchase Order No. 15-9-0259N)	Quantity (pieces)	Total amount A.S.
D-35, NL-54.5, shank 10 x 26 mm, T.C.T., left-hand	2	784
D-35, NL-54.5, shank 10 x 26 mm, T.C.T., right-hand	2	784
TOOLS FOR HIGH SPEED ROUTER, SOM, ITALY, TYPE R8		
ROUTER CUTTERS Z-1 FOR ECCENTRIC CHUCK		
D-4, NL-6, GL-36, shank 9.5 x 20 mm, T.C.T.	14	2,254
D-6, NL-8, GL-41, shank 9.5 x 20 mm, T.C.T.	14	2,674
D-10, NL-20, GL-54, shank 9.5 x 20 mm, T.C.T.	14	3,850
D-15, NL-30, GL-67, shank 12 x 20 mm, T.C.T.	14	4,970
PROFILE ROUTER CUTTER Z-2 UPTO 12 X 20 MM, WITH TWO CUTTING EDGES FOR OPEN PROFILES		
D-8-19 mm, B-10 mm, T.C.T.	2	2,520
D-50-59 mm, B-20 mm, T.C.T.	2	5,022
Profiled router cutter Z-2, cylindrical shank 12 x 20 mm, with two cutting edges for closed profiles, D-50-59 mm, B-30 mm	2	5,706
ROUTER CUTTER Z-2 FOR CONCENTRIC CHUCK		
D-10, NL-26, GL-53, shank 9.5 x 20 mm	10	1,440
D-20, NL-38, GL-68, shank 12 x 20 mm	10	4,290
D-30, NL-42, GL-74, shank 12 x 20 mm	5	3,450
Total net		81,679
Airfreight (estimated)		3,070
Total C&F Pyongyang		84,749

II. Special tools (Purchase order No. 15-9-0494N)	Quantity (Pieces)	Total amount A.S.
UNIVERSAL PROFILE ROUTER CUTTERHEAD		
B-40 mm, PT-15 mm	2	4,122
Ball bearing with guide and screw	2	976
SPECIAL PROFILED KNIVES		
Knife profile "A"	6	6,576
Knife profile "B"	4	4,384
Knife profile "C"	2	2,400
Knife profile "D"	2	2,400
Knife profile "E"	2	2,400

II. Special tools (Purchase order No. 15-9-0494N)	Quantity (Pieces)	Total amount A.S.
T.C.T. HINGE BORING BITS Z-4, V-2, D-35 MM, NL-54.5 MM, SHANK 10 X 26 MM		
Left-hand	2	800
Right-hand	2	800
HSS TIPPED PROFILED CUTTERBLOCK, Z-2, WOODEN BOX INCLUDING SPACERS	1	6,773
DUFIX-DOOR MOULDING AND COUNTER PROFILE SET, Z-2		
HSS-profile cutter 157 x 15 x 1.25"	2	9,540
HSS Grooving/jointing cutter 157 x 22 x 1.25"	1	6,750
HSS Grooving cutter 158 x 12 x 1.25"	1	5,010
HSS rebate cutter 158 x 30 x 1.25"	1	5,050
	Total net	57,981
	Airfreight (estimated)	3,070
	Total C&F Pyongyang	61,051

III. Grinding wheels for woodworking tools, and sanding paper belts (Purchase order No. 15-9-0291N)	Quantity (pieces)	Total D.M.
DIAMOND GRINDING WHEELS		
12A2/20° 125-10-3BM-C75-D70-20	5	1,075
12A2/45° 100-10-3-BM-C75-D70-20	5	1,200
CYLINDRICAL GRINDING POTS 4B-60-M9-V-100-180-20(D100)	10	700
CYLINDRICAL GRINDING WHEELS FLAT WITH 60° RIM, 4B-46-M6-V-150-10-20	20	800
GRINDING WHEELS SHAPE BH 175 X 20, 4B-60-K6-V175-22-20	10	700
GRINDING WHEELS SHAPE B 100, B80-J6-V-100-12-20	10	400
SANDING PAPER BELT FOR SANDING VENEERED EDGES, GRIT 80, WIDTH 75 MM	100 m	400
	Total net	5,275
	Airfreight (estimated)	225
	Total, C&F Pyongyang	5,500

RECAPITULATION:

	Currency Paid	US$ equivalent (approx.)
I. Standard tools (A.S.)	84,749	6,570
II. Special tools (A.S.)	61,051	4,730
III. Tool grinding wheels (D.M.)	5,500	3,055
Total C&F Pyongyang		14,355

The standard tools (I), Purchase Order No. 15-9-0259N, were delivered in the middle of May and the remaining orders are due for delivery during May and June 1989.

4. Purchase of measuring instruments

For a good control of machine accuracy and for a correct preparation of the woodworking tools, the Pilot Furniture Plant should have the appropriate measuring instruments.

Some of these instruments are already available at the Pyongyang Wood Processing Complex. These are:

- An electrical instrument to measure the moisture content in wood and wooden products;
- A Ford Cup No. 4 to measure the viscosity of glues and lacquers;
- A scale and a drying oven to control the dry substance content of glues and lacquers;
- Measuring tapes with metric mm scale and a limited number of Vernier callipers.

To introduce some simple and practical measuring instruments - not available at the Pilot Furniture Plant, the project purchased the following measuring instruments:

Measuring instruments (purchase order No. 15-9-0527N)	Quantity (pieces)	Total D.M.
Rigid straight ruler, 1,000 mm, graduated in mm	3	129
Adjustable bevel square 200 mm	3	10.5
Vernier callipers 1/20 mm reading, 150 mm measuring range	3	87
Saw setting dial gauge, measuring range 0-2 mm	3	216
Total net (D.M.)		442.5
Airfreight (estimated)		57.5
Total C&F Pyongyang (D.M.)		500
Approx. US$		278

5. Situation with the equipment to be provided by the Government

The Government decided to provide its part of the equipment for the Pilot Furniture Plant by importing some of the machines and by producing some

other simple machines locally. Five machines purchased abroad were already delivered. The technical specifications of these machines are hereunder:

1. **Veneer trimming machine, Model NG-28**
   Made in USSR
   Maximum length of veneer pack 2,800 mm
   Width of veneer pack: max. 1,000, min. 75 mm
   Power of electric motor: main motor 7.5 kW, feeding motor 0.55 kW
   Maximum hydraulic pressure 6.3 MPa

2. **Automatic double end tenoning/profiling machine**
   SHODA (Japan), Model SI-136
   Workpiece size:
   length: unlimited
   width: 150-2430 mm
   thickness, maximum 50 mm
   Feeding speed: 5-15 m/min.
   Feeding motor 1.5 kW
   Width setting motor 0.5 kW
   Circular saw:
   Diameter 305 mm, bore 31.75 mm
   Rotations 3450 rpm (60 Hz)
   Power: 3.7 kW
   Cutter spindle
   Max. cutter diameter 255 mm, bore 31.75 mm
   Rotation 3450 rpm (60 Hz)
   motor 3.7 kW
   Scoring saw:
   Diameter 150 mm, bore 25.4 mm
   Rotation: 3450 rpm (60 Hz)
   Motor 0,75 kW

3. **Wide belt sanding machine**
   Takekava (Japan), Model WSE 130A
   Maximum size of workpiece:
   Width: 1,296 mm
   Thickness 150 mm
   Minimal length of workpiece 460 mm
   Speed of sanding belt 20 m/sec.
   Feeding speed 6.5 - 22 m/min.
   Power motors:
   Sanding 22 kW
   Feeding 1.5 kW
   Lifting table 0.4 kW
   Compressed air consumption 40 l/min.
   Dust exhaust min. 100 m^3/min.
   Voltage 380 V, 60 Hz, 3-phase

4. **Moulder**
   Shoda (Japan), model SM-123
   Size of work table 880 x 720 mm
   Diameter of spindle 25.4 mm
   Usable length of spindle 100 mm
   Lift of spindle 100 mm
   Rotation of spindle 5000/10000 rpm
   Power 2.2 kW

5. **Curtain lacquering machine**
   UCRU (Romania), Model MTL2
   Maximum working width: 1,400 mm
   Conveyor belt width 900 mm
   Manually adjusted speed:
   Min. 30 m/min.
   Max. 96 m/min.
   Drive motor
   Power: 1.1 kW
   Rotation: 935 rpm

Lacquer distributing head
Slit opening: 0-4 mm
Film thickness control: manual
Lacquer tank capacity 2 x 40 l.
Lacquer cooling agent: water
Pumping unit motors:
2 pieces 0.75 kW/piece
Rotation: 1,415 rpm
Pumping capacity max. 40 l/unit/min.
Limit dimensions of the wooden panels:
Min. length 550 mm
Max. width 1,350 mm
Max. height 200 mm
Voltage 380 V, 60 Hz, 3-phase

Another two machines will be provided by reconditioning existing ones. These are: the panel sizing machine, and the horizontal belt sanding machine.

The panel sizing machine will be fitted with one circular sawblade, with a sliding table and the feeding will be done manually.

The horizontal belt sanding machine has a sliding worktable and was produced locally.

The rest of the equipment has been designed and ordered and will be produced by local equipment manufacturers. The most important units of equipment to be made locally are:

1. Single spindle drilling machine
2. Edge sanding machine for concave edges
3. Undercoating machine for finishing furniture parts.
4. Spray booth for lacquering
5. Lacquer drying tunnels
6. Lacquer sanding tables with dust extraction
7. Preassembling and assembling tables with pneumatic pistons - 4 pieces;
8. Case assembling press
9. Dead roller conveyors (4 pieces)
10. Disc conveyor for the glue spreading machine
11. Wheel conveyor for the curtain lacquering machine
12. Hand lifting trucks - four pieces
13. Pallets for internal transport - 100 pieces.

The counterpart expects that the above items will be delivered by the middle of June and installed until the end of the same month.

The expert estimates that the items to be produced locally will probably be installed by the end of August 1989, and he considers this to be satisfactory.

Apart from the equipment for the production operations and for the internal transport system, the Government should provide equipment such as compressors, fans, cyclones, filters, components of compressed air installations, all types of electric components and various pipes.

6. Situation of the industrial installations

Electric wiring (electric power and light), the heating installations (process heating and heating of the premises), the compressed air system, the water supply, the sawdust extraction system, the gas extraction systems and the drainage are all part of the industrial installations to be considered in the factory.

The installation of the electric wiring system has started and can be finished by the end of June 1989. None of the other installations have started.

The existing steam boiler can produce steam with a maximum temperature of 110°C, the working temperature of the veneering press is thus between 100 and 105°C. This causes longer pressing times and consequently a somewhat lower capacity.

The counterpart foresees the use of the existing compressor for the production of compressed air. It has a maximum pressure of 6 bars and a capacity of 3,000 l/min. Because the compressor is located at 100-150 m from the major consumption centres, resistance in the pipes will cause a rather big loss of pressure.

Since the required working pressure is usually 6 to 7 bars on manometers, a more suitable compressor would be one which works at about 10 bars, i.e. 25 percent above the required pressure for woodworking machines. The provision of an adequate compressor is a problem that will have to be solved before start of production in the factory. The pipes and pipe line components (trio controls, water traps, connectors etc.) which are needed for the compressed air installations have not yet been provided .

Since more than half of the machines cannot work without compressed air, the completion of the compressed air installation system must be completed as soon as possible.

The water supply installations to be connected to the glue spreading machine, to the lacquer spray booth and to the curtain lacquering machine, as well as to the sanitary rooms poses no problem and will be done shortly.

One of the more serious problems the factory is facing is the installation of the dust extraction system. Piping material, fans motors, cyclones, filters etc. are required. This system must also have a high installation priority since many machines cannot be used without it being operational.

The installation of the gas extraction system (for gases emanating in the hot press, the lacquer spray booth and in the lacquer drying tunnels) should also be made before start of work with the equipment.

The existing open drainage canal inside the factory must be closed to avoid excessive humidity which can cause deformations of furniture parts.

Industrial installations are essential for a proper and safe utilization of the equipment, and must thus be done correctly without improvisation.

The necessary technical data for the industrial installations are:

1. Technical data for electric wiring:

Pos.	Name of machine	Power of individual motors (kW)	Total power (kW)
1	Panel sizing machine	4.0	4.0
2	Veneer trimming machine: - main motor - feeding motor	 7.5 0.55	 8.05
3	Veneer joining machine	1.5	1.5
4	Wide belt sanding machine: - sanding - feeding - lifting table	 22.0 1.5 0.4	 23.9
5	Glue spreading machine	0.75	0.75
6	Glue mixer	0.55	0.55

Pos.	Name of machine	Power of individual motors (kW)	Total power (kW)
7	Hot hydraulic veneering press	5.7	5.7
8	Double end tenoner/profiler:		
	- feeding	1.5	
	- width setting	0.5	
	- circular saw left	3.7	
	- circular saw right	3.7	
	- cutter left	3.7	
	- cutter right	3.7	
	- scoring saw left	0.75	
	- scoring saw right	0.75	18.3
9	Single edge banding machine:		
	- feeding	3.0	
	- end cutting	0.33	
	- end cutting	0.33	
	- trimming	1.5	
	- trimming	1.5	
	- sanding	1.1	
	- glue heating	1.1	8.86
10	Automatic multi-spindle drilling machine:		
	- horizontal drilling	1.5	
	- vertical drilling	1.5	
	- vertical drilling	1.5	4.5
11	Spindle moulder	2.2	2.2
12	High speed router	3.5	3.5
13	Single spindle drilling machine	1.7	1.7
14	Concave edge sanding machine	1.2	1.2
15	Universal belt sanding machine	0.6	0.6
16	Horizontal belt sanding machine	3.0	3.0
17	Horizontal belt sanding machine		
	- sanding	3.0	
	- table lifting	0.5	
	- fan	1.5	5.0
18	Undercoating machine		
	- feeding	1.1	
	- rollers	1.1	2.2
19	Spray booth - fan	10.6	10.6
20	Lacquer drying tunnel:		
	- conveyor	2.2	
	- drying fan	4.0	
	- drying fan	4.0	
	- cooling fan	4.0	14.2
21	Curtain lacquering machine:		
	- feeding	1.1	
	- pumping unit	0.75	
	- pumping unit	0.75	2.6

Pos.	Name of machine	Power of individual motors (kW)	Total power (kW)
22	Auxiliary drilling machine: - drilling - drilling	 1.7 1.7	 3.4
28	Lacquer sanding tables - fan	1.7	1.7
29	Universal tool grinder	0.6	0.6
30	Fan in dust preventing space	3.0	3.0
31	Fan for refreshing air in the finishing department	7.0	7.0
32	Compressor	10.0	10.0
	Total power installed (kW)		148.61

2. Data for process heating requirements:

Pos. 7 Hot hydraulic veneering press, 7 heated plates 2,500 x 1,300 x 40 mm, 6 bars, 110°C.

Pos. 20 Lacquer drying tunnels, 80°C.
(For other details see design of drying tunnels)

3. Technical data for the installations of compressed air.

Pos.	Place of consumption	Pressure in bars	Consumption l/min.
4	Wide belt sanding machine	7	40
9	Single edge banding machine	6	200
10	Automatic multi-spindle drilling machine	6	200
11	Moulder	5	40
12	High speed router	6	80
15	Universal belt sanding machine	6	60
19	Spray booth	5	200
22	Auxiliary drilling machine	5	80
25	Assembly press - Preassembly benches 2 pcs x 40 - Assembly benches 2 pcs x 60 - Assembly pneumatic handtools	5 5 5 5	120 80 120 100
	Total consumption (l/min)	5-7	1,320
	Plus 20 % losses and reserve		264
	Installed capacity (l/min)		1,584

4. Water supply installations:

Pos.	Consumption place	Type of use	Consumption l/min
5	Glue spreading machine	Cleaning machine	10
6	Glue mixer	Preparation of glue	10
19	Spray booth	Filling bases for water curtain	10
21	Curtain lacquering machine	Cooling lacquer	10
22	Sanitary water	As per regulations	

5. Technical data for the design of the dust extraction system:

Pos.	Name of machine	Mixture Q m^3/sec.	Min.speed v m/sec.	Pipe diam. d (mm)
1	Panel sizing machine	0.310	20	140
4	Wide belt sanding machine	0.600 0.450 0.450	20 20 20	197 173 173
8	Double end tenoner	0.265 0.265 0.225 0.225 0.160 0.160	20 20 20 20 20 20	130 130 120 120 100 100
9	Single edge banding machine	0.480	20	175
10	Automatic multi-spindle drilling machine (cleaning)	0.160	20	100
11	Moulder	0.310	20	140
12	Router	0.225	20	120
14	Narrow belt sanding machine	0.225	20	120
15	Universal belt sanding machine	0.310	20	140
16	Horizontal belt sanding machine	0.310	20	140
17	Horizontal belt sanding machine	0.310	20	140
Total quantity of dust plus air mixture 5.440 m^3/sec. = 19,584 m^3/h				

The installations for gas extraction and drainage - which are simple - do not need special calculations apart from the data given with the respective equipment. The counterpart's engineers can make the designs in accordance with local practice.

7. Training programme for the pilot furniture plant

One of the project document's immediate objectives is to "... train wood technicians and machine operators in the efficient operation of all the machinery and maintenance of tools, so as to manufacture furniture of medium quality." This should partially be achieved through the accomplishment of output 6 which states: "20 wood machinists, 10 assemblers and 4 team leaders trained in the efficient use of the available manufacturing equipment, able to manufacture furniture of medium quality acceptable for export".

During this mission, the Chief Technical Adviser conceived a training programme covering all the training activities foreseen in this project. This training programme is given in Annexes III and IV.

Most of the personnel to be trained are very young (less than 25 years). They have some experience in the existing secondary wood processing plants that are operating on a handicraft basis. The switch from a predominantly handicraft operation to industrial production does not occur by learning how to perform certain operations only. The workers must know basic elements of the whole production system and their inter-relationship.

The training programme is designed in the form of 14 short courses for machine operators and assemblers and two courses for the managerial staff. It covers the most important areas of industrial production in a factory producing case furniture, such as: materials, products, organization, tools sand fixtures, panel sizing, veneer trimming and joining, veneering, processing veneered panels, moulding and routing, sanding, finishing, assembling, quality control and safety measures.

The two courses foreseen for the factory managerial staff cover: management based on modern methods and basic elements of marketing.

Each course is broken down into topics with the training time required and the competence level that will be achieved.

8. Training of machine operators

Some of the courses have been conducted during this mission. Short manuals, written in simple language, understandable to the workers were prepared for the courses which were attended by the workers selected to work in the Pilot Furniture Plant. The subjects are as follows:

1. Wood, affiliated products and other materials used in the production of case furniture.
2. Furniture products: design, construction and quality standards.
3. Organization of production and work preparation.
4. Panel sizing
5. Veneer trimming and joining
6. Veneering
7. Processing of veneered furniture parts.

The training manuals were translated into Korean and were used by he counterpart's engineers who lectured together with the Chief Technical Adviser.

The remaining courses will be conducted during the CTA's next missions and the course on tools, jigs and measuring instruments should be conducted by the tool maintenance expert during his three-month mission.

Practical training can only be conducted once the machines are connected to their energy sources.

Altogether, 36 workers were selected to be trained in the following operations:

- panel sizing	2
- veneer trimming	2

- veneer joining	2
- veneering	4
- veneered board processing (trimming, tenoning, profiling, drilling)	6
- Moulding and routing	2
- Sanding	4
- Finishing	4
- Preassembling and assembling	10
TOTAL	36

About 70 percent (25) of the trainees are young women and 30 percent (11) are men.

Some courses (such as: wood, affiliated products and other materials used in the production of case furniture; furniture products: design, construction and quality standards; production organization and work preparation; quality control and safety measures in furniture manufacturing) were foreseen for all the trainees. The other courses were aimed only for the operators of the respective operations. The counterpart's coordinator requested that all the trainees participate in all the courses, and this wish was fulfilled.

The list of trainees (names, sex and work assignments) is given hereunder.

Name	Sex	Work assignment
Kim Su Ok	M	Panel sizing
Ro Bok Sil	F	Veneer trimming
Pak He Ok	F	Veneer joining
Kim Hyong Suk	F	Veneer joining
Hoang Mi Hoa	F	Veneer joining
So Il Chol	M	Wide belt sanding
Pak Yong Ae	F	Glue spreading
An Song Ok	M	Veneering press
Li Song Hi	F	Veneering press
Cha Yong Suk	F	Veneering press
Che Song Ok	F	Veneering press
Kim Sun Bok	F	Panel Trimming/tenoning
Li Yang Chun	M	Panel trimming/tenoning
Jon Myong Il	M	Edge banding
Ju Hyon Sil	F	Edge banding
Jo Yong Sil	F	Edge banding
Kim In Hok	M	Multispindle drilling
Jo Won Suk	F	Multispindle drilling
An Sang Ok	M	Moulding
Kim Jun Chil	M	Routing
Go Sun Yong	F	Sanding
Che Yong Ae	F	Sanding

Name	Sex	Work assignment
Pad Son Hi	F	Sanding
Kim He Nam	F	Preassembling
So In Ok	F	Preassembling
Jo Gyong Ae	F	Finishing
Li Hyang Suk	F	Finishing
Pak Bun Hi	F	Finishing
Kim Myong Ae	F	Finishing
Ho Yong Nam	M	Assembling
Rim Chun Gun	M	Assembling
Che Jong Suk	F	Assembling
Kang Myong Suk	F	Assembling
Jo Sun Bo	F	Assembling
O Myong Ok	F	Assembling
Hong Ghang Ho	M	Assembling

9. Basic principles of the organization of production

The Pilot Furniture Plant will be one of the key production units within the Pyongyang Wood Processing Complex (PWPC). Within the Complex, the production units work strictly in accordance with the production plan and instructions given by the technical and other departments are centralized at the level of the Complex. The organization is well rooted and has proven its efficiency. Thus, the organization at the level of the PWPC will not be analyzed for possible improvements, but accepted as is.

This chapter refers to the organization of production at the factory level. In order to organize production, the product line, the factory's degree of specialization, the capacities available and the type of production must be taken into consideration.

The product line is based on a modular system of case furniture with interchangeable parts.

The factory is highly specialized and produces a limited number of furniture parts which could be assembled on various products.

The factory has flexible production equipment which could easily be set to produce various parts using the machinery installed. Basically, medium size production series are foreseen.

Due to the above characteristics, the Pilot Furniture Plant is suitable for the modern concept of organization of production so as to fully utilize the advantages of a modern factory. Thus, modern principles of organization can be easily applied in the Pilot Furniture Plant

The concept of the organization of production was discussed with the counterpart on several occasions and its advantages were fully understood. With the counterpart's approval, it was included in a training manual and explained to all the trainees.

According to the principles of the organization, the factory is divided into four departments: cutting, machining, finishing and assembling. Each department has its own stock of furniture parts which are interchangeable and

uniform allowing their utilization in the assembly of various products. The parts are produced in the quantities determined by the economic "optimum", i.e. keeping the inventory between the minimum and the maximum level. Production is scheduled according to "demand-pull" (i.e. from the storage of finished products) rather than "supply-push" (i.e.from the first to the last operation). Sales orders will be issued from the storage of finished products with no direct reflection on the production.

If the products, ordered by customers, are not available in the finished products stores, the order will be forwarded to the work preparation unit. The work preparation unit will issue an order to the assembly department to assemble the required products, using finished parts from their stock. If the parts are available, the rest of the factory will not have any work in fulfilling this order. If the finished parts are not available, the finishing department will get the order to take the parts from their stock of machined parts and finish them.

The last situation would be if neither parts nor materials are available in stock. That is when the purchase department gets the order to supply the material required. But since all departments have to maintain a so-called mini-max inventory, this will happen very seldom.

This production organization model works with an optimal inventory and almost prompt delivery of goods sold. Actually, this a cybernetic model, easily applicable to computers and subject to optimalization.

It could be easily incorporated in the organizational structure of the Pyongyang Wood Processing Complex. Once accepted, it will prove to be an efficient organization and production control system.

Since the PWPC practises a uniform organization in its production units, which is significantly different from the one proposed by the CTA, the counterpart should decide on whether this suggestion could be accepted before further work is done on a detailed design of organization of the Pilot Furniture Plant.

The model is shown in a simplified form in Fig. 1. and a possible organizational chart is shown in Fig. 2.

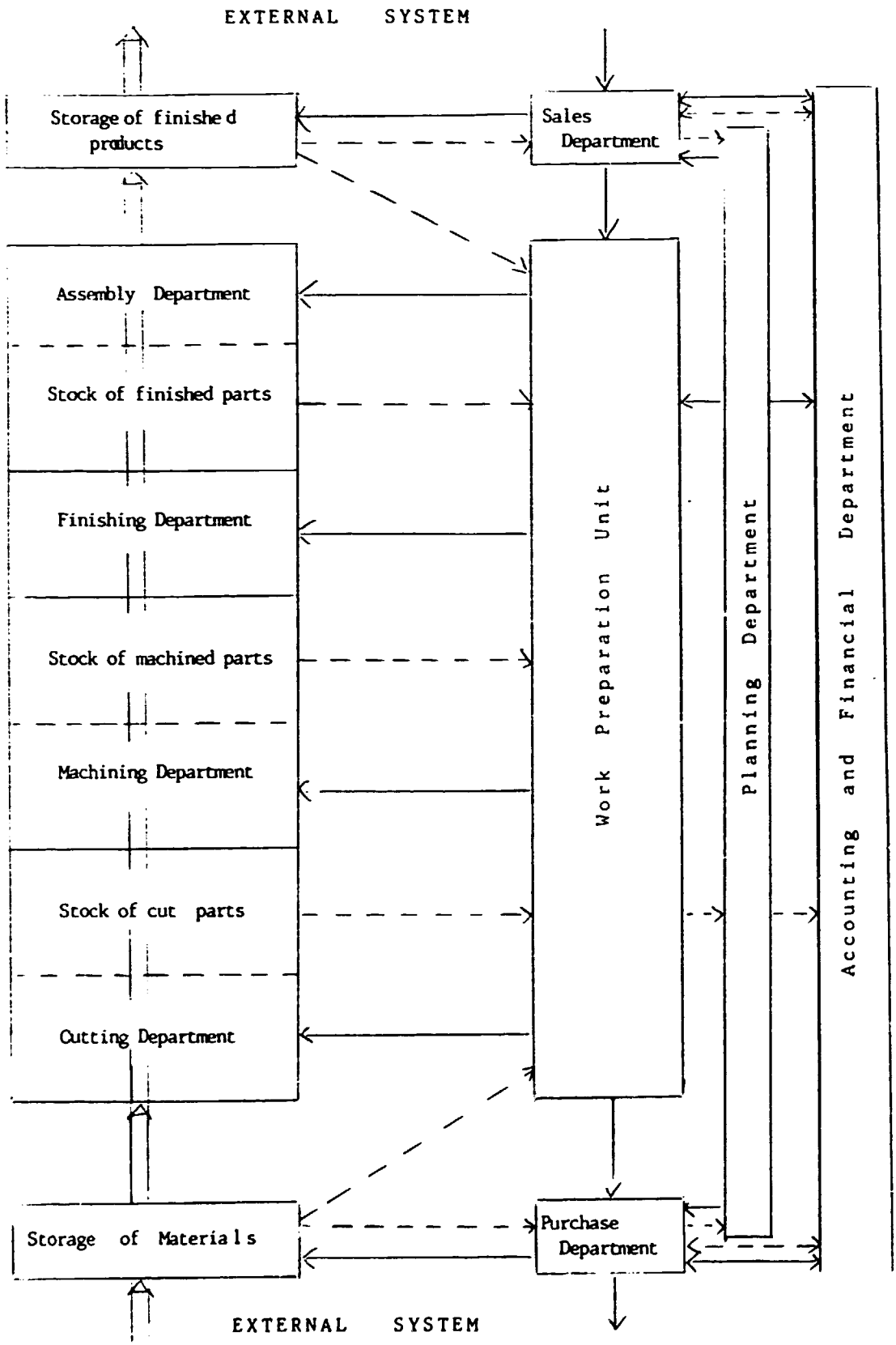

Fig.1: Model production system for the Pilot Furniture Plant.
Key: ——→ Orders, - - - - - →Information, ⟹ Material flow.

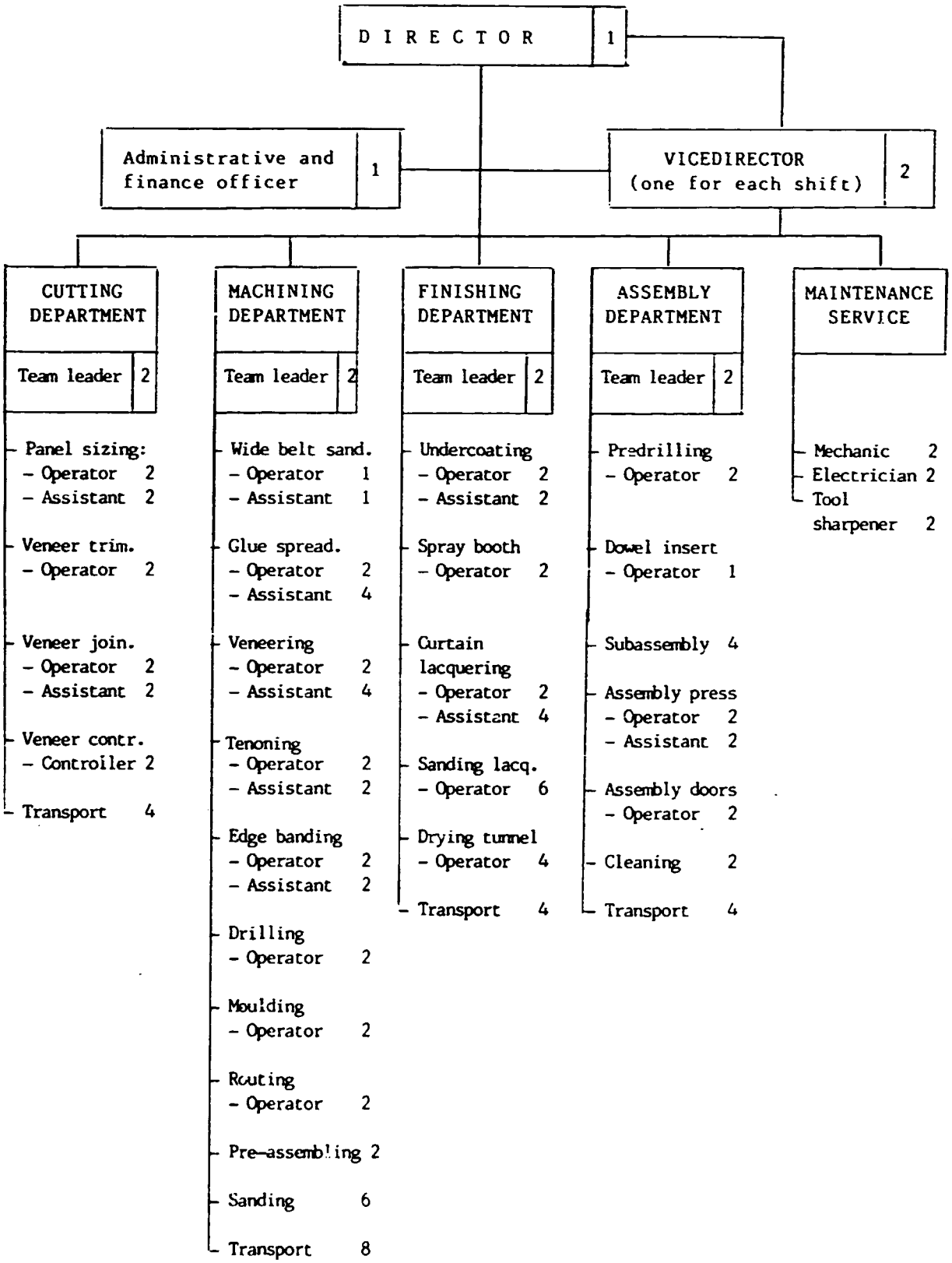

Fig. 2: Possible organizational chart for the Pilot Furniture Plant.

10. Updated workplan for the completion of the project

The updated workplan contains all he activities which have to be completed before the beginning of production in the Pilot Furniture Plant. The time estimated for the completion of single activities is somewhat longer than the terms set by the counterparts. According to the expert's assessment, the Pilot Furniture Plant could be ready for trial production at the beginning of September 1989. The estimated real possibilities of the counterpart and UNIDO have been used to estimate the deadlines foreseen in this workplan.

Activity Number	Activity	To be done by	Completed by
1. Provision and installation of equipment			
1.1	Installation of tenoner	CTP[1]	30.6.89
1.2	Installation of moulder	CTP	30.6.89
1.3	Installation of curtain lacquering machine	CTP	30.6.89
1.4	Provision and installation of panel sizing machine	CTP	30.6.89
1.5	Production of preassembling benches with pneumatic pistons - 2 pieces	CTP	31.8.89
1.6	Production and installation of spray booth with water pump and fan	CTP	31.8.89
1.7	Production and installation of lacquer drying tunnels with drying and cooling zones	CTP	31.8.89
1.8	Production of two sanding tables for sanding lacquer, with dust extraction	CTP	31.7.89
1.9	Provision of lacquer undercoating machine	CTP	Uncertain[2]
1.10	Production of assembling benches with pneumatic pistons - 2 pieces	CTP	31.8.89
1.11	Production and installation of assembling press	CTP	31.8.89
1.12	Provision of pneumatic and electric hand tools (hand drills, screw drivers, nail guns, staplers, hand sander, hand router and veneer hand splicer)	CTP/UNIDO	Uncertain[3]

[1] CTP = counterpart

[2] The lacquer undercoating machine is important, but production can start without it.

[3] There is no money available in the project budget to buy these very necessary tools.

Activity Number	Activity	To be done by	Completed by
2. Industrial installations			
2.1	Electric wiring: - for machines - for illumination	 CTP CTP	 30.6.89 30.7.89
2.2	Heating: - for hot hydraulic press - for lacquer drying tunnels - for heating premises	 CTP CTP CTP	 30.6.89 31.8.89 31.8.89
2.3	Water supply: - for glue spreading machine - for lacquer spray booth - for sanitary rooms	 CTP CTP CTP	 30.6.89 31.8.89 30.6.89
2.4	Compressed air: compressor, pipeline, and all necessary components (filter, water traps, regulators, oiling units, connectors, hoses etc.)	CTP	31.7.89
2.5	Dust extraction installations	CTP	31.7.89
2.6	Extraction of gases (hot hydraulic press, lacquer drying tunnels and spray booth)	CTP	31.8.89
3. Renovation of building:			
3.1	Finishing of factory floor	CTP	15.6.89
3.2	Removing partition walls in the factory's machining department	CTP	30.5.89
3.3	Close the open drainage inside the factory	CTP	30.5.89
3.4	Building barriers to dust between the machining and finishing rooms	CTP	30.6.89
3.5	Finishing sanitary rooms	CTP	15.6.89
3.6	Finishing tool sharpening room	CTP	30.5.89
3.7	Finishing maintenance room	CTP	Uncertain[4]
3.8	Finishing office rooms to be used by team leaders and controllers	CTP	Uncertain[5]

[4] The counterpart has not yet taken a decision to build these rooms.

[5] Same as [4]

Activity Number	Activity	To be done by	Completed by
3.9	Building resting and smoking room	CTP	30.7.89
4. Industrial transport:			
4.1	Hand lifting truck-production - 5 pieces	CTP	31.8.89
4.2	Production of 100 pallets	CTP	31.7.89
4.3	Making and setting a shelf between veneer trimming and joining machine	CTP	30.6.89
4.4	Making shelves for joined veneer sheets	CTP	30.6.89
4.5	Production and installation of dead roller conveyors for: - panel sizing machine - wide belt sanding machine - veneering (hydraulic press) - assembling line	 CTP CTP CTP CTP	 31.8.89 31.8.89 31.8.89 31.8.89
4.6	Production of disc conveyor for the glue spreading machine	CTP	31.8.89
4.7	Production of wheel conveyor for the curtain lacquering machine	CTP	31,8.89
4,8	Chain conveyor for lacquer drying tunnel	CTP	31.8.89
4.9	Trolley racks for drying lacquer - 20 pieces	CTP	31.8.89
4.10	Ball table in front of assembly press	CTP	31.8.89
5. Work tables:			
5.1	Work table for control of veneer before trimming	CTP	30.6.89
5.2	Work table for completing veneer sheets	CTP	30.6.89
5.3	Work table for veneer joining machine	CTP	30.6.89
5.4	Work table with glass top and lights for controlling quality of veneer sheets	CTP	30.6.89
5.5	Work table for assembling sandwiches before pressing (veneering)	CTP	30.6.89
5.6	Work tables for mounting hardware (3)	CTP	30.6.89
5.7	Work tables (2) for sharpening room	CTP	30.6.89

Activity Number	Activity	To be done by	Completed by
5.8	Work tables (2) for maintenance room	CTP	30.6.89
6. Tools and jigs:			
6.1	Purchase of complete tools for the tenoner/profiler	CTP	31.8.89
6.2	Purchase of sanding belts and papers for sanding veneer	CTP	31.8.89
6.3	Purchase of sanding papers for sanding lacquer	CTP	31.8.89
6.4	Assured sources for the permanent supply of tools	CTP	30.6.89
6.5	Construction of jigs for: moulding, routing, preassembling, drilling and assembling	CTP/CTA	30.9.89
6.6	Production of jigs	CTP	30.10.89
7. Work preparation:			
7.1	Finishing prototypes of furniture	CTP	30.5.89
7.2	Detailed drawings of all parts	CTP	30.6.89
7.3	Material standards for all parts	CTP	30.7.89
7.4	Operational lists with time standards for all parts	CTP	30.8.89
7.5	Production documentation completed	CTP/CTA	30.9.89
7.6	Assistance in the work preparation	CTA	Sept./Oct.
7.7	Standardization of all production elements	CTA	30.10.89

Activity Number	Activity	To be done by	Completed by
8. Materials:			
8.1	Provision of raw materials: particle board, plywood, sawnwood, veneer	CTP	30.8.89
8.2	Provision of auxiliary materials: urea formaldehyde glue, hardener, fillers, PVC glue, hot melt glue, thermo-plastic thread, screws, hardware (hinges, handles etc.), lacquers, stains, dowels etc.	CTP	30.8.89
9. Experts' missions and training activities:			
9.1	Tool maintenance expert (3 months)	11-03	August/ October
9.2	CTA mission (2 months)	11-01	September / October
9.3	Training tool sharpeners	11-03	August/ October
9.4	General training of machine operators in tool maintenance	11-03	September
9.5	Practical training in the machining department	CTA	September
9.6	Theoretical and practical training in finishing and assembling departments	CTA	October
9.7	Practical training of quality controllers	CTA	September / October
9.8	Training of the factory's management: - management techniques - basic elements of export marketing	CTA CTA	September October
9.9	Trial production (min. 2 months)	CTP/CTA	October/ November

CONCLUSIONS

To summarize the current situation and the work done so far during the project, the following can be concluded:

1. During the CTA's first mission, from March to June 1988, a detailed workplan for the project's execution was prepared, aimed at meeting the Government's intention to finish the project prior to the 13th World Youth and Students Festival, Pyongyang, July 1989. Unfortunately, during the CTA's first and second missions, the workplan was ignored by the counterpart and only some of the activities were completed.

2. There was also a delay in the delivery of equipment purchased by UNIDO which was caused by an enormous demand for such equipment in

Europe resulting in far longer delivery dates than normally foreseen having been quoted by all suppliers.

3. The building foreseen for the Pilot Furniture Plant, has been used until mid-April 1989 for urgent production; its renewal was thus postponed until after the receipt of the machines.

4. A considerable portion of the work for completing the industrial installations had been postponed, for the same reason, to be achieved after the machines were placed on the factory floor.

5. The delivery time for some of the equipment ordered by the Government - to be produced locally - is still uncertain. This also refers to the internal transport equipment. The provision of some of the equipment is also dubious, e.g. panel sizing machine, lacquer undercoating machine etc.

6. The production of the furniture prototypes was also not finished in time thus impeding further work on product development.

7. Owing to the above facts and taking the situation of the development of the Pilot Furniture Plant into consideration, it is clear that the project cannot be finished by mid-1989. It is more realistic to expect completion within the time scheduled in the project document.

8. The new workplan was worked out on the assumption that the counterpart will continue to implement the project activities with no break and that the provision of equipment, tools and production materials specified in this report will be achieved in due time.

9. A considerable assortment and quantity of tools for the woodworking machines were ordered and delivery is already under way.

10. The sum allocated on the project's budget for equipment to be purchased by UNIDO was insufficient, and some items which are very important for the production of furniture of a satisfactory quality were not included in the purchase list. Among them are: electric and pneumatic handtools, an attachment to the tool grinding machine for the repair of tungsten carbide tipped circular sawblades, a panel sizing machine, a lacquer undercoating machine, a lacquer sanding machine and an auxiliary drilling machine for drilling finished furniture parts to mound the hardware.

11. As far as the expert can assess the raw material situation, this will be the greatest hurdle the factory will have to overcome to obtain a permanent supply of the desired quality. The supply of appropriate particle board could also cause problems.

12. The Pilot Furniture Plant will have to surmount its difficulties in obtaining adequate sanding papers and special gluing materials (such as hot melting glue and thermoplastic thread).

13. The counterpart does not grant training of workers and managerial staff the attention it merits and attempts to reduce training time to below acceptable standards, even though proper training is essential for a successful production. With no training, the workers will have the greatest difficulties in switching from a predominantly artisanal method of production to a modern industrial production system.

14. The efficiency of production in the Pilot Furniture Plant will depend on the appropriate organization and work preparation which should differ from the organization of the other production units of the PWPC.

15. Establishing the Pilot Furniture Plant means more than just getting additional production capacity. The Pilot Furniture Plant must

help introduce new technological and organizational improvements which could be applied in other factories throughout the country.

RECOMMENDATIONS

In order to end the project successfully within the expected time (i.e. by end 1989, including two to three months of trial production), the following must be done:

1. The proposed workplan, included in this report, must be completed by both the Government and UNIDO, with no exceptions and without delays.

2. The counterpart should pay more attention to the production of the furniture prototypes and pay considerable attention also on the work preparation and production documentation processes.

3. An increase of US$ 25,000 for non-expendable equipment necessary for an efficient production of medium quality furniture should be provided to permit the purchase of:
   - a panel sizing machine US$ 15,000
   - an attachment to the tool grinding machine for repairing tungsten carbide tipped circular sawblades US$ 5,000
   - some important items of pneumatic and electric hand tools for assembling operations (screwdrivers, drills, nail guns, staplers veneer splicer etc.) US$ 5,000

4. Since the compressor existing in the Pilot Furniture Plant cannot produce the pressure required by some key machines, the counterpart should urgently provide an adequate compressor working at a maximum pressure of 10 bars and with a capacity of 1,500 l/min of compressed air.

5. The training of workers and upgrading of their skills is an indispensable part of the development of the Pilot Furniture Plant.

6. The managerial staff of the factory must also be acquainted with modern management techniques and marketing methods.

7. The Pilot Furniture Plant should accept the proposed concept of organization of production which is based on inventory control, and on a workplace of the closed type.

8. The Pilot Furniture Plant must seek permanent suppliers of materials, components and tools and establish long-term cooperation with them.

9. Designers and other professionals who will carry out further development of the factory should have the opportunity to visit, from time to time, the major furniture shows, as well as woodworking equipment fairs.

10. The Korean industry should develop most urgently their production of particle board to produce boards of a good quality. It is the only way to convert the lowest grade of wood and woodwaste into valuable products enabling further successful development of the furniture industry and ensuring a fuller utilization of their forest resources.

ACKNOWLEDGEMENT

During this four-month mission, the expert experience the outstanding support of all the UNDP staff in Pyongyang, and it was the expert's pleasure to collaborate with them.

Also, all the counterpart staff treated him in the best traditional Korean hospitality manner, fully ready to cooperate sincerely with him and providing mutual understanding.

To all, the expert owes his warmest gratitude and respect.

ANNEX I

18 November 1987

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

PROJECT OF THE PEOPLE'S DEMOCRATIC REPUBLIC OF KOREA

ASSISTANCE IN THE ESTABLISHMENT OF A PILOT FURNITURE PLANT

JOB DESCRIPTION

POST TITLE: Expert in furniture production (Chief Technical Adviser)

DURATION: Eight months (split mission)

DATE REQUIRED: As soon as possible.

DUTY STATION: Pyongyang.

PURPOSE OF PROJECT: The project aims at facilitating the creation of a model furniture production unit for the manufacture of items of satisfactory quality. To do so it will:

(a) establish a modern pilot furniture plant for industrial production within the existing furniture factory of the Pyongyang Wood Complex.

(b) Train wood technicians and machine operators in the efficient operation and maintenance of the machinery and tools.

(c) design and produce a product line based on standardize interchangeable furniture parts.

(d) train managerial staff in overall management techniques.

DUTIES: The expert will be attached to the Pyongyang Furniture Complex. He will lead a team of three-short-term consultants comprising also a furniture designer and a tool maintenance expert (both for three months). In order to achieve this, he will be specifically responsible to:

- define the production programme for the model furniture plant taking into account local customs, existing production and the plant's capacity and installed equipment;
- survey the state of the equipment for the pilot plant provided by the Korean authorities, assess its suitability, and, based on this and the production programme, draw up the technical specifications of the equipment to be purchased by the project;
- in collaboration with his counterparts plan the production technology for the Pilot Furniture Plant;
- Survey the existing quality of the products and recommend improvements, drawing up new quality standards to be used by the factory;

- Propose a detailed programme for a study tour for the Korean technicians.

Before completing the first phase of the split mission, the expert shall draw up the technical specifications of the work to be carried out on the existing machines to recondition them so that they may perform according to accepted international standards. He shall also propose the layout of the plant, determining the location of both existing equipment and that to be purchased by the project.

In the second phase of the split mission, the expert shall:

- test the machines that have been reconditioned;
- survey the existing quality control measures and recommend an integral system;
- train quality controllers;
- prepare a training manual for production operations;
- improve safety in the plant;
- train technicians in the design and production of jigs and fixtures;
- prepare technical reports related to the above and prepare, in his capacity of chief technical adviser, the progress and terminal reports.

QUALIFICATIONS: Wood technologist or engineer with considerable experience in the operation, at the floor level, and in management of a modern medium-sized furniture plant producing average quality products in series. Experience at policy making level necessary. Experience in developing countries highly desirable.

LANGUAGE: English preferred, Russian acceptable.

BACKGROUND INFORMATION: The Democratic People's Republic of Korea is a predominantly mountainous country with some 9 million hectares (or 74 percent) of its land, designated as forest areas. The total growing stock of wood is estimated to be about 620 million m^3, allowing an average annual cut of approximately 6.5 million m^3. The primary wood processing industry is supplied with some 1.8 million m^3 of sawlogs domestically produced and with a limited quantity of logs imported from the Soviet Union. The furniture production in the country has been developed mainly within the wood processing complexes which produce also sawnwood, joinery, and various wood-based panels.

The level of development of the wood processing industry, and of the furniture manufacturing in particular, is lagging behind the general level of development of the country. Productivity and product quality are at a very low level in the factories where machines are old. Furthermore, although a large number of professionals are educated at the University level and at various other specialized schools, they could benefit further by being exposed to new technologies in the field of furniture production. The lack of know-how and modern

equipment are major impediments to the development of this industry.

On the other hand, the Government is giving high priority to the improvement of the living standard of the population. This calls for the increase in production and improvement of the quality of the furniture produced in the country. To this end, the Government has requested UNDP/UNIDO assistance in this field.

The furniture factory within the Pyongyang Wood Complex has been selected for its transformation into a Pilot Furniture Plant. This complex also has a sawmill with a nominal annual capacity of 100,000 m^3 of sawn logs, a plywood factory with a nominal capacity of 600,000 square metres of plywood and 500,000 square metres of veneer, a particle board factory with a nominal capacity of 5,000 m^3, a joinery factory with a nominal capacity of 100,000 square metres of doors and windows and a furniture factory with a nominal capacity of 100,000 pieces of furniture per annum. It employs 1,100 people and has an annual value of production of approximately 8 million Wons. The Pyongyang Wood Complex belongs to the General Bureau for Building Materials which is an independent government sector enterprise controlling about 20 percent of the country's wood processing industry. The balance is controlled by the Ministry of Forestry.

ANNEX II

COUNTERPARTS

Mr. Li Song Hak	Technical Director, General Bureau for Building Materials in Pyongyang, National Director of the project.
Mr. Ko Ju Chol	Senior Officer, Fifth Department, Ministry of Foreign Trade, in charge of UNIDO projects.
Mr. Jo Dal Son	General Director, Pyongyang Wood Processing Complex.
Mr. Ryu Chun Guy	Chief, Technical Department, PWPC
Mr. Jo Jin Su	Future Director of the Pilot Furniture Plant.
Mr. Jo Myon Hun	Senior Officer in the GBBM, Pyongyang.
Mr. Ho Gum Sok	Senior Officer in the GBBM, Pyongyang.
Mr. Jo Kun Gon	Chief, Design Bureau, PWPC.
Mrs. Ok Gyong Ae	Designer
Mrs. Kim Hye Nam	English interpreter.
Mr. Baek Yong Do	Driver.

ANNEX III

TRAINING PROGRAMME FOR FURNITURE MANUFACTURING

1. Introduction

This training programme is designed to accomplish the objective and outputs foreseen in the project "Assistance in the Establishment of a Pilot Furniture Plant" (DP/DRK/86/011).

Referring to the project document, the immediate objective is to "train wood technicians and machine operators in the efficient operation of all the machinery and maintenance of tools, so as to manufacture furniture of medium quality", and also to "train managerial staff in overall management techniques including introduction to the marketing of furniture products".

This objective will be achieved through the accomplishment of outputs Nos. 6, 8 and 10.

Output No. 6 states: "20 wood machinists, 10 assemblers and four team leaders trained in the efficient use of the available manufacturing equipment, able to manufacture furniture of medium quality acceptable for export."

Output No. 8 states: "Two wood technicians trained to design and make the required production fixtures aimed at attaining accurate machining of components parts."

And output No. 10 states: "Design of overall factory organization, with established work preparation, cost accounting and management procedures, with managerial staff trained in (a) factory management based on modern industrial production methods and in (b) the basic elements of marketing."

The planned activities of the quoted outputs are:

For output No. 6:
- 6.1 Prepare a training programme for furniture manufacturing.
- 6.2 Prepare a training manual for each of the major production operations.
- 6.3 Train 20 machine operators, 10 assemblers and four team leaders to manufacture furniture of acceptable quality.

For output No. 8:
- 8.1 Train two wood technicians to design, produce and maintain jigs and other furniture production fixtures.

For output No. 10:
- 10.3 Train factory management in modern industrial production methods.
- 10.4 Acquaint the managerial staff with the basic elements of export marketing.

Training labourers is an integral part of production in modern industrial enterprises. Technical and technological developments are offering, practically on a daily basis new products and methods which make human work easier, safer and more productive. To follow such advances, people working in industry have to learn and to train in order to acquire new knowledge and skills necessary for the handling of modern equipment and processes.

In developing countries, such training has a decisive importance for the fuller utilization of new production techniques and for mastering new technological processes. To avoid unnecessary mistakes and to gain indispensable skills, training courses are the most rational mode, because people can learn, in a short time, the best ways of performing their production duties.

2. Training programme for the Pilot Furniture Plant

This training programme is designed to meet the specific requirements of the Pilot Furniture Plant. The main topics covered in the programme are:

1. Wood, affiliated products and other materials used in the production of case furniture;
2. Furniture products: design, construction and quality standards;
3. Production organization and work preparation;
4. Panel sizing;
5. Veneer trimming and joining;
6. Veneering;
7. Processing of veneered furniture parts: trimming, tenoning edge banding and drilling;
8. Moulding and routing;
9. Sanding;
10. Finishing;
11. Preassembling, assembling and packaging;
12. Tools, jigs and measuring instruments;
13. Quality control;
14. Safety measures in the furniture production;
15. Management based on modern industrial production methods;
16. Basic elements of marketing.

The main goals of this training are to enable workers, not only to learn how to perform their jobs, but also to understand the industrial production system as a whole.

Courses numbers 1, 2, 3, 12, 13 and 14 are foreseen to be attended by all workers to be trained, while the other courses are intended only for the workers who will perform the respective production operations.

All these courses are independent from one another, but in their totality they represent an integral training programme for the production of casegoods furniture in a medium size factory.

3. Methodology of training

There is an old Chinese wisdom which says "What I hear I will forget, what I see I will remember, and what I have done I will know." The output of this training should be knowledge learned by workers who will increase their ability for effective production. To achieve this, the training method will rest on three steps as follows:

1. Explain (to hear),
2. Demonstrate (to see), and
3. Try (to do).

Short manuals, written in a simple language, understandable to the workers, will be prepared for each course, translated into Korean and distributed to the trainees. All graphs, tables and formulae will be adjusted to the level of understanding of the people to be trained.

Theoretical teaching will take place in a classroom and its duration will be adapted to the minimum of theory which has to be known for a certain job. This part of the teaching will be performed by the expert (CTA) and the Chief of the Technical Department in the Pyongyang Wood Processing Complex (PWPC).

The practical part of the training will be organized at work areas for the respective work operations. For that purpose, the work areas must be organized correctly, including production documents, materials, tools, jigs, gauges, pallets, protective devices and everything that is necessary for productive, safe and good quality work. The expert will explain and show how to check a machine, tools, jigs and, in the case of wrong adjustments, how to correct them and prepare the equipment for correct use. The expert will show the correct way of performing operations and continue to supervise these operations until he concludes that proper work is fully accepted and that the quality of production is satisfactory.

The Chief of the Technical Department and other engineers who have undertaken training abroad will also collaborate in performing this practical

training. Some practical experience of the trainees will help in the practical part of training.

Course No. 12 (tools, jigs and measuring instruments) should be conducted by the Tool Maintenance Expert.

Course No. 13 (Quality control). The manual prepared during the CTA's first mission can be used.

Courses Nos. 15 and 16 ("Management based on the modern industrial production methods" and "Basic elements of marketing") are foreseen for the managerial staff and will be conducted in a way to initiate discussion and an active participation of the trainees.

4. Selection of trainees

The persons to be trained will be selected by the counterpart, according to their duties and to the topics of the training programme. Besides workers who will directly perform particular production operations, all other people concerned with certain aspects of the production, such as foremen, members of the management, maintenance personnel etc. could be included in the training.

It is recommended that in selecting the trainees attention should be paid that their physical and psychological abilities be in accordance with the requirements of the pertinent jobs.

The list of trainees is an integral part of the training programme, and it determines the number of copies of the training manuals to be prepared and distributed for every course.

5. Training programme

TITLE	TRAINING HOURS	
	Theoretical	Practical
1. Wood, affiliated products and other materials used in the production of case furniture	4.5	1.25
2. Furniture products: design, construction and quality standards.	2.75	0.5
3. Production organization and work preparation	4.75	2
4. Panel sizing operation	2.75	3.5
5. Veneer trimming and joining	2.75	4.5
6. Veneering	5	4.5
7. Processing of veneered furniture parts: trimming, tenoning, edge banding and drilling	4.5	9.25
8. Moulding and routing	2.75	4.75
9. Sanding	0.25	4.75
10. Finishing	4.25	6.75
11. Preassembling, assembling and packaging	4.5	8.5

TITLE	TRAINING HOURS	
12. Tools, jigs and measuring instruments	5.75	4
13. Quality control	5	2.5
14. Safety measures and work protection in the furniture industry	5.5	1.25
15. Management of production in a modern industrial factory	10.25	4
16. Basic elements of marketing	5.25	-
GRAND TOTAL	70.50	62.00

Detailed syllabi for each topic are given in Annex IV.

ANNEX IV

DETAILED SYLLABI FOR THE 16 TOPICS OF THE PROPOSED TRAINING COURSE

Topic 1: Wood, affiliated products and other materials used in the production of casegoods furniture

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
1.1	Introduction	0.25	--	Understanding the purpose of the course
1.2	Growth process of a tree and anatomy of wood	0.25	--	Understanding wood structure and properties of wood and wooden products
1.3	Classification of wood by species, hardwoodS, softwoodS and major species used for furniture production in the country	0.25	0.5	Ability to recognize the most common wood species and to distinguish hardwoods, softwoods, sapwood and heartwood of any species.
1.4	Physical and mechanical characteristics of wood with emphasis on the properties of domestic species	0.25	--	Better understanding wood as a raw material and relationship between properties of wood and processing methods.
1.5	Moisture content and shrinkage of wood, including shrinkage data for domestic species	0.25	--	Understanding changes occurring in wood during its drying process, like deformation and other defects caused by shrinkage and swelling of wood.
1.6	Wood destructors and wood preservation, including drying and finishing of wooden products	0.25	--	Understanding requirements for correct handling and storing of wood and wooden products.
1.7	Sawnwood, its dimensions, quality grading and utilization in secondary wood processing	0.25	0.5	Ability to better utilize sawnwood both quantitatively and qualitatively.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
1.8	Veneer used in furniture production and its properties	0.25	0.25	Better understanding of the veneering process and ability to distinguish the most common species and quality grades.
1.9	Plywood, its properties and use in furniture production	0.25	--	Knowledge of its basic properties, sizes and quality grades important for furniture production.
1.10	Blockboard, its properties and use in furniture production	--	0.25	Knowledge of blockboard important for processing in furniture production
1.11	Particle board, its standard properties and used in furniture production	0.25	0.25	Knowledge of mechanical and other characteristics of the particle board which are important for processing and its better utilization in furniture production.
1.12	Fibreboard (basic information	0.25	--	General knowledge of fibreboard and its use in the manufacture of furniture.
1.13	Surface improved boards (basic information).	0.25	--	General knowledge of surface improved boards and possibility of their use for the manufacture of furniture.
1.14	Glues and glue additives, their classification, major properties and use in furniture production	0.5	--	Better understanding of the gluing process and ability to select the correct glues and gluing parameters.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
1.15	Finishing materials: lacquers, fillers, putties, thinners, stains etc. their classification, basic properties and use in furniture production	0.5	--	General knowledge of finishing materials, their role, properties and technological requirements for the correct finishing of furniture products.
1.16	Metal components: hardware, fittings, metal products for joining and fastening and their use in furniture production	0.25	--	General knowledge of metal components, possibilities and advantages of their use in furniture production.
1.17	Plastic components and other materials used in the production of casegoods furniture	0.25	--	General knowledge of the most common plastic components and other products which could be used in the Pilot Furniture Plant.
	TOTAL	4.50	1.75	

Topic 2: Furniture Products: Design, Construction and Quality Standards.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
2.1	Introduction	0.25	--	Understanding the purpose of the course.
2.2	General knowledge about furniture production	0.5	--	Understanding the main characteristics of secondary wood processing and classification of furniture products.
2.3	Importance of product development for the successful production of furniture	0.25	--	Understanding the necessity of permanent work on innovation and product development.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
2.4	Strategic approach and main stages of product development in the furniture industry	0.25	--	Understanding the product development process from an idea to a finished prototype.
2.5	Design of furniture products and what a designer must take into consideration when making a new design	0.25	--	Better understanding of functions of products and the compromise between the customer's requirements and the possibilities of production. Comprehending the importance of design.
2.6	Standardization and interchangeable parts, the uniformity of components and variety of products	0.25	--	Full understanding of the advantages of production based on standardized interchangeable parts.
2.7	Construction of case furniture and use of appropriate constructive joints and fittings suitable for an industrial manufacturing method.	0.5	0.5	Ability to understand principles of construction of case furniture, for industrial production, and to read simple construction drawings.
2.8	Detailed drawings of furniture parts and reading of drawings	0.5	--	Easy understanding and reading of detailed drawings in order to select tools and set up a machine for an appropriate operation.
2.9	Fixed and knock-down furniture constructions, the major differences, advantages and prerequisites	0.25	--	Understanding the knock-down furniture constructions and conditions required for such production.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
2.10	Furniture quality standards and their use in the furniture production, how to measure the precision of machining and to estimate quality of materials.	0.5	--	Understanding and ability to use the furniture quality standards. Ability to recognize defects and to measure precision of work.
	TOTAL	3.50	0.50	

Topic 3: Organization of production and work preparation.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
3.1	Introduction	0.25	--	Understanding the purpose of the course.
3.2	Types of furniture production	0.5	--	Knowledge about types of furniture production and their basic characteristics.
3.3	Production system, its establishment and maintenance	0.5	--	General understanding of a production system and its elements.
3.4	Organization of production for manufacturing case furniture	0.5	1	Understanding the organization system of the Pilot Furniture Plant
3.5	Purpose and organization of work preparation	0.5	--	Knowledge of work preparation tasks and procedures, as well as the work preparation micro-organization.
3.6	Data base, its preparation and maintenance	0.5	--	Understanding elementary facts about the data base and its role.
3.7	Preparation of production documents, use of documents in production and processing of information	0.5	--	Knowledge of production documents, type of documents, their function and the procedures they are subjected to.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
3.8	Job order and other relevant documents reaching the work place	0.5	--	Ability to understand and use all documents sent to the work places, such as orders or instructions.
3.9	Improvement of production methods and time standards	1	1	Understanding the relations between improvement of production methods and operational time standards.
	TOTAL	4.75	2.0	

Topic 4: Panel Sizing Operations.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
4.1	Introduction	0.25	-	Understanding the purpose of the course.
4.2	Cutting listS, panel sawing schemes and utilization of boards	0.5	--	Ability to understand cutting lists and sizing scheme and to produce furniture parts in accordance with these documents.
4.3	Panel sizing saws	0.5	1	Knowledge bout construction of panel sizing saws, their functions and work principles.
4.4	Characteristics of sawblades for panel sizing saws	0.5	0.5	Knowledge of all elements and parameters of sawblades used for panel sizing operations.
4.5	Organization of the work area	0.5	0.5	Ability to organize the work area to comply with safety measures and the rational utilization of equipment and energy

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
4.6	Performing panel sizing operations	--	1	Ability to set up a machine and to perform panel sizing operations in a safe and efficient way and to produce parts with a required dimensional precision.
4.7	Safety measures	0.5	0.5	Understanding dangers which may occur because of improper use of the machine or because of neglecting the safety measures.
	TOTAL	2.75	3.50	

Topic 5: Veneer Trimming and Joining

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
5.1	Introduction	0.25	--	Understanding the purpose of the course.
5.2	Utilization of veneer and veneer cutting lists	0.25	--	Ability to understand and use a cutting list. Knowledge of the principles of utilization of veneer.
5.3	Veneer trimming machine	0.5	1	Knowledge of the construction, working principles and use of the veneer trimming machine.
5.4	Veneer trimming tools	0.25	0.25	Knowledge of the characteristics of tools and basic maintenance requirements.
5.5	Operating instructions for veneer trimming machine	--	1	Ability to operate correctly and control a veneer trimming machine.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
5.6	Safety measures for veneer trimming operation	0.25	0.25	Understanding the dangers of improper use of the machine and measures for work safety.
5.7	Veneer joining machine	0.5	0.5	Knowledge of the construction, working principles and use of a veneer joining machine.
5.8	Thermoplastic thread for joining veneer	0.5	--	Knowledge of the thermoplastic gluing material for joining veneer and its advantages.
5.9	Organization of work area for veneer joining operations	-	0.25	Ability to organize the work area to ensure a rational utilization of time and workers' energy.
5.10	Operating instructions for veneer joining machines	-	1	Ability to operate and control a veneer joining machine.
5.11	Safety measures for veneer joining operations	0.25	-	Understanding safety measures in order to prevent injuries and damages to the machine and the veneer sheets.
5.12	Veneer quality controlling table	0.25	-	Knowledge of the function and use of a veneer quality controlling table.
5.13	Inspection of veneer and repairing defects	-	0.25	Ability to recognize defects and to repair them. Understanding quality standards for veneer.
	TOTAL	3.00	4.50	

Topic 6: Veneering.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
6.1	Introduction	0.25	--	Understanding the purpose of the course.
6.2	Glue and other ingredients in a glue mixture	0.5	-	Ability to select a glue in accordance with the type of veneer and the type of press, and to select other ingredients of a glue mixture.
6.3	Preparation of a glue mixture	0.5	0.5	Ability to prepare a glue mixture in accordance with a formula.
6.4	Glue control and controlling instruments	0.25	0.5	Ability to control the viscosity, dry solids content and to use simple control instruments. Knowledge of gluing tests.
6.5	Operating instructions for a glue mixer	0.25	0.25	Ability to operate a glue mixer.
6.6	Glue spreading machines	0.5	0.5	Knowledge of construction and working principles of a glue spreading machine.
6.7	Control of the consumption of glue	0.25	-	Ability to control the consumption of glue.
6.8	Operating instruction for a glue spreading machine	0.5	0.5	Ability to set up and to operate glue spreading machine.
6.9	Cleaning the glue spreading machine	0.25	0.25	Understanding the importance of cleaning the machine and how to clean the glue spreading rollers.
6.10	Hydraulic hot press	0.5	0.5	Knowledge bout construction and working principles of a hydraulic hot press.

6.11	Governing pressure and temperature in the press	0.5	0.25	Ability to determine the pressure according to the surface to be veneered and, given the diagram, to select the pressing time for a given temperature.
6.12	Operating instructions of a hydraulic hot press	0.5	1	Ability to operate multi-daylight hot presses with manual loading and unloading.
6.13	Protection and clearing of the hot platens of the press	0.25	--	Understanding the importance of cleanliness and how to clean and protect the hot platens.
6.14	Organization of the work area	-	0.25	Ability to organize the work area in a rational way.
6.15	Safety measures	0.25	0.25	Understanding dangers which may occur because of improper use of glue spreading machines and hydraulic hot presses, as well as safety measures necessary for safe work.
	TOTAL	5.25	4.75	

Topic 7: Processing of veneered furniture parts: Trimming, Tenoning, edge banding and drilling.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
7.1	Introduction	0.25	-	Understanding the purpose of the course.
7.2	Basic requirements for the trimming and tenoning of veneered furniture parts	0.25	-	Knowledge of the purpose of trimming/tenoning of veneered furniture parts and requirements for precision and quality of cuts.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
7.3	Double-side trimming and tenoning machines	0.5	0.5	Knowledge of the construction and working principles of the machine.
7.4	Setting-up the double-side trimming/tenoning machine and its tools	-	1	Ability to set-up the machine and its tools for any required operation.
7.5	Tools for processing veneered furniture parts	0.5	0.5	Knowledge of the types of tools used for the processing of veneered furniture parts, and the tools' parameters.
7.6	Operating instructions for edge trimming/tenoning machines	0.5	1	Ability to operate a double-side trimming/tenoning machine
7.7	Single edge banding machine	0.5	0.5	Knowledge of the single edge banding machine and its working principles.
7.8	Setting up the edge banding machine and the adjustment of its tools	-	1	Ability to set up the machine and its tools for a production operation.
7.9	Not-melt glue and its preparation for application	0.25	-	Properties of hot-melt glue and its preparation.
7.10	Operating instructions for the edge banding machine	0.5	1	Ability to operate the edge banding machine.
7.11	Multi spindle drilling machine	0.5	0.5	Knowledge of the construction and working principles of the multi-spindle drilling machine
7.12	Setting up of multi-spindle drilling machines and their drilling tools.	-	1	Ability to set up the multi spindle drilling machine and its drilling tools.
7.13	Operating instructions for the multi-spindle drilling machine	0.5	1	Ability to operate the multi-spindle drilling machine

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
7.14	Control of drilling	-	0.5	Knowledge of the procedures to check the precision of drilling and how to use gauges and other controlling instruments.
7.15	Organization of work area	--	0.25	Understanding the importance of a well organized work area and to know how to prepare the workplace.
7.16	Safety measures	0.25	0.5	Understanding the potential dangers if the machines (double side trimming, single-side edge banding and multi-spindle drilling) are operated incorrectly, and knowledge about safety measures for these machines.
	TOTAL	4.50	9.25	

Topic 8: Moulding and routing.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
8.1	Introduction	0.25	-	Understanding the purpose of the course.
8.2	Moulding and routing operations in the production of furniture.	0.5	-	General knowledge of the universality of moulding and routing machines and the various possibilities of moulding and routing operations.
8.3	Single spindle moulders	0.5	-	Knowledge of the construction and modus operandi of the moulding machine.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
8.4	Moulder cutters	0.5	-	Knowledge of the moulding tools and their parameters.
8.5	Setting up moulding machines and moulding tools	-	0.5	Ability to set up a moulder and its moulding cutters for any required operation.
8.6	Operating instructions for a moulder	-	1	Ability to operate correctly the single spindle moulder.
8.7	High-speed routers	0.5	-	Knowledge of the construction and working principles of high speed routers.
8.8	Bits and cutters for routing operations	0.5	-	Knowledge of the routing tools and their correct parameters.
8.9	Setting up a router and routing tools	-	1	Ability to set up a high speed router and all the bits and cutters for routing operations.
8.10	Operating instructions for a high speed router	-	1	Ability to operate a high speed router.
8.11	Organization of the work area.		0.25	Ability to organize the work area rationally.
8.12	Safety measures	-	1	Knowledge of the dangers of improper use of moulding and routing machines, and of the measures for the safe operation.
	TOTAL	2.75	4.75	

Topic 9: Sanding

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
9.1	Introduction	0.25	-	Understanding the purpose of the course.
9.2	Importance of sanding in furniture production	0.5	-	Understanding the role of sanding and its influence on the quality of surface finishing.
9.3	Classification of sanding machines	0.5	-	Elementary knowledge of the types of sanding machines and their basic characteristics.
9.4	Classification of sanding papers and belts	0.5	-	Knowledge of the used materials and properties of sanding papers, and the respective end uses of each type.
9.5	Selection of correct grits of sanding papers according to the type of sanding to be performed	0.25	-	Understanding grit numbers and knowing how to select the correct grit of sanding paper.
9.6	Preparation of sanding belts	-	1	Ability to prepare a sanding belt and to glue it correctly.
9.7	Wide belt sanding machines	0.5	-	Knowledge of the construction and working principles of a wide belt sanding machine
9.8	Narrow belt sanding machines	0.25	-	Knowledge of the construction and working principles of a narrow belt sanding machine.
9.9	Brush sanding machines	0.25	-	Knowledge of the construction and use of brush sanding machine.
9.10	Drum sanding machines	0.25	-	Knowledge of the construction and use of drum sanding machine

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
9.11	Disc sanding machines	0.5	-	Knowledge of the construction and use of a disc sanding machine.
9.12	Operating instructions for a wide belt sanding machines	-	1	Ability to operate a wide belt sanding machine
9.13	Operating instructions for a narrow belt sanding machine	-	1	Ability to operate a narrow belt sanding machine
9.14	Organization of the work area	-	0.25	Ability to organize the work area rationally.
9.15	Quality control of sanded surfaces	-	1	Ability to control the quality of sanded surfaces, in accordance with the quality standards set.
9.16	Safety measures.	0.5	0.5	Knowledge of the sanding dust and its hazards to health and of the safety measures to protect the health and risks of explosions and fire.
	TOTAL	4.25	4.75	

Topic 10: Finishing

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
10.1	Introduction	0.25	-	Understanding the purpose of the course.
10.2	General information on the finishing of furniture	0.5	-	General knowledge of the importance of the correct finishing of furniture.
10.3	Finishing materials, their classification and characteristics	1	-	Knowledge of finishing materials, their characteristics and use.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
10.4	Spray guns	0.25	1	Knowledge of spray guns, their constructions and operating principles.
10.5	Spray booths	0.25	0.5	Knowledge of spray booths, their construction and operating principles.
10.6	Roller lacquer spreading machines	0.5	-	Elementary knowledge of the principles of spreading stains and undercoating lacquers with roller lacquer spreading machines.
10.7	Curtain coating machines	0.5	1	Knowledge of the construction and working principles of a curtain coating machine.
10.8	Lacquer drying tunnels	0.5	1	Knowledge of the working principles of a lacquer drying tunnel.
10.9	Setting up a curtain coating machine	-	1	Ability to set up a curtain coating machine.
10.10	Lacquer coating with spray guns	-	0.25	Ability to use a spray gun correctly and to get a satisfactory coating.
10.11	Operating a the curtain coating machine	-	1	Ability to operate a curtain coating machine.
10.12	Control of finished surfaces	-	0.5	Knowledge of the quality criteria and control procedures for surface finished surfaces.
10.13	Safety measures and fire prevention	0.5	0.5	Understanding the inflammable characteristics of finishing materials and how to prevent or fight fires.
	TOTAL	4.25	6.75	

Topic 11: Preassembling, assembling and packaging.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
11.1	Introduction	0.25	-	Understanding the purpose of the course.
11.2	Assembling tables	-	0.5	Knowledge of the use of assembling tables equipped with pneumatic pistons.
11.3	Assembling clamps (presses)	-	1	Ability to use assembling presses for assembling case furniture.
11.4	Use of compressed air for preassembling and assembling operations	0.5	0.5	Knowledge of proper use of compressed air for assembling operations.
11.5	Pneumatic hand tools (drills, screwdrivers, staplers etc.)	0.5	0.5	Ability to use various pneumatic hand tools.
11.6	Gluing materials used for furniture assembly	0.25	-	Knowledge of the glues which are used regularly for assembling furniture.
11.7	Screws, nails, staples and various joining products	0.25	0.25	Knowledge of the various joining products which are regularly used for furniture assembly.
11.8	Hinges, locks and other hardware used for the production of furniture	0.25	0.25	Knowledge of the hardware used in furniture production
11.9	Control of quality of the parts to be assembled	0.5	0.5	Knowledge of how to check the quality of parts to be assembled into furniture products.
11.10	Performing assembling operations	-	2	Ability to perform assembly work with satisfactory results.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
11.11	Control of quality of assembled units	-	0.5	Ability to check the quality of assembling according to the furniture quality standards.
11.12	Preassembling of knock-down furniture	0.5	1	Ability to assemble parts of knock-down furniture (mounting hardware and assembling some subassembly groups).
11.13	Cleaning assembled furniture	-	0.5	Knowledge of how to clean glue and other materials from assembled furniture.
11.14	Packaging materials	0.5	-	General information of packaging materials.
11.15	Packaging of furniture products	0.5	-	Knowledge of the basic principles of packaging of furniture
11.16	Organization of the work area	-	1	Ability to organize the work area in a rational way.
11.17	Safety measures	0.5	-	Knowledge of safety measures for assembly.
	TOTAL	4.50	8.50	

Topic 12: Tools, jigs and measuring instruments.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
12.1	Introduction	0.25	-	Understanding the purpose of the course.
12.2	Classification of woodworking tools	0.5	-	General knowledge of the various woodworking tools.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
12.3	Circular saw blades	0.5	0.5	Ability to select the correct saw blade and its parameters, and to control its readiness for sawing.
12.4	Knives and cutters	0.5	0.5	Knowledge of the main characteristics of the various knives and cutters used in the processing of wood and wooden products.
12.5	Drilling tools	0.5	0.25	Knowledge of the main characteristics of various drilling tools.
12.6	Routing bits	0.5	0.25	Knowledge of the main characteristics of routing bits.
12.7	Profiling tools	0.5	0.25	Ability to use profiling tools.
12.8	Grinding wheels	0.5	0.5	Ability to select the correct grinding wheels for sharpening various woodwork tools.
12.9	Jigs used for the production of case furniture	1	1	General knowledge of the jigs and their use in the production of case furniture.
12.10	Gauges used in furniture production	0.5	0.25	Knowledge of the use of gauges in furniture production.
12.11	Measuring instruments used in furniture production	0.5	0.5	How to use various measuring instruments to control accuracy of machining.
	TOTAL	5.75	4.00	

Item 13: Quality Control.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
13.1	Introduction	0.25	-	Understanding the purpose of the course.
13.2	Importance of quality in furniture products	0.25	-	Understanding the importance of quality for the successful production of furniture.
13.3	Quality standards for furniture	1	1	Ability to apply furniture quality standards for materials and machining accuracy.
13.4	Production factors that quality depends on	0.5	-	Understanding the influence of various production factors on the quality of furniture.
13.5	Measuring instruments and gauges used for quality control	0.5	0.5	Ability to perform the control of quality of furniture parts and products by using various measuring instruments and gauges.
13.6	Quality control by operators	0.5	1	Ability to perform simple quality control before and after operations.
13.7	Quality control procedures in furniture manufacturing	0.5	-	Understanding quality control information systems and systems of preventing and correcting production mistakes.
13.8	How to improve quality	0.5	-	Knowledge of how to participate in the improvement of quality.
13.9	How to avoid defective work	0.5	-	Knowledge of methods of reducing defects close to zero.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
13.10	Quality and productivity	0.5	-	Understanding relations between quality and productivity.
	TOTAL	5.00	2.50	

Topic 14: Safety measures and work protection in the furniture industry.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
14.1	Introduction	0.25	-	Understanding the purpose of the course.
14.2	Some characteristics of woodworking machines and tools	0.5	-	Understanding dangers and injuries which may be caused by improper use of woodworking machines.
14.3	Sawdust and its hazards to health	0.5	-	Understanding the necessity of extracting sawdust form the workplace, and the correct ways of doing so.
14.4	Working conditions (light, temperature, sound, circulation of air, chemicals etc.) and their tolerable values	0.5	-	Knowledge of the optimal working conditions and legal limits for various parameters.
14.5	Personal protective means	0.5	-	Knowledge of the function and use of personal protective means.
14.6	Protective guards and devices on woodworking machines.	0.5	-	Knowledge of the function and correct use of protective guards and devices.
14.7	Earthing machines and protection against electric shocks	0.25	0.25	Understanding the purpose and necessity of correct earthing of all electric-powered equipment.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
14.8	Fire-fighting	0.5	0.5	Ability to use fire-fighting equipment (extinguishers) and to follow fire prevention measures.
14.9	Safety and cleanliness of the work area	0.25	-	Understanding the importance of cleanliness for safe work.
14.10	Legal regulations on safety and work protection	0.5	-	Knowledge of the legal regulations related to the safety of work.
14.11	Responsibility for observing safety regulations	0.5	-	Knowledge of the responsibility of workers in following safety measures.
	TOTAL	4.75	0.75	

Topic 15: Production management in a modern industrial factory.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
15.1	Introduction	0.25	-	Understanding the purpose of the course.
15.2	Basic characteristics of an industrial organization	0.5	-	Knowing of the structure of an industrial organization at the factory level.
15.3	Role of management in a modern industrial enterprise	1	-	Understanding the essential tasks of management in a modern industrial enterprise with emphasis on the factory level.
15.4	Information system as a base for making decisions	1	-	General knowledge of information systems at the factory level and how to design such a system.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
15.5	Optimization of decisions	1	1	General knowledge of some tools which are often used in taking decisions such as: decision tree, mini-max inventory, simplex method, etc.
15.6	Other management techniques (ABC analysis, CPM method, management by objectives etc.)	2	1	Ability to understand these management methods and to use them in a simple form.
15.7	Management in the Pilot Furniture Plant	1	-	Understanding the tasks of management in the Pilot Furniture Plant and the ability to manage the factory.
15.8	Controlling the utilization of capacities, materials and their resources	1	1	Ability to establish a control system for an efficient control of the main resources of production.
15.9	Planning and controlling the economic results of production	1	1	Ability to use a direct costing system for planning and control of the economic results of production.
15.10	Motivation as a management factor to achieve goals	0.5	-	Understanding the importance of motivation and which are the major motivators.
15.11	Keeping up with development trends in the world	1	-	Understanding the necessity of information on the state of development of the furniture industry in the world and how to follow up on that development.
	TOTAL	10.25	4.00	

Topic 16: Basic elements of marketing.

ITEM	TOPICS	TRAINING TIME (in hours)		LEVEL OF COMPETENCE TO BE REACHED
		Theoretical	Practical	
16.1	Introduction	0.25	-	Understanding the purpose of the course.
16.2	Marketing concept	1	-	Understanding the essentials of marketing and its development.
16.3	Basic tasks of marketing in furniture production	1	-	Knowledge of the tasks of marketing with an emphasis on the export marketing of furniture products.
16.4	International trade and marketing	0.5	-	Understanding the role of marketing in international trade.
16.5	Market research	0.5	-	Understanding the necessity and tasks of market research for the production of furniture.
16.6	Entering a new market	0.5	-	Learning how to select a new market and how to prepare for entering into that market.
16.7	Expanding in the market	0.25	-	General knowledge of the methods for penetration in a market.
16.8	Protecting the market	0.25	-	Knowledge of some crucial facts important for protecting the market once entered.
16.9	Competition as an important factor in the marketing oriented industry	1	-	Understanding the role of competition in the market and how to be competitive.
	TOTAL	5.25	0.0	

ANNEX V

SUBSTANTIVE OFFICER'S COMMENTS

The expert has covered the topics to the high standard we have become accustomed to expect from him. The information provided is sufficient to enable the plant's engineers to complete what is expected of them by the time he returns for the next mission.

The main impact in this report is the overall training programme he has proposed (in Annexes III and IV). These will be the "software" that the project will have contributed to ensure the full and correct use of the hardware purchased from project funds. We wish to stress however that once the manuals that will be prepared have been translated into Korean they should be diffused to other furniture plants in the country and also be used as training manuals in the country's vocational schools and technical institutes.