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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: Planning improvements and
training activities*

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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* This document has not been edited.

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INTRODUCTION

The furniture production expert, Radmilo Malis, assigned to the project as Chief Technical Advisor, carried out this mission from 8 January to 6 March 1992. It was aimed at accomplishing the tasks planned in the project revision agreed and signed on 11 October 1992 by the Government of the Democratic People's Republic of Korea (DPR of Korea), the United Nations Development Programme and the United Nations Industrial Development Organization as the executing agency. His duties are outlined in his job description in Annex I.

According to the original project document, the project was aimed at improving the country's furniture industry in order to fully utilize the available wood resources, increase efficiency in production and to produce furniture of a satisfactory quality for local consumption and, eventually, also for export.

Since the original project budget was sufficient only for the completion of the production line for panel furniture, a project revision was made to cover also assistance in the production of solid wood furniture. The Pyongyang Solid Wood Branch Factory was selected to be developed into the Pilot Furniture Plant. To achieve this, the UNDP input was increased by an additional US\$ 391,800, and the Government's input (in kind) was also increased by 412,900 Won.

At the end of the project, the following results are expected:

- The Pilot Furniture Plant will be in a position to produce furniture of medium quality at double the rate of production obtained at the beginning of the project;
- A system of internal standards for products, based on interchangeable parts and components with new designs will have been introduced;
- Staff will have been trained in the efficient use of the available manufacturing equipment and in tool maintenance;
- A system of safety and work protection measures will have been introduced, and
- A proposal for the factory's overall 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 will have been proposed.

This is the first of three missions foreseen to be carried out by the furniture production expert during the project's one year extension.

Great attention was paid to planning the improvements and to the training activities.

The following points are covered in this report:

1. Project's background,
2. Findings,
3. Activities,
4. Conclusions,
5. Recommendations.

Other documents prepared during this mission are enclosed to this report as annexes.

1. Project's background

The initial UNDP/UNIDO assistance to the DPR Korea's woodworking sector was an SIS project in 1986 (SI/DRK/86/880). It consisted in the recruitment of a UNIDO consultant to survey the status of the country's furniture manufacturing industry and to prepare the draft of a project for the establishment of a small-scale Pilot Furniture Plant, financed from UNDP/IPF funds.

The existing furniture factory of the Pyongyang Wood Complex was selected for transformation into the Pilot Furniture Plant for the production of solid wood and casegoods furniture products. At the beginning of the project's execution the counterpart decided to use another factory building for the Pilot Furniture Plant, and to equip it completely with the new equipment. Due to the limited project budget (US\$ 300,000) the project's objectives were reduced to only cover the production of panel (casegoods) furniture.

The project lasted from March 1988 to November 1989.

Realizing the success of the panel furniture production line, the Government requested a revision of the project to reinstate the original objectives of a Pilot Furniture Plant capable of producing both solid wood and panel furniture.

A thorough assessment of the needs and requirements was done by a UNIDO consultant in May 1991, who advised that the Pyongyang Solid Wood Branch Factory should be transformed into the Pilot Furniture Plant for the production of solid wood furniture.

The parties involved in the project accepted the consultant's views and agreed to make a major revision of the project by providing additional funds for equipment, consultancies and training, and to extend the project's duration by one year, i.e. until the end of 1992.

2. Findings

The findings relate to the following subjects:

1. Product line development,
2. Development of technology,
3. Training of the counterpart staff,
4. Improvement of quality of products, and
5. Improvement of organization.

The findings and assessments done during this mission have provided the information necessary for the activities foreseen in the project's work plan.

2.1 Product line development

In order to prepare pertinent information needed for the product lines' improvement, the existing products were thoroughly analyzed.

The existing product line consists of 25 different products, each of them produced in a rather small quantity, ranging from 22 to 1500 units a year. The products are listed in Table 1, below, which contains data on: sales prices, number of units and sales value per year for each product, its percentual share of total sales, its weight and sales price per kilogram of finished product. The list is based on the production figures for 1991.

Table 1: The existing product line (figures are for production in 1991).

No.	Items	Unit	Units	Total sales	Percentage of		Weight	Price
		Sales Price Wons	sold in 1991	value Wons	total sales for Item	Cumulus	per unit kgs	per kg of item
1	Single bed	600.0	764	458.400	30.8	30.8	98	6.12
2	Upholstered arm chair	240.0	770	184.800	12.4	43.2	19	12.63
3	Dresser with three mirrors	500.0	210	105.000	7	50.2	42.3	11.82
4	High back chair	60.0	1500	90.000	6	56.2	7.1	8.45
5	Double bed	1768.0	45	79.560	5.3	61.5	123	14.37
6	Free cushion sofa	812.5	86	69.875	4.7	66.2	48	16.93
7	Dresser	312.0	210	65.520	4.4	70.6	38.7	8.06
8	Wardrobe - 4 doors	966.7	52	50.268	3.4	74	193.4	5
9	Coffee table	250.0	200	50.000	3.4	77.4	22	11.36
10	TV stand	157.3	340	46.682	3.1	80.5	28.5	4.82
11	Single sofa	600.0	68	40.800	2.7	83.2	32	18.75
12	End table	120.0	250	30.000	2	85.2	10	12
13	Bookcase	320.0	77	24.640	1.7	86.9	75.2	4.26
14	Corner cabinet	750.0	32	24.000	1.6	88.5	76.2	9.84
15	Small desk	100.0	240	24.000	1.6	90.1	31.8	3.14
16	Executive desk	770.0	30	23.100	1.5	91.6	55	14
17	Wardrobe	440.0	45	19.800	1.3	92.9	73	6.03
18	Three-seat sofa	881.0	22	19.382	1.3	94.2	52.5	16.78
19	Radio stand	124.8	150	18.720	1.3	95.5	12.5	12.50
20	Standing coat hanger	165.0	96	15.840	1.1	96.6	10.3	16.02
21	Upholstered chair	40.0	360	14.400	1	97.6	6.6	6.06
22	Clerk's desk	170.0	70	11.900	0.8	98.4	48	3.54
23	Bedroom hanger	55.7	180	10.026	0.7	99.1	8.7	6.40
24	Video stand	400.0	24	9.600	0.6	99.7	29.5	13.56
25	Chest of drawers for linen	133.5	30	4.005	0.3	100	56.4	5.23
Total:			5851	1,490,318	-	-	-	7.84

The data presented in the table shows that 80.5 percent of the sales value is earned by selling 10 items, while another 15 items represent less than 20 percent of the sales. The last ten items listed only represent 9.9 percent of sales.

Chairs, bedroom items and upholstered sets with coffee tables are the major products and the development of any new product line should be based on these products.

There are great differences between the sales prices per kilogram of products. These range from 3.14 to 18.75 Wons per kilogram of finished item. The somewhat higher prices in Wons/kg of upholstered products are caused by the cost of materials, while the differences among wooden products are mainly due to the big variations in processing times.

The sales value created per hour of production time also varies considerably from one product to another, ranging from 2.58 to 20.52 Wons/hour. These variations are shown in Table 2.

Tables 1 and 2 show that all products having low prices per kilogram or per hour of production time must be thoroughly analyzed and probably redesigned. It must be determined whether this is because of a low sales price, an excessive use of materials, an inadequate design, inefficient production methods, or a combination of these factors.

Table 2: Sales value created per hour of production time for the existing product line.

<u>No.</u>	<u>Items</u>	<u>Sales price</u>	<u>Unit production time (hours)</u>	<u>Sales value produced for one hour</u>
1	Single bed	600.0	48.51	12.37
2	Upholstered arm chair	240.0	36.24	6.62
3	Dresser with three mirrors	500.0	135.78	3.68
4	High back chair	60.0	13.41	4.47
5	Double bed	1768.0	237.21	7.45
6	Free cushion sofa	812.5	86.90	9.35
7	Dresser with mirrors	312.0	80.37	3.88
8	Wardrobe with four doors	966.7	203.94	4.74
9	Coffee table	250.0	66.06	3.78
10	TV stand	137.3	48.91	2.81
11	Single sofa	600.0	29.24	20.52
12	End table	120.0	44.09	2.72
13	Bookcase	320.0	79.05	4.05
14	Corner cabinet	750.0	142.30	5.27
15	Small desk	100.0	35.86	2.79
16	Executive desk	770.0	139.33	5.27
17	Wardrobe	440.0	133.01	3.31
18	Three seater sofa	881.0	51.99	16.95
19	Radio stand	124.8	48.21	2.59
20	Standing coal hanger	165.0	64.00	2.58
21	Upholstered chair	40.0	11.71	3.42
22	Clerk's desk	170.0	51.07	3.33
23	Bedroom hanger	55.7	16.79	3.32
24	Video stand	400.0	55.47	7.21
25	Chest of drawers for linen	133.5	44.08	3.03

The factory employs three designers who are in charge of product development and of the preparation of production documentation. It also has a separate room for making prototypes, equipped with one narrow bandsaw, one universal woodworking machine and the necessary hand tools.

Besides lacking experience, the designers are limited in their work by a very poor selection of raw materials and an even poorer choice of hardware and various auxiliary materials. The designers have very limited chances to visit furniture exhibitions abroad or even to get appropriate literature for furniture design.

The factory's management claims that their products are designed strictly in accordance with customers' demands. Some design ideas are also taken from available foreign furniture catalogues.

The customers' demands are screened by the General Bureau for Building Materials (GBBM) and actually this institution plays a decisive role in selecting new designs. The factory management also takes an active part, especially in the evaluation of designs or prototypes.

The product development documentation prepared consists of:

- Design drawings with all important construction details and dimensions,
- A technical description of the product,
- Time standards and unit costs of labour,
- List of materials and their cost,
- Based on these documents, the chief of the Technical Department determines direct production costs and send the data to the Planning Department to calculate the sales price.

Production plans for a whole year are given by the General Bureau for Building Materials (GBBM), but every three months, the plan is reviewed jointly by the management of the factory and the GBBM and can be modified to meet customers' demands.

Sales/production orders are also issued by the GBBM. The majority of the products are delivered directly for furnishing newly built apartments in Pyongyang, following orders of the GBBM. If the buildings are not ready for furnishing the furniture is delivered to the furniture stores in Pyongyang, or, more rarely, stored in the factory's warehouse. Up to 20 percent of the total production output can be sold to individual customers directly from the factory.

At the present stage of development the factory has no competitors on the market and developing forces are rather weak. On the other hand the factory has strong competition in the supply market where a number of similar factories compete for the limited raw material resources. This situation is very unfavourable for product development.

2.2 Development of technology

The Pyongyang Solid Wood Branch Factory is of a medium size, with about 120 employees. It has the following four production sections:

- Preparation of raw materials.
- Machining,
- Assembling,
- Finishing.

The section for preparation of raw materials consists of:

- Production of sawnwood (sawmill),
- Dry kilns for drying of sawnwood,
- Production of peeled veneer and plywood,
- Production of sliced decorative veneer.

The quantities of semi-manufactured products produced in this section are almost negligible: about 1000 m³ of sawnwood, 400 m³ of plywood and 100 m³ of sliced veneer a year. However, the factory's management did not accept the expert's recommendation to stop this production and to buy these materials from bigger sawmills and plywood factories in Pyongyang. The factory has had bad experiences with the supply of raw materials, and, since it is easier to get logs from the forest than products from primary wood processing plants, they want to keep these small capacities running notwithstanding the extremely high costs of this production. They

revoked their earlier decision to stop the production of veneers and plywood, and a new factory layout had to be designed.

All the existing machines in this section were produced in the DPR of Korea. The veneer peeling lathe and the veneer slicer were made in 1991, but they both look very obsolete.

An old log bandsaw has been used to produce sawnwood, but it cannot meet the production requirements and will be replaced with a new one.

The existing dry kilns, in which sawnwood is dried directly with flue gases, cannot satisfy either the required capacity nor the quality of drying. The boiler house cannot provide enough steam for drying the wood, and consequently the dry kilns cannot be converted now into steam-heated and properly controlled kilns. The management wants them to be reconstructed, but again using flue gases as heating agent.

The machining section is equipped with both old and new machines for some basic machining operations. The existing machines are described in the expert's technical report: "Revision and planning of the project's extension" (document number DP/ID/SER.A/1514), dated September 1991. Additional equipment, also specified in the above mentioned report, will be provided as UNDP's input to the project. The existing electrical and dust extraction installations have to be reconditioned and reconstructed in order to permit their connection to the new machines.

Besides introducing additional machines, the satisfactory machining of furniture parts, with the required accuracy, calls for several basic changes, such as:

- better maintenance and setting of woodworking tools;
- introduction of jigs where appropriate;
- introduction of precise measuring instruments for quality control;
- introduction of appropriate production documentation, such as detailed drawings of parts and operational instructions;
- improvement of safety measures.

Furniture assembly is done immediately after machining, using only hand tools. The parts are put together and fixed with glue and nails. Screws are never used. A lot of hand work is done to adjust individual parts so that they fit the product.

The surface of the assembled products is repaired and cracks and holes are filled with putty and sanded by hand-held pads.

Glue is spread on the outside surfaces of panel parts and veneer sheets that have not been spliced, are glued on the surfaces.

This phase of production is performed in a typical artisanal way and about one third of the total production time is used for assembly.

Production of upholstered furniture items is also mainly done in the assembly section, including cutting of foam and fabrics and sewing of fabrics.

With better-machined furniture parts and the relocation of the upholstery to some other room, assembling could be greatly improved, mainly through a better organization, and with the addition of proper assembling benches, powered hand tools and a transport conveyor.

The finishing section is an empty room where all the finishing operations are done manually, with brushes as the main tool. Spraying is done in a totally wrong and very dangerous way, without a spray booth and the electric installations which are not properly protected.

At least two spray booths and a couple of spray guns should be introduced to satisfy both the technological and ecological requirements.

In order to design a new factory layout, the main factory building should be enlarged by covering the area between the assembling and finishing sections.

2.3 Training of counterparts

In order to design an appropriate training programme and to prepare adequate training manuals, the expert had to examine the existing level of knowledge of the factory's staff, including all the key personnel working in the factory. This has been done through the observation of production and through discussions on various topics. The general conclusion is that the basic general knowledge of technology is rather good, but that knowledge is not adequately applied in the process. Most of the people are not familiar with advanced furniture manufacturing technologies nor with modern organization and management of production. Many materials, components and hardware items are unknown. The knowledge needed for the selection of appropriate woodworking tools and their proper maintenance is very limited. Only few of the staff know something about modern woodworking machines. Safety measures are unknown, hence not observed. The economics of furniture production is a vague area even for some of the management staff.

These deficiencies should be remedied through the training programme and training activities.

2.4 Improving the quality of products

The first impression was that this factory has a rather good quality of products, especially when compared with the rest of the local furniture production. A closer look showed that the somewhat better quality is achieved at extremely high costs of production.

The factory has many obstacles that impede the achievement of a satisfactory quality at reasonable costs. One such difficulty, which looks almost unsurmountable, is the very poor quality of raw materials, and the very limited choice of auxiliary materials and hardware.

However, the quality of products depends on many production factors, and the quality of materials is only one of them. First of all the factory does not have any quality standards which clearly define quality requirements. The quality policy is not precisely defined by the management. The quality controllers - one in the machining section and the other in the assembling section - mainly work on repairing defective parts and products. This is a totally wrong practice. No record is kept of the type of defect, frequency of occurrence, severity etc. for future analysis. The cost of bad quality are unknown. Responsibilities for bad quality are not properly defined. The people working in production oppose the decisions of the quality controllers. The accuracy of woodworking machines and tools is never controlled.

Improvements in quality should try to eliminate the existing shortcomings, at least those which call for no investments.

2.5 Improvements in organization

The expert's main concern, at the time of his mission, was devoted to the organization of the technical department, quality control and of the production department of the factory.

The technical department is subordinated to the Chief engineer, who is the second in command (after the Managing Director) in the factory. The Chief engineer is in charge of all technical and production matters.

The technical department has a position between the planning and the production departments. It is in charge of product development and of the preparation of all the production documentation.

Only three persons are currently working in this department. Obviously this is not sufficient for the development of products nor for an improved and more detailed preparation of production.

So far, quality control is not organized as a separate unit, but it acts as a part of the production department and under the supervision of the production manager. The management hesitates to establish a separate quality control unit because of possible disputes between controllers and production people. Of course, this is a wrong assumption, and in future, the organization should have a totally independent quality control unit, fully authorized to decide what can be accepted and what cannot.

The production department is headed by the production manager who supervises the production sections. Each production section (preparation of raw materials, machining, assembling and finishing) is led by a team leader who has a deputy. The deputy team leader is in charge of dispatching production orders to the labourers and to record all production data needed for the control of production.

This organization model is well rooted in practice and is part of a standard management model imposed in the country. It could be very efficient and should not be changed.

3. Expert's activities

The activities carried out by the expert during his mission related to the following subjects:

1. Revision of the project's work plan;
2. Development of a product line;
3. Development of technology;
4. Training activities;
5. Improvement of the quality of products; and
6. Improvement of organization.

These activities follow the findings and assessments described in chapter 2 of this report.

3.1 Revision of the project's work plan

The project's work plan proposed in the project revision had to be revised and brought up to date at the actual beginning of the project's execution and synchronized with the factory's own priorities and limitations.

Also some points related to the improvement of environmental conditions, a more advanced quality control, cost accounting and marketing activities requested as a condition for the approval of the project revision by the Project Appraisal Committee of UNDP, Regional Bureau for Asia and the Pacific and its EAPAC Division Appraisal.

UNDP's Resident Representative in Pyongyang also requested that the work plan should be revised to incorporate these requirements.

The modified work plan has been prepared and agreed with both the UNDP and the Government authorities. It is given in Annex II of this report.

3.2 Development of the product line

The major part of development of new products and the improvement of existing ones will be carried out by the design expert who will work in close collaboration with the factory's designers.

However, the furniture production expert worked with his counterparts to analyze the demands of the furniture users, to define the factory's production programme and to survey the existing standards for furniture products.

The expert also did some initial work aimed at establishing basic principles for the standardization of products in the Pilot Furniture Plant. These principles will be incorporated in new designs of products.

All the findings, recommendations and results of the expert's work have been explained to the consultant in design, with suggestions for the development of a product line which will fit the customers' demands and the factory's resources and possibilities.

The work on standardization will be continued after the designers have finished the design of some basic products and after (a) the introduction of new equipment; and (b) the technological methods used have been improved.

A recommendation was made to the design expert to start with the modification of the existing chairs and bedroom items, while new designs should also cover chairs, beds and, if possible, one combined kitchen and dining room set.

3.3 Development of technology

The upgrading of the technology is a basic prerequisite for the attainment of the project's objectives. During this mission the expert worked on the following technological problems:

- (a) Selection of machines to be purchased for the project;
- (b) Design of an improved layout for the Pilot Furniture Plant;
- (c) Development of a principal technological design for the dry kiln in the Pilot Furniture Plant;
- (d) Survey of the existing machinery to be reconditioned, and spare parts to be purchased; and
- (e) Selection of woodworking tools to be purchased.

(a) Based on the specifications prepared earlier and the offers obtained by UNIDO, woodworking machines and equipment for the maintenance of woodworking tools have been selected during the expert's briefing in Vienna, in the middle of December 1991. All the machines, except the long neck stitching machine which needed further investigation, have been ordered by UNIDO and will be shipped within two to four months. They should be received in Pyongyang around July 1992.

(b) An improved layout taking into account the counterpart's final requirements has been designed. The proposed layout was accepted and the counterpart will provide technical plans for the electrical wiring and dust extraction installations according to this layout. The layout is given in Annex III.

(c) The existing dry kilns are a problem limiting any increase of production, and therefore making the achievement of the project's objectives impossible. Using flue gases for the drying of wood has been abandoned many years ago, because it can create some very serious problems,

such as: deterioration of wood, fires or even poisoning. However, the management did not have any choice other than to continue using flue gases to dry the wood. Since the drying process in the existing dry kilns cannot be controlled and regulated at all, and since they have a very small capacity, the management decided to construct new drying kilns which could satisfy the factory's foreseen drying capacity.

The expert calculated this capacity and the sizes of the new drying kilns, and made the principal technological design, ensuring that, in future, steam heated radiators can be built in without any structural modifications to the buildings.

He recommended to the counterpart to engage a civil engineer for the technical design of the building, and a specialist in thermodynamics to design the installations for the generation, cleaning and distribution of flue gases in the kilns.

The principal design of the dry kilns, as worked out by the expert and recommended to the counterpart, is given in Annex IV.

(d) A survey of the existing machinery to be reconditioned and of the spare parts to be purchased was done with the counterpart technical staff. The majority of the machines were bought in 1990 and are in a rather good condition. Only minor repairs are necessary and, for that purpose, the counterpart requested the purchase by the project of ball bearings and V-belts which should be replaced prior to the completion of the factory in accordance with the new layout.

The plan for the reconditioning of the machines and a list of spare parts is given in Annex V.

(e) Woodworking tools and tool grinding wheels have been selected and specified. Their specification is given in Annex VI.

3.4 Training activities

The expert prepared training programmes for all the training activities foreseen in the project document, namely:

1. Training programme for in-service training (see Annex VII).
2. Study tour programme (see Annex VIII).
3. Group training programme (see Annex IX).

The expert adapted the following three of the training manuals he had prepared previously to the conditions and needs of the Pilot Furniture Plant:

1. Wood, affiliated products and other materials used in the production of solid wood furniture;
2. Quality control in the production of solid wood furniture;
3. Organization and planning of production in manufacturing solid wood furniture.

Furthermore, a training manual on tools, jigs and measuring instruments used in the production of solid wood furniture was prepared during this mission.

All these manuals will be issued as separate technical reports. Theoretical training has been conducted on the following subjects:

1. Wood, affiliated products and materials,
2. Quality control,
3. Tools, jigs and measuring instruments.

The lists of trainees is given in Annex X.

The organization and planning of production, with the proposed organization of the Technical Department, has been explained to the management staff so that they may prepare the forms needed for production documentation until the expert's next mission.

3.5. Improvement of the quality of products

Based on the survey of the quality of the products, prepared by the expert, an improved quality control system has been designed, and a training manual for the training of quality controllers has been prepared.

Quality standards for furniture products have been proposed and thoroughly explained. The organization of the quality control unit has been proposed to the counterpart. The quality controllers and the Technical Department staff have been trained in quality control procedures and methods. The practical training of the controllers will be done after the factory will have improved its production.

3.6 Improvement of organization

After reviewing the factory's existing organization, the expert realized that only minor organizational changes can be accepted in the technical and production departments. Namely, as a whole, the factory's organizational structure is a typical standard organization applied elsewhere in the country and it is considered to be the most suitable for local conditions.

Minor organizational improvements in the technical department have been elaborated in the Manual on Organization and Planning of Production, and the organization of the quality control unit is explained in the Manual on Quality Control. The organization of the production department is satisfactory and should not be changed.

The expert recommended the transfer of the upholstery operation to a separate room and the establishment of a separate section for upholstery as foreseen in the new factory layout. The counterpart shares the expert's views and is willing to modify the factory's organizational structure to accommodate this proposal.

Note: The expert did not have the opportunity to assist the counterpart in the improvement of production methods nor to conduct practical training during this mission because production in the factory was very slow or even, often, completely stopped. This was due to lack of raw materials (logs).

CONCLUSIONS

As a result of two months work and observations in the Pilot Furniture Plant, the following conclusions can be drawn:

1. The supply of raw materials, especially logs, is far below the factory's needs. The quality of logs received is very low, and the sawnwood produced is not suitable for use in furniture production.
2. The factory lacks sufficient capacities to produce the thermal energy needed for wood drying, veneering, finishing and for the heating of the work areas.
3. The factory has a very poor supply of woodworking tools, and, also, a poor maintenance of tools, especially with respect to the tungsten carbide tipped tools.

4. There is an inexplicable resistance towards any kind of cooperation with other furniture factories that could compensate for the lack of certain capacities. This may be because, contrary to the very weak, if any, competition in the sales market of furniture, there is a very strong competition in the supply market, causing a resistance to any kind of cooperation among the furniture factories.
5. There is also a distinct striving for an autarchy and full independence of the factory, regardless of how much it costs.
6. Only a few items of hardware and jointing components, regularly used in the manufacture of furniture, are available. The factory does not use any screws because this item is not included in its plan.
7. Knowledge of raw materials and technological possibilities is rather vague, but there is a strongly expressed interest for learning new things.
8. The factory's production line consists of too many (25) very different products, and more than 50 percent of the items are produced in quantities of less than 100 units per year. Unless the factory accepts to reduce the diversity of its products it will be very difficult, and even economically unjustifiable, to standardize the products and their components.
9. The attitude of the factory staff towards the project is very positive and enthusiastic. The collaboration with the experts is excellent. The factory management shows a strong inclination towards action. The outlook for the successful completion of the project is optimistic.

RECOMMENDATIONS

The Pilot Furniture Plant has the responsibility to serve as an example of a modern well organized production unit with a high utilization of its installed capacity, materials and energy, and with satisfactory economic results. In order to achieve this, the following measures are recommended:

1. The factory should specialize in a certain group of technologically related products which permit a maximum utilization of available resources.
2. The planning authorities of the General Bureau for Building Materials should assure a sufficient supply of raw materials and other materials and components in accordance with the factory's capacities and needs.
3. The Government authorities should approve an investment for a boiler house in the Pilot Furniture Plant, with a minimum capacity of 5000 kgs of steam per hour, at a minimum steam temperature of 120°C.
4. In order to compensate for the insufficient capacities or to utilize better the existing ones, the factory should establish adequate production cooperation with other furniture factories in Pyongyang.
5. The Pilot Furniture Plant should try to discontinue the economically unreasonable production of plywood and veneer and to obtain these semi-manufactured products from better equipped and more efficient plywood factories.
6. In order to ensure a profitable production, the factory must improve its costing and pricing system, taking into account fixed expenses and the real cost of capital.

7. In order to improve and maintain a satisfactory quality of products at reasonable production costs, the factory should establish internal quality standards and organize an independent quality control unit.
8. The factory needs a good universal tool grinding machine for maintenance of tungsten carbide tipped tools, and should employ a technician trained in their correct sharpening.
9. In order to keep track of developments in the international furniture production market, technicians working in the factory should have a chance to visit foreign furniture and woodworking equipment exhibitions.
10. The factory's motivation system should be improved to better recognize knowledge and stimulate quality, especially recognizing the results of an innovative work.

ANNEX I

Date: 22 October 1991

PROJECT OF THE GOVERNMENT OF PEOPLE'S DEMOCRATIC REPUBLIC OF KOREA

ASSISTANCE IN THE ESTABLISHMENT OF A PILOT FURNITURE PLANT

JOB DESCRIPTION

DP/DRK/86/011/11-01 Rev.1 (J-13101)

Post title: Expert in furniture production (Chief Technical Adviser)

Duration: Eight months (3 split missions of 2 months each and two one month study tours)

Date required: As soon as possible in 1992

Duty station: Pyongyang (6 months total)
Europe (2 months, accompanying two study tours)

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 standardized 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 (the former for six months and the latter for three months). In order to achieve this, he will be specifically responsible to:

- Assist in designing a new technology for the pilot furniture plant;
- Assist in the selection, installation and commissioning of the equipment purchased by the project;
- Train team leaders, wood technicians and machinists in the full and efficient use of production equipment available under actual production conditions, and training assemblers and finishing operators;
- Develop and introduce standards for the products of the Pilot Furniture Plant;

- Develop the required production fixtures;
- Conduct a study tour and group training abroad;
- Introduce machining methods suitable for serial production with interchangeable parts;
- Introduce basic quality control procedures for work in process and control of finished products;
- Design and introduce improved production organization, production planning and cost accounting methods;
- Train the management in improved organization methods and basic export marketing techniques;
- Prepare technical reports, project performance evaluation reports and the project's terminal report;
- Cooperate with the National Project Director in carrying out the above duties.

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 requirements: 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 cubic meters, allowing an average annual cut of approximately 6.5 million cubic meters. The primary wood processing industry is supplied with some 1.8 million cubic meters 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 cubic meters of sawn logs, a plywood factory with a nominal capacity of 600,000 square meters of plywood and 500,000 square meters of veneer, a particle board factory with a nominal capacity of 5,000 cubic meters, a joinery factory with a nominal capacity of 100,000 square meters 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.

The Pilot Furniture Plant was originally intended to produce both solid wood and panel furniture. Due to shortage of funds it was subsequently decided to produce only panel furniture. Because the results achieved were deemed satisfactory, the authorities decided to allocate additional funds and inputs in kind to expand the project again to its original aims.

ANNEX II
WORK PLAN 1992

Activity No.	Activity Description	Responsible parties	DURATION (months)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1.1.1	Define production programme	Counterpart/ CTA	0.5	■											
2.1.1	Select a country for study tour	Counterpart/ CTA/UNIDO	0.5	■											
2.2.1	Select a country for group training abroad	Counterpart/ CTA/UNIDO	0.5	■	-----										
2.5.1	Survey the existing standards for products	CTA	0.5	■											
3.1.1	Survey of Korean furniture users and their demand	Design Expert/CTA	0.5		■										
4.1.1	Review and analyze present production organization and production planning, accounting and cost	CTA	0.5		■										
4.3.1	Make a survey and analyze the existing furniture distribution system	CTA	0.5		■										
2.3.1	Prepare training programme	CTA	1.0	■	■										
1.1.2	Select new equipment to be purchased and old to be reconditioned	Counterpart/ CTA	0.5	■											
1.1.8	Design dry kiln technology	CTA	1.0		■	■									
2.1.2	Study tour programme including environment protection and control measures	CTA	0.5		■										
1.2.2	Prepare training programme abroad, separate for all three fellows	Counterpart/ CTA	0.5		■										
2.6.1	Make a survey of the existing quality control	CTA	1.0	■											

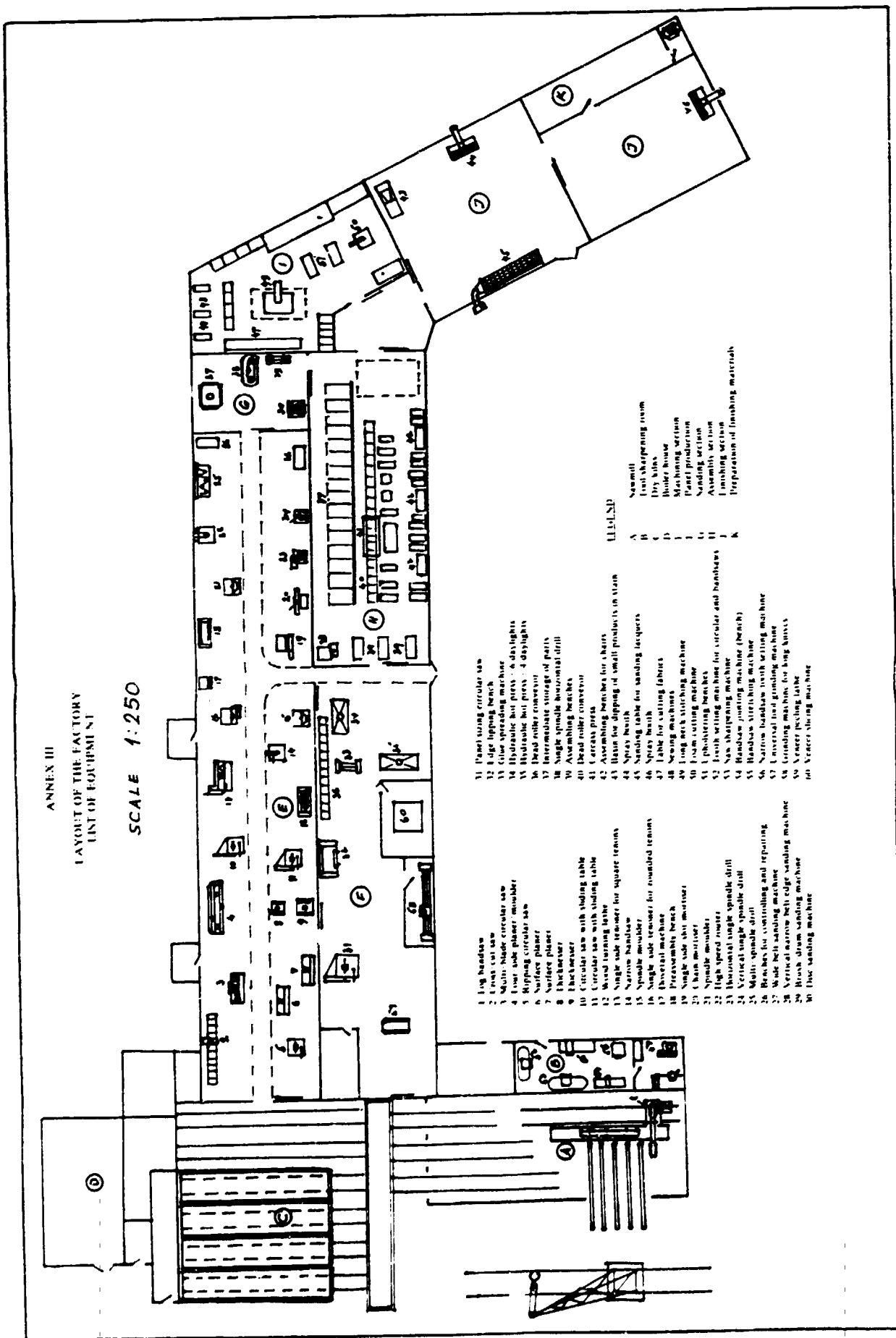
Activity No.	Activity Description	Responsible parties	DURATION (months)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2.5.2	Establish a new system for internal standards for producing components parts	CTA	1.0		■										
3.1.2	Make survey of materials available and the technological possibilities	Design expert/CTA	0.5		■										
4.1.2	Design new production organization and procedures in the factory	CTA	0.5		■										
5.0.0	Prepare technical report	CTA/Design expert	0.5		□			□			□				□
1.1.3	Design of new technology	CTA	3x0.5+1	■											
1.1.4	Reconditioning & testing reconditioned equipment	Counterpart	5.0			□	□	□	□	□					
2.1.3	Select four participants for study tour	Counterpart/CTA/UNIDO	3.0	■	■	■	■	■							
2.2.3	Select 3 fellows for group training abroad	Counterpart/CTA/UNIDO	3.0	■	■	■	■	■							
2.6.2	Design a new system for integral quality control	CTA	0.5		■										
3.1.3	Design new products with standardized interchangeable parts & components	Design expert	2.0		■	□	□								
3.1.5	Train 2 factory designers in product development techniques	Design expert	2.0		■	□	□								
4.1.3	Design appropriate production documentation in accordance with production organization	CTA	0.5		■										
1.1.5	Purchase new equipment	UNIDO	7.0	■	■	■	■	■	■	■	■	■	■	■	■
2.6.3	Develop a training manual for controllers	CTA	5.0		■	■	■	■	■	■	■	■	■	■	■
2.3.2	Prepare training manuals for major operations	CTA	4.0	■	■	■	■	■	■	■	■	■	■	■	■

Activity No.	Activity Description	Responsible parties	DURATION (months)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2.3.3	Train 20 machine operators, 10 assemblers & 4 team leaders to manufacture furniture of acceptable quality	CTA	4.0		■					▬	▬		▬		
2.1.4	Conduct the study tour	CTA/ participants	1.0					▬							
4.2.1	Set up appropriate management system	CTA	0.5							▬					
4.3.2	Train the factory management in basic elements of marketing	CTA	0.5							▬					
2.5.3	Introduce new standards	CTA/ Counterpart	1.0								▬	▬			
2.5.4	Train 2 technicians in maintaining & further developing standards	CTA	0.5							▬					
4.2.2	Train factory management staff in modern industry production methods	CTA	0.5								▬				
1.1.9	Technical design for dry kiln	Counterpart	2.0			▬	▬	▬							
1.1.11	Technical design for changes in the building	Counterpart	2.0			▬	▬	▬							
1.1.13	Technical design for electrical wiring	Counterpart	1.0				▬								
1.1.15	Technical design for a dust extraction system	Counterpart	1.0				▬								
2.2.4	Conduct the group training abroad	Fellows/ CTA	1.0									▬	▬		
2.4.1	Prepare training manual for design construction and use of jigs	CTA	1.0							▬					
3.1.4	Prepare product documentation and bring new product into production	Counterpart/ CTA	2.0							▬	▬				
1.1.6	Install and commission equipment according to technical design	Counterpart	2.0							▬	▬				

Activity No.	Activity Description	Responsible parties	DURATION (months)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1.1.10	Construction of dry kiln	Counterpart	4.0												
1.1.12	Construction work on factory building	Counterpart	2.0												
1.1.14	Electrical wiring according to new layout	Counterpart	2.0												
1.1.16	Install new dust extraction system	Counterpart	2.0												
2.1.5	Report on study tour and suggest follow-up action	Participants/ CTA	0.5												
2.2.5	Report on group training abroad	Fellows/ CTA	0.5												
2.4.2	Train 2 wood technicians to design jigs	CTA	0.5												
2.6.4	Train 6 controllers in procedures & techniques of quality control	CTA	0.5												
4.1.4	Introduce new production organization, procedures & documentation to be used in PFP	CTA/ Counterpart	2.0												
4.2.3	Train factory management in basic elements of accounting and economic indices	CTA	0.5												
4.2.4	Train factory management in basic management techniques & decision-making processes	CTA	0.5												
2.7.1	Conduct one week workshop in PFP & repeat the workshop if required to disseminate to all factories	CTA/ Counterpart	0.5												
1.1.7	Study of environmental report of new technology and introduction of appropriate control measures	CTA/ Counterpart/ UNIDO	4.0												

ANNEX III
LAYOUT OF THE FACTORY
LIST OF EQUIPMENT

SCALE 1:250



- | | | |
|--|---|---------------------------------------|
| 1 Log head saw | 31 Panel using circular saw | 51 Saw mill |
| 2 Thin cut saw | 32 Edge tipping bench | 52 Last Sharpening room |
| 3 Multi blade circular saw | 33 Glue spreading machine | 53 Dry bins |
| 4 Four side planer moulder | 34 Hydraulic hot press - 6 daylight | 54 Boiler house |
| 5 Ripper circular saw | 35 Hydraulic hot press - 4 daylight | 55 Machining section |
| 6 Surface planer | 36 Lead roller conveyor | 56 Panel production |
| 7 Surface planer | 37 Intermediate storage of parts | 57 Sanding section |
| 8 Thicknesser | 38 Single spindle horizontal drill | 58 Assembly section |
| 9 Thicknesser | 39 Assembling benches | 59 Finishing section |
| 10 Circular saw with sliding table | 40 Lead roller conveyor | 60 Preparation of finishing materials |
| 11 Circular saw with sliding table | 41 Cracks press | |
| 12 Wood turning lathe | 42 Assembling benches for chairs | |
| 13 Single side trimmer for square timbers | 43 Station for dipping of small products in stain | |
| 14 Narrow band saw | 44 Spray booth | |
| 15 Spindle moulder | 45 Sanding table for sanding lacquers | |
| 16 Single side trimmer for rounded timbers | 46 Spray booth | |
| 17 Horizontal machine | 47 Table for cutting fabrics | |
| 18 Press assembly bench | 48 Sewing machines | |
| 19 Single side shill moulder | 49 Long mesh stitching machine | |
| 20 Chain moulder | 50 Foam cutting machine | |
| 21 Spindle moulder | 51 Upholstering benches | |
| 22 High speed router | 52 Patching machines for circular and handbars | |
| 23 Horizontal single spindle drill | 53 Saw sharpening machine | |
| 24 Vertical single spindle drill | 54 Handbar jointing machine (bench) | |
| 25 Multi spindle drill | 55 Narrow band saw with writing machine | |
| 26 Benches for controlling and repairing | 56 Universal lathe grinding machine | |
| 27 Wide belt sanding machine | 57 Grinding machine for long timbers | |
| 28 Vertical narrow belt edge sanding machine | 58 Veneer peeling lathe | |
| 29 Branch drum sanding machine | 59 Veneer peeling machine | |
| 30 Thin sanding machine | 60 Veneer peeling machine | |

U.L.L.N.P.

A Saw mill
B Last Sharpening room
C Dry bins
D Boiler house
E Machining section
F Panel production
G Sanding section
H Assembly section
I Finishing section
J Preparation of finishing materials
K

ANNEX IV

CALCULATION OF CAPACITY AND PRINCIPAL SCHEMES FOR THE DRY KILN
IN THE PILOT FURNITURE PLANT

Quantity of sawnwood to be dried	1800 m ³ /annum
Wood species: - pine/spruce	50%
- birch	25%
- ash, oak etc.	25%

Calculated using Sokolov's formulas:

1. Wood species coefficient	20
2. Thickness (average 32 mm)	39
3. Width/thickness ratio (approx. 4)	10
4. Quality of drying (II)	10
5. Construction of dry kiln (weak forced circulation of air)	17
6. Moisture content reduction (from 60% to 8%)	85
TOTAL	181

Duration of drying (according to Sokolov's table)

T 5.8 days
Plus 1.2 days for cooling, emptying and refilling
Total 7 days per drying cycle

Total available time 330 days

$330 : 7 = 47$ drying cycles per year

Capacity of one kiln:

Size of one stack $5 \times 1.5 \times 2 \text{ m} = 15 \text{ m}^3$
One kiln contains 2 stacks = 30 m^3
Volume utilization: - length 80%
- width 70%
- height 60%
Volume: 33%

Capacity of one kiln: $47 \times 30 \times 0.33 = 465.3 \text{ m}^3$
Number of kilns required: $1800 : 465.3 = 3.87$
Number of kilns chosen: 4 (four)

TOTAL CAPACITY: $4 \times 465.3 = 1861 \text{ m}^3$

Since the existing drying kilns can satisfy neither the required capacity nor provide the quality of drying, the factory will make a major reconstruction and build drying kilns in such a way that they can use flue gases for heating. The principal schemes of such drying kilns are shown in three projections in figures 1, 2 and 3 of this Annex.

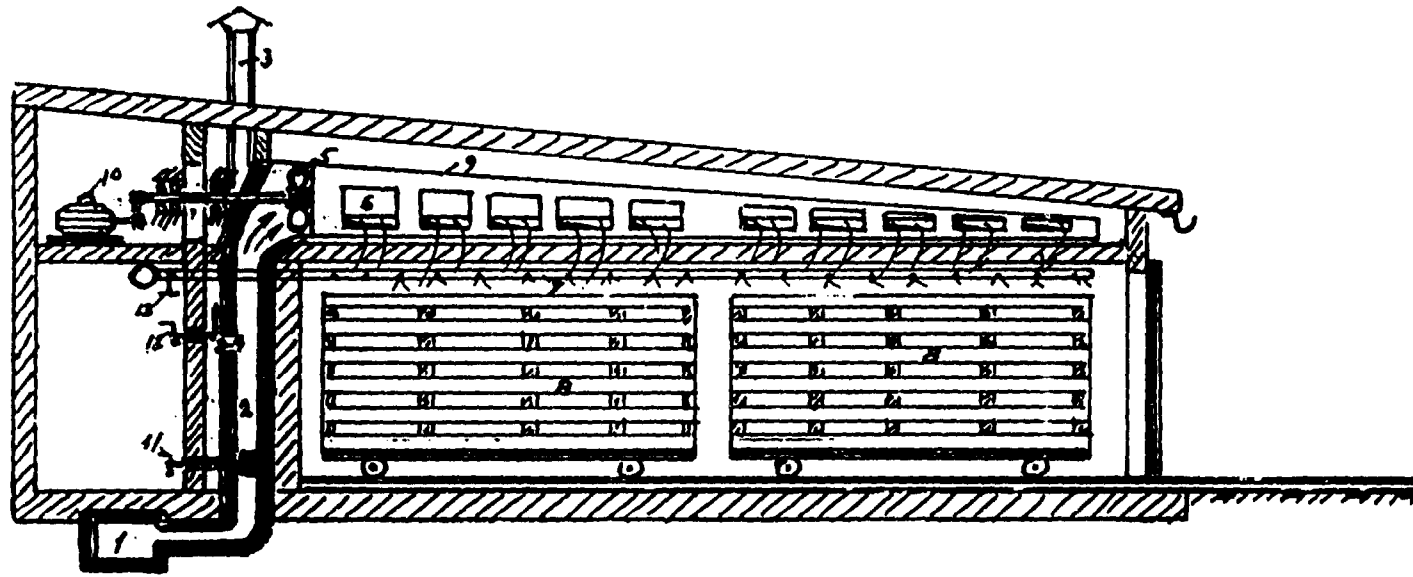


Fig. 1: Side elevation.

Legend:

1. Channel for gases
2. Duct for hot gases
3. Pipe for extraction of moist gases
4. Opening for fresh air that can be regulated
5. Axial fan for forcing gases into the kiln
6. Openings to direct gases into the kiln
7. Steam pipes for moistening air in the kilns
8. Stacks of wood to be dried
9. Pipe for directing hot gases blown by the fan
10. Electric motor for the fan
11. Valve to control quantity of flue gas admitted
12. Rotating lid for entry of fresh air
13. Steam valve

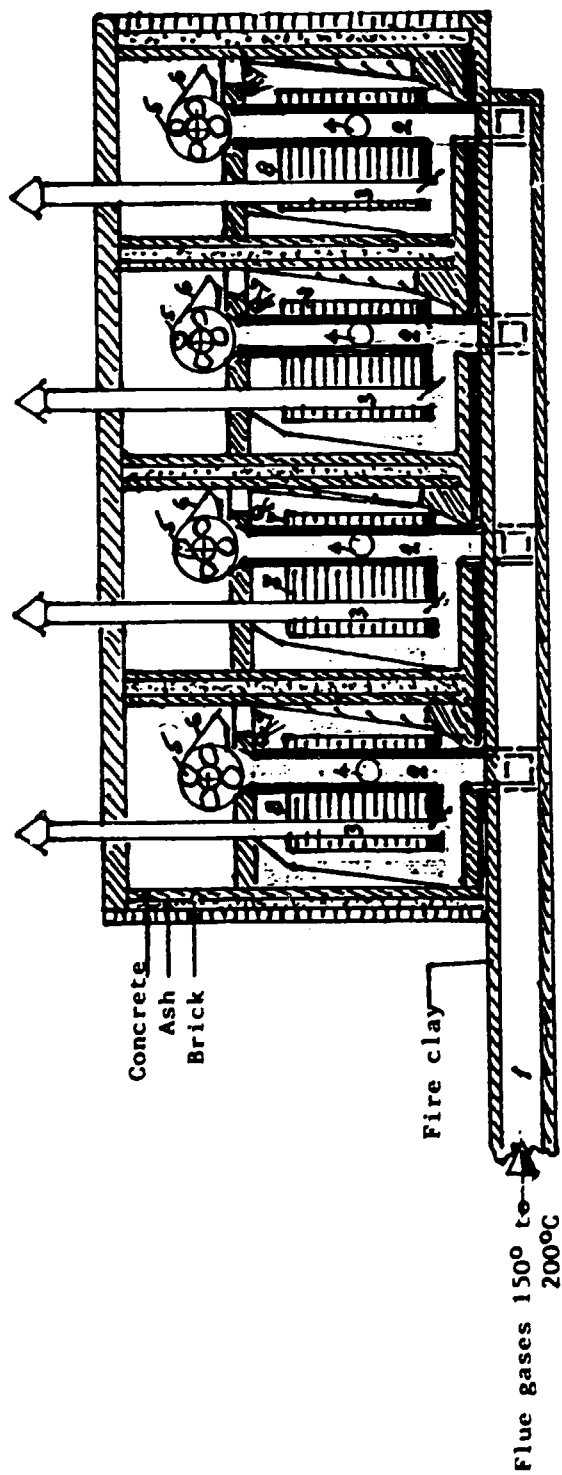


Fig. 2: End elevation.

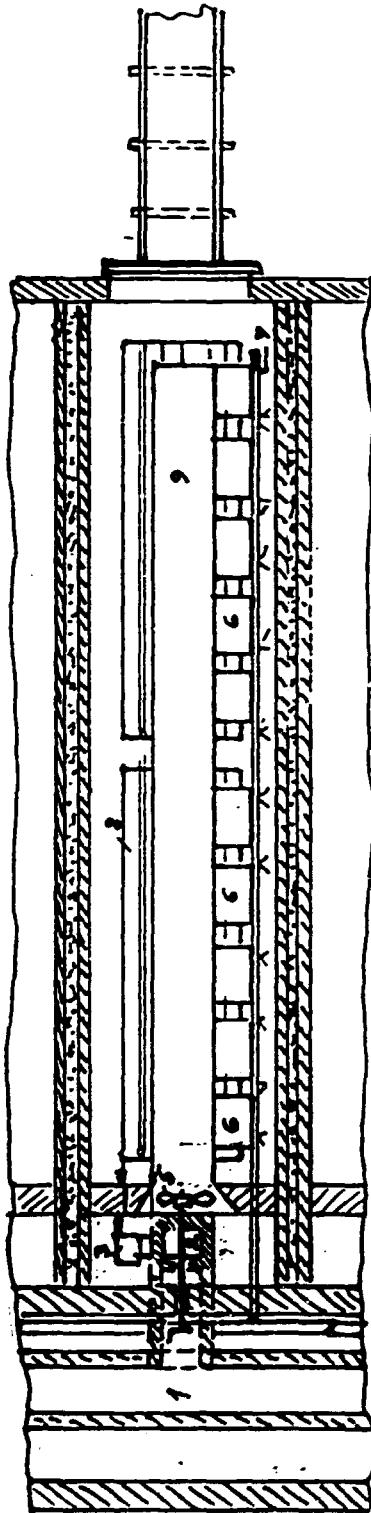


Fig. 3: Detail of plan of one unit.

ANNEX V

REVIEW OF THE MACHINES TO BE RECONDITIONED

No.	Description of the machines	Parts that should be repaired	Spare parts needed	Completion Time
1	Glue spreading machine, made in Korea, 1983. 2 rollers, Ø 250 mm, L-1300 mm	Add one roller to regulate the thickness of the glue layer	None	April 1992
2	Cross-cutting circular saw, made in Korea, 1978	Make a new frame and replace saw axle	None	May 1992
3	Multi-blade circular saw, C-250, Griggio (I), 1990	Replace ball bearings on conveyor and saw shafts and V-belts.	Ball bearings: No. 6202 - 2 pieces No. 6307 - 2 pieces V-belt Wulco, 3V-600 9.5 x 1525 mm: 5 pieces	June 1992
4	Thicknesser PS-500, Made in Poland, 1985	Repair electric motor and replace ball bearings	Ball bearings: No. 6003 - 2 pieces No. 6004 - 2 pieces No. 6205 - 2 pieces	May 1992
5	Thicknesser PS-400, Griggio (I), 1990	Repair cutterhead and feeding system	Ball bearings: No. 6202 - 1 piece No. 6203 - 1 piece V-belt Type A, teeth shaped 8D L-1120 mm - 2 pieces L-1380 mm - 2 pieces	June 1992
6	Surface planer PF/C400, Griggio (I), 1990	Change bearings on the cutterhead	Ball bearings: No. 62208 - 1 piece No. 62207 - 1 piece V-belt 8x7 mm L-1180 mm - 2 pieces	July 1992
7	Circular saw with sliding support SCs 1000, Griggio (I), 1990	Repair working table, saw axle and electric motor	Ball bearings: No. 6202 - 2 pieces V-belt 5C, 10x10, L-650 - 2 pieces	June 1992
8	Panel sizing circular saw SC 5000, Griggio (I), 1990	Repair: working table, saw axle, electric motor and system and safety covers	Ball bearings: No. 6203 - 2 pieces V-belts M.A. Continental SPZ Lw 9.5 L-800 mm - 2 pieces L-780 mm - 2 pieces	July 1992
9	Circular saw with sliding table SC 500, made in Japan	Repair working table and electric motor	None	April 1992
10	Wide belt sanding machine, LC 1300 E, Griggio (I), 1990	Repair compressed air system	Ball bearings: No. 6202 - 1 piece No. 6203 - 1 piece V-belts Manuli S.P.A. 7G, L-1457 mm - 4 pieces; High pressure hose 15 kgs/cm, inner Ø 8 mm, 2 meters	July 1992

No.	Description of the machines	Parts that should be repaired	Spare parts needed	Completion Time
11	Spindle moulder T-1000, Griggio (I), 1990	Repair working table and electric system	Ball bearings: No. 6204 - 2 pieces V-belt continental SPZ B8, Lw 9.5 x 900 mm - 2 pieces	June 1992
12	Spindle moulder, made in Poland, 1975	Repair working table and electric system	Ball bearings: No. 6202 - 2 pieces No. 1205 - 2 pieces	May 1992
13	Narrow bandsaw SN/AC 440, Griggio (I), 1990	Repair: saw wheels and saw guides	Ball bearings: No. 6200 - 4 pieces V-belt 9.5 x 9.5 mm, L-840 mm - 2 pieces	June 1992
14	Horizontal single spindle drill TRC/N, Griggio (I), 1990	Repair electric motor and support with clamping parts	Ball bearings: No. 6205 - 2 pieces Drill chucks 0 to 20 mm - 2 pieces	July 1992
15	Horizontal single spindle drill, made in Japan, 1975	Repair electric motor and support with clamping parts	None	April 1992
16	Chain mortiser G-281, Griggio (I), 1990	None	Guide bars medium pitch: 8-10x30x125 mm - 2 pieces; 8-10x37x150 mm - 2 pieces; Sprockets: 2 pieces 8-10x30-37/z5	-
17	Vertical single spindle drill, made in Japan 1975	None	None	-
18	Single side tenoner for square tenons GT-4, Griggio (I), 1990	Repair: working table, clamping elements, electric system and spindles	Ball bearings: No. 6206 - 2 pieces No. 6305 - 2 pieces Flat belt nylon 2.5 x 40 x 2020 mm - 5 pieces, Cutterheads: D- 85/60 mm L- 100 mm d- 25 mm 2 knives + 2 spurs left rotation 1 piece right rotation 1 piece	July 1992
19	Circular saw, made in Japan, 1982	General overhaul	None	May 1992
20	Surface planer PS-300, made in Japan, 1982	General overhaul	none	May 1992
21	Thicknesser PS-300, made in Japan, 1978	General overhaul	None	April 1992
22	Universal tool grinder, SM-175 H, Griggio (I), 1990	Repair: supports and spindles	Ball bearings: No. 6202 - 2 pieces	July 1992
23	Hydraulic hot press, 6-daylights, DOHH-360, made in Poland, 1975	General overhaul	Sealing tape (pressure seal) for connections for hydraulic pipes, pressure total 150 t. : 3 rolls	May 1992

ANNEX VI

LIST OF WOODWORKING TOOLS TO BE ORDERED

1. For multiblade circular saw, Griggio, C-250:
T.C.T. saw blades:
D-330 mm
d-60 mm
B-3.8/2.5 mm
Z-24
2 + 2 stabilizers
Keyway 2/6x20 10 pieces

2. For circular saw with sliding support, Griggio, SCS 1000:
T.C.T. circular saw blades:
D-300 mm
d-30 mm
B-3.2 mm
Z-48
Leitz WK-150-2-05 5 pieces

3. Panel sizing circular saw, Griggio, SC 3000
T.C.T. circular saw blade
D- 350 mm
D-30 mm
B-4.4 mm
Z-54
Leitz WK-250-2-36 5 pieces
Scoring circular saw (T.C.T.)
D-125 mm
d-20 mm
B-4.4 mm
Z-24
Leitz: WK-856-2-05 2 pieces

4. Circular saw blade, T.C.T., alternate top bevelled teeth:
D-250 mm
d-25 mm
B-3.2 mm
Z-48 3 pieces

5. Circular saw blade T.C.T. alternate top bevelled teeth:
D-250 mm
d-35 mm
B-4.4 mm
Z-24 2 pieces

6. Single side square tenoner
HSS knives and spurs:
L-100 mm
B-55 mm
T-4 mm
2 slits 12 mm wide, 26 mm from ends to the centre of slits

7. Woodworking tool grinding wheels:

7.1 Corundum wheels (Al_2O_3), white colour (AA):Shape - straight, edge 45°

D-150 mm

d-20 mm

B-6 mm

Grit - 60

Bonding - resin

Hardness - J

5 pieces

Shape dish:

D-150 mm

d-20 mm

Grit - 46

Hardness J

Bonding - resin

5 pieces

Straight cylindrical, bevel 2 mm:

D-130 mm

d-26 mm

B-16mm

Grit - 60

Hardness - H

Bonding - resin

5 pieces

Pot type:

D-150 mm

d-32 mm

B-60 mm

Grit - 60

Hardness - H

Bonding - resin

3 pieces

7.2 Diamond grinding wheels:

Dish type:

D-150 mm

d-32 mm

Diamond layer 5 x 2.5 mm

C100 D64

5 pieces

D-125 mm

d-20 mm

Diamond layer 6 x 3 mm

C75 D125

5 pieces

Taper cup type:

D-100

d-20

Diamond layer 5 x 6 mm

D76 C100

2 pieces

ANNEX VII

**TRAINING PROGRAMME
For In-service Training**

PURPOSE OF TRAINING: To train selected people in skilled production operations and competent performance of management jobs in the Pilot Furniture Plant.

SELECTION OF TRAINEES: Selection of trainees will be done jointly by the factory management and the project's CTA.

TRAINING METHOD: Training manuals will be prepared and distributed to trainees. Theoretical lectures will be conducted in a classroom and practical training will be done using the production facilities of the Pilot Furniture Plant.

TRAINING TIME: Training courses will be conducted during the expert's missions as follows:

January/February:	3
April:	1
July/August:	3
October/November:	3

NOTE: *The training manuals prepared for this project will also be used for the workshop that will be organized at the end of the project for the technical and managerial staff of other furniture factories in the DPR of Korea.*

No.	Topics	Hours		Level of competence to be reached
		Theo- reti-cal	Prac- tical	
1.	WOOD, AFFILIATED PRODUCTS AND OTHER MATERIALS USED IN THE PRODUCTION OF SOLID FURNITURE	0.25		Ability to properly select and use raw materials and other materials used in the production of furniture.
1.1	Growth process of a tree and anatomy of wood	0.5	-	Understanding wood's structure and its properties.
1.2	Classification of wood species and identification of the major species used for furniture production	0.5	-	Ability to recognize the main wood species and assess their suitability for furniture production
1.3	Physical and mechanical characteristics of wood	0.5	-	Better understanding of the relationship between properties of wood, construction of wooden products and processing methods.
1.4	Moisture content, shrinkage and swelling of wood, and the wood drying process	0.5	-	Understanding changes occurring in wood during drying and deformations caused by shrinkage and swelling.
1.5	Sawnwood as a raw material in furniture production	0.5	-	Ability to select appropriate sawnwood with respect to quality, dimensions and price.
1.6	Veneer used in furniture production	0.25	-	Knowledge about the main characteristics of veneer
1.7	Plywood and blockboard and their use in furniture manufacturing	0.25	0.5	Knowledge about plywood and blockboard as raw materials for furniture
1.8	Particle board and its use in furniture production	0.25	-	Knowledge about particle board as a raw material for furniture.
1.9	Fibreboard. (basic information)	0.25	-	General knowledge of fibreboard and its use.
1.10	Plastic foils and surface improved boards. (basic information)	0.25	-	General knowledge of surface improved boards and the possibility of their use by the Pilot Furniture Plant
1.11	Glues and glue additives used in the woodworking industries	1	1	Knowledge of the basic properties of various types of glues used by the woodworking industries.
1.12	Lacquers, stains and other surface finishing materials used for finishing furniture products	1	1	Knowledge about various lacquers, thinners, stains, paints and other materials used for finishing furniture.
1.13	Metal components: hardware, fittings etc. and their use in furniture	0.5	0.5	General knowledge of metal components, their selection and use in furniture production
1.14	Glass and various plastic components used for furniture production	0.5	-	General knowledge of glass and major plastic components that could be used in furniture.
	Total	7	4	

No.	Topics	Hours		Level of competence to be reached
		Theoretical	Practical	
2.	SOLID WOOD FURNITURE PRODUCTS, DESIGN, CONSTRUCTION AND STANDARDS	0.5	-	Better knowledge of solid wood furniture, design construction and product development techniques.
2.1	Classification and main characteristics of furniture products	0.5	-	Better knowledge of furniture products, their characteristics and classification
2.2	Design of products: basic requirements and rules for design, and evaluation of designs	1	-	Understanding design process and basic knowledge necessary for the evaluation of a design
2.3	Construction of furniture products with construction and detailed drawings	1	2	Ability to construct a product based on a given design and to produce construction and detailed drawings.
2.4	Standardization of solid wood furniture products and components	1	1	Understanding the standardization method and ability to maintain and further develop internal standards.
2.5	Product development techniques and procedures	2	-	Understanding the necessity of permanent work on innovation and product development. Knowledge about product development techniques and procedures.
2.6	Value analysis of furniture products	1	2	Basic knowledge about value analysis and ability to perform simple value analysis
	Total	7	5	

No.	Topics	Hours		Level of competence to be reached
		Theo- reti- cal	Prac- tical	
3.	MACHINING OPERATIONS IN MANUFACTURING SOLID WOOD FURNITURE	0.5	-	Better knowledge of woodworking machines and ability to perform machining operations correctly.
3.1	Sawing machines:	3	2	Knowledge of sawing machines, and their technical characteristics.
3.1.1	- Crosscutting on circular saws			
3.1.2	- Ripping on circular saws			
3.1.3	- Panel sizing saws			
3.1.4	- Narrow bandsaws			
3.2	Sawing operations:	2	4	Ability to perform sawing operation in a correct and safe way, and knowledge of ways to ensure maximal utilization of raw materials
3.2.1	- Crosscutting			
3.2.2	- Ripping			
3.2.3	- Panel Sizing			
3.2.4	- Sawing with bandsaws			
3.3	Planing machines:	2	2	Knowledge of planing machines and their setting for required operations
3.3.1	- Surface planers			
3.3.2	- Thicknessers			
3.3.3	- Four sided planers			
3.4	Planing operations:	2	4	Ability to perform planing operations correctly and to achieve the desired accuracy and quality of surface
3.4.1	- Surface planing			
3.4.2	- Thicknessing			
3.4.3	- Planing with four-sided planer			
3.5	Tenoning machines	1	1	Knowledge of tenoning machines
3.6	Tenoning operations	0.5	1	Ability to perform tenoning operations
3.7	Mortising machines	0.5	1	Knowledge of mortising machines
3.8	Mortising operations	0.5	1	Ability to perform mortising operations
3.9	Turning lathes	0.5	1	Knowledge of turning lathes
3.10	Turning operations	0.5	1	Ability to perform turning operations.
3.11	Moulding machines	0.5	-	Knowledge of single spindle moulder
3.12	Moulding operations	0.5	1	Ability to perform moulding operations on single spindle moulders.
3.13	Routing machines	0.5	-	Knowledge of high-speed routers
3.14	Routing operations	0.5	1	Ability to perform routing operations on a high speed router
3.15	Drilling machines	1	1	Knowledge of various drilling machines
3.16	Drilling operations	1	1	Ability to perform drilling operations on various machines
3.17	Sanding machines	1	1	Knowledge of sanding machines
3.18	Sanding operations	1	2	Ability to perform sanding operations on various sanders
3.19	Organization of work areas to perform various machining operations	1	1	Ability to organize the working area in order to minimize movements and ensure safety.
3.20	Safety measures for machining operations on woodworking machines	2	1	Knowledge of and ability to apply safety measures required for operating woodworking machines.
	Total	22	27	

No.	Topics	Hours		Level of competence to be reached
		Theoretical	Practical	
4.	PREASSEMBLING AND ASSEMBLING SOLID WOOD FURNITURE	0.25	-	Understanding the tasks and the major requirements of preassembling and assembling operations in the production of furniture.
4.1	Constructive joints in furniture.	1	-	Knowledge of various constructive joints and their suitability for joining furniture parts.
4.2	Hardware, fittings and jointers used in the production of furniture	1	-	Knowledge of the most often used hardware, fittings and jointers in the manufacture of furniture.
4.3	Preassembling and assembling benches and presses	1	1	General knowledge of assembling presses and benches and ability to use them correctly.
4.4	Powered hand tools used for the operations of assembly of furniture	1	1	Knowledge and ability to use electrical and pneumatic powered hand tools for preassembly and assembly of furniture.
4.5	Glues used for assembling furniture	0.5	0.5	General knowledge and ability to use glues for assembling furniture correctly.
4.6	Preassembling and assembling operations	1	3	Ability to perform assembling operations correctly.
4.7	Production of knock-down furniture.	0.5	-	Understanding the advantages and requirements of production of knock-down furniture.
	Total	6.25	5.5	

No.	Topics	Hours		Level of competence to be reached
		Theoretical	Practical	
5.	FINISHING OF SOLID WOOD FURNITURE	0.25	-	Understanding the tasks, prerequisites and importance of surface finishing of furniture.
5.1 5.1.1 5.1.2 5.1.3 5.1.4 5.1.5	Finishing materials - Lacquers - Stains - Thinners - Fillers - Other finishing materials	2	1	Knowledge of major finishing materials, their control, preparation and proper use in the finishing of furniture parts and products.
5.2	Finishing equipment and facilities	1	1	Knowledge of spray guns, spray booths, and other lacquer and paint spreading equipment and ability to use them correctly.
5.3	Preparation of surfaces to be finished (sanding, repairing, cleaning)	0.5	0.5	Knowledge of the correct preparation and control of surfaces to be finished.
5.4	Control of finished surface (hardness, adhesion, gloss and defects)	0.5	0.5	Knowledge of the requirements and control of surface finishes with regard to hardness, smoothness, gloss, adhesion and defects.
5.5	Fire-fighting and environmental measures to be observed during finishing operations	1	-	Knowledge of dangers and preventive fire-fighting and environmental measures to be observed in finishing rooms and in handling of finishing materials
	Total	5.25	3	

No.	Topics	Hours		Level of competence to be reached
		Theoretical	Practical	
6.	TOOLS, JIGS AND MEASURING INSTRUMENTS USED IN THE PRODUCTION OF SOLID WOOD FURNITURE	0.5	-	Knowledge and ability to select and use various woodworking tools, jigs and measuring instruments
6.1 6.1.1 6.1.2 6.1.3 6.1.4 6.1.5 6.1.6	Wood cutting tools: - Circular and bandsaw blades - Planing knives - Moulding cutters - Wood turning knives - Routing bits - Mortising chains	4	2	General knowledge and ability to select, order, control, maintain and use various woodworking tools. Ability to balance and set the tools correctly on the machines and to notice eventual defects on tools.
6.2	Sanding papers	1	1	General knowledge and ability to select, order and use appropriate sanding papers and to joint sanding belts.
6.3	Tool grinding wheels	1	-	General knowledge and ability to select and use appropriate grinding wheels to maintain the tools
6.4	Jigs used in the manufacture of furniture	1	1	General knowledge of jigs, their construction and use.
6.5 6.5.1 6.5.2 6.5.3 6.5.4	Measuring instruments used in the production of solid wood furniture - Instruments measuring sizes - Gauges - Instruments and scales controlling tools - Other measuring instruments used in the production of furniture.	1	1	Knowledge of the major characteristics and correct use of various measuring instruments, gauges and other controlling instruments used regularly in the production of solid wood furniture.
	Total	8.5	5	

No.	Topics	Hours		Level of competence to be reached
		Theoretical	Practical	
7.	QUALITY CONTROL IN THE PRODUCTION OF SOLID WOOD FURNITURE	0.5	-	Understanding what quality is and its importance for the successful manufacture of durable goods.
7.1	Importance of quality in the production of furniture	1	-	Understanding why quality of products should be controlled, customers' point of view and economical consequences.
7.2	Internal quality standards for solid wood furniture: 7.2.1 - Definition of level 7.2.2 - Guide to the use of tables 7.2.3 - Quality of materials 7.2.4 - Quality of workmanship 7.2.5 - Definition of defects	2	1	Ability to apply quality standards for materials, accuracy of machining, and finished products.
7.3	Production factors on which quality depends	0.5	-	Understanding the influence of various production factors on quality.
7.4	Measuring instruments and gauges for quality control	1	1	Knowledge of and ability to use some quality control instruments and gauges.
7.5	Quality control by operators	1	1	Ability to perform simple quality control before and after operations and understanding the quality circles system.
7.6	Quality control procedures in the production of furniture: 7.6.1 - Existing quality control procedures in the PFP 7.6.2 - General considerations 7.6.3 - Quality control of materials 7.6.4 - Control of manufacturing accuracy in processing 7.6.5 - Quality control in surface finishing 7.6.6 - Quality control of assembly 7.6.7 - Testing of finished products 7.6.8 - Quality control procedures 7.6.9 - Quality control reports	2	2	Understanding the quality control information system, with its preventive and corrective activities. Ability to perform quality control at various stages of production. Ability to use quality control documentation. Ability to complete quality control reports.
7.7	How to avoid defective work and improve quality	1	2	Knowledge of methods for reducing defects.
7.8	Organization of quality control in the Pilot Furniture Plant 7.8.1 - Responsibility of operators and assemblers 7.8.2 - Contribution of standardization to the improvement of quality 7.8.3 - Contribution of information to the improvement of quality 7.8.4 - Quality and productivity	0.5	-	Understanding the functions of the quality management system in the Pilot Furniture Plant. Understanding the organization of the quality control in the factory, and how good standards and proper information can contribute to the improvements of quality. Understanding how a good quality control system can improve productivity.
		9.5	7	

No.	Topics	Hours		Level of competence to be reached
		Theoretical	Practical	
8.	ORGANIZATION OF PRODUCTION, PRODUCTION PLANNING AND CONTROL IN THE PRODUCTION OF SOLID WOOD FURNITURE.	0.5	-	Better understanding the organization of industrial production, production planning and control procedures.
8.1	Organization of production in the secondary wood processing	1	-	Understanding the factory's organizational system and organizational structure.
8.2	Production planning procedures and methods	2	4	Knowledge of the production planning processes, ability to use production documents, understanding cost accounting and pricing of products. Understanding roles of production and job orders.
8.2.1	- Product line data base			
8.2.2	- Preparation and use of production documents			
8.2.3	- Job order and other relevant production documents			
8.2.4	- Cost accounting and pricing products			
8.3	Allocation and timing of job orders and control of the production process. Provision of materials, tools, jigs and documentation	2	2	Understanding logical sequences of production, their planning and control, and the completion of the production documentation with information from production.
8.4	Organization of the production planning unit and job descriptions	1	1	Understanding the organization and tasks of the production planning unit.
	Total	6.5	7	

No.	Topics	Hours		Level of competence to be reached
		Theo- reti-cal	Prac- tical	
9.	MANAGEMENT BASED ON THE MODERN INDUSTRIAL PRODUCTION METHODS	0.5	-	Understanding the essence of management based on modern industrial production methods.
9.1	Basic characteristics of a medium-size industrial enterprise for manufacturing furniture	1	-	Understanding the modern concept of an industrial enterprise that could be applied to the pilot furniture factory.
9.2	Role of management in an industrial enterprise	1	-	Understanding better the roles and tasks of management's staff in shaping the company policy, strategy and development
9.3	Information systems in a company and their role.	1	1	Ability to understand and exploit an efficient information system in the Pilot Furniture Plant.
9.4	Decision making processes and methods	1	1	Ability to use some decision making methods in order to avoid risk and obtain optimal solutions.
9.5	Some other management techniques that could be applied in the Pilot Furniture Plant	1	1	Ability to use some simple techniques like: ABC analyses, CPM portfolio analysis, inventory control methods etc.
9.6	Motivation as an achieving factor	1	-	Understanding the importance of motivation and stimulation of people for innovations and better quality work.
	Total	6.5	3	

No.	Topics	Hours		Level of competence to be reached
		Theo- reti- cal	Prac- tical	
10.	BASIC ELEMENTS OF MARKETING IN THE FURNITURE PRODUCTION	0.5	-	Understanding the essentials of marketing in the production of furniture.
10.1	Marketing concept and tasks	1	-	Understanding the basic ideas of marketing.
10.2	Market research, customers' needs and wishes, and competition	1.5	-	Understanding the purpose and tasks of market research. Information on customers' needs and wishes and on competition.
10.3	Promotion of products, entering into a market and protecting the position acquired.	1	-	Ability to plan marketing activities in order to expand into a new market.
10.4	Marketing and international trade of furniture	1	-	Understanding basic facts of the marketing role in the international trade of furniture.
	Total	5	-	

RECAPITULATION

Topic No.	Topic Description	Number of trainees	Training hours		
			Theory	Prac-tical	Total
1	Wood, affiliated products and materials used in furniture production	25	7	4	11
2	Solid wood furniture products, design, constructions and standards	20	7	5	12
3	Machining operations in manufacturing solid wood furniture products	25	22	27	49
4	Preassembling and assembling of solid wood furniture	28	6.25	5.5	11.75
5	Finishing of solid wood furniture	22	5.25	3	8.25
6	Tools, jigs and measuring instruments used in the furniture production	30	8.5	5	13.5
7	Quality control in the production of solid wood furniture	10	9.5	7	16.5
8	Production organization planning and control in furniture production	10	6.5	7	13.5
9	Management based on modern industrial production	7	6.5	3	9.5
10	Basic elements of marketing in furniture production	7	5	-	5
	TOTAL		83.5	66.5	150

ANNEX VIII

STUDY TOUR PROGRAMME

A. Basic Data:

Project title: Assistance in the establishment of a pilot furniture plant.
Project number: DP/DRK/86/011
Executing agency: UNIDO, Vienna
Host country: Yugoslavia, with visits to the INTERBIMALL and SASMIL woodworking machinery and auxiliary equipment Fairs in Milan, Italy.
Duration: 4 m/m (four weeks for four participants), including travel.
Time: May/June 1992, starting 18 May 1992, ending 16 June 1992.
Funding: Budget line 32: US\$ 41,700
Language required: English
Participants:

1. Mr. Ko Ju Chol, Senior Officer in the General Bureau for Cooperation with International Organizations.
2. Mr. Kim Ha Jun, Managing Director of the Pilot Furniture Plant.
3. Choe Si Jun, Deputy Chief Engineer, Technical Department, General Bureau for Building Materials.
4. Mr. Kim Gi Un, Deputy Chief Engineer, Pilot Furniture Plant.

Study tour accompanied by:

Radmilo Malis, Furniture Production Expert.

Reporting on study tour:

Separate reports will be prepared by the participants and the accompanying expert and submitted to UNDP/UNIDO by 15 July 1992.

B. ITINERARY:

18 May 1992 Departure from Pyongyang on the flight Pyongyang/Sofia/Milan.
 20 May 1992 Arrival in Milan, Italy.
 21-26 May 1992 Visit the INTERBIMALL and SASMIL woodworking machinery and auxiliary products Fairs in Milan.
 27 May 1992 Departure from Milan and arrival in Ljubljana, Slovenia.
 28 May to 3 June 1992

- Visit to two solid wood furniture manufacturing factories.
- Visit the manufacturer of the surface finishing equipment SOP KRŠKO.
- Visit LAMA Dekani, producer of furniture hardware.
- Eventually, visit other manufacturer(s) of woodworking tools and machines - provided UNIDO could make arrangements with such factories.

3 June 1992 Departure from Ljubljana and arrival in Sarajevo.

4 to 12 June 1992 Visit four solid wood furniture factories:

- VRBAS-Banja Luka (2 days).
- GT-MEBL-Gornai Vakuf (2 days).
- SOKOLAC (1 day).
- ROGATICA (1 day).
- Travel and week-end (3 days).

14 June 1992 Departure from Sarajevo on the route Sarajevo-Belgrade-Sofia-Pyongyang
 16 June 1992 Arrival in Pyongyang.

N.B. DSA for days of eventual earlier departure from Pyongyang or later return will not be paid from project funds.

C. STUDY PROGRAMME:

1. VISIT THE INTERBIMALL WOODWORKING MACHINERY FAIR AND THE SASMIL FAIR FOR AUXILIARY PRODUCTS IN MILAN. The study tour participants will:

- become familiar with the types of woodworking machines existing on the market and which of them could be most suitable for the future development of the Korean wood processing industry.
- get acquainted with the most important manufacturers of woodworking machines.
- get acquainted with the main technical features of contemporary woodworking machines.
- learn about features included in the design of in woodworking machines to provide safety and environmental protection.
- become familiar with various woodworking tools and measuring instruments.
- collect catalogues, technical and commercial information for the most interesting equipment.
- get acquainted with modern technological concepts in manufacturing solid wood furniture.

Visit the SASMIL Fair:

- to obtain information on modern hardware fittings, foils and other laminating materials, surface finishes, upholstery materials etc. available to the furniture industry in developed countries.

2. VISIT FACTORIES IN SLOVENIA: During the visits to two solid wood furniture factories, the participants will get to know how some very efficient and highly productive factories are equipped and organized. Special attention will be paid to the following topics:

- product development,
- production planning,
- maintenance of tools
- construction and use of jigs
- utilization of woodworking machines
- utilization of materials,
- quality control
- wages and motivation
- technological innovations
- standardization of products and production elements.

The purpose of these visits is to see some possibilities for the future development of the furniture production in the DPR of Korea.

During the visit to SOP Kresko, the study tour participants will see production of wood drying kilns and various equipment for furniture finishing, including fully automated finishing lines with lacquer drying tunnels and automatic fire fighting systems.

Special attention will be paid to the environment protecting regulations and measures.

During the visit to LAMA Dekani, the participants will become acquainted with a large variety of furniture hardware items, and see one successful manufacturer.

This can contribute to the production of new hardware items for the Korean furniture industry.

Eventually, visits to some manufacturers of woodworking tools and machines will offer the fellows an insight into production of woodworking machines and tools in Slovenia which are at a level that could be very suitable for the Korean furniture industry.

3. VISIT TO FOUR SOLID WOOD FURNITURE FACTORIES IN BOSNIA AND HERZEGOVINA:

The factories selected produce solid wood furniture of medium quantity both for the domestic market and for export.

The products are made of solid wood and include wooden panel components.

Both softwood and hardwood is used.

This is very close to the situation in the DPR of Korea.

The study tour participants will see the factories having production programmes, quality, equipment, and level of organization which could be applied in the DPR of Korea in the near future.

The main attention will be focused on:

- Design of products.
- Technology and equipment,
- Utilization of materials,
- Maintenance of tools and jigs,
- Organization of production,
- Cost-accounting and pricing policy,
- Safety measures and protection of the environment.

4. EXPERT'S ASSISTANCE:

The furniture production expert accompanying the study tour will suggest to the participants what they should pay a special attention to and give them the necessary explanations.

After each factory visit, he will discuss with the participants what they have seen and understood and suggest to them what can be and should be applied in the DPR of Korea.

ANNEX IX
PROGRAMME FOR GROUP TRAINING

A. Basic data:

PROJECT TITLE: Assistance in the Establishment of a Pilot Furniture Plant.

PROJECT NUMBER: DP/DRK/86/011/H/01/37

EXECUTING AGENCY: United Nations Industrial Development Organization (UNIDO), Vienna

HOST COUNTRY: Yugoslavia, Romania, Germany or any Eastern European country willing to accept the organization of the group training.

DURATION: 3 m/m (4 weeks for each of the three fellows) including travel time.

TIME: September 1992.

FUNDS AVAILABLE: US\$ 30,200

LANGUAGE OF TRAINING: English

FELLOWS:

1. Mr. Kim Li Yong, Chief Engineer of the Pilot Furniture Plant.
2. Mr. Li Yon Ho, Production Manager of the Pilot Furniture Plant.
3. Mr. Kim Pyong Chol, Team Leader in the Surface Finishing Section.

ACCOMPANIED BY: Mr. Radmilo Malis, Furniture Production Expert.

REPORTING: Separate reports will be prepared by the fellows and by the accompanying expert, and submitted to UNDP/UNIDO by 15 October 1992.

B. Itinerary¹

31 August 1992	Departure from Pyongyang on the flight Pyongyang - Sofia - (country of training)
2 September 1992	Arrival in (country of training)
4 to 12 September 1992	One week training in a solid wood furniture factory.
13 to 20 September 1992	One week training in another solid wood furniture factory.

¹ (a) Upon selection of the host country, the itinerary will be finalized to conform with the actual flight times.

(b) DSA for eventual earlier departure or later return to Pyongyang will not be paid from project funds.

21 to 26 September 1992	One week training in a third solid wood furniture factory.
27 September 1992	Departure from (country of training) to Sofia.
28 September 1992	Departure from Sofia to Pyongyang.
29 September 1992	Arrival in Pyongyang

C. Training Programme

In the furniture factories the fellows will visit, they will focus in the following individual training programmes.

1. Mr. Kim Li Yong, Chief Engineer (PFP)

- Production management in general.
- Organization of production process.
- Optimization of the product line and production planning.
- Production documentation and information systems in the factory.
- Work dispatching and control of production operations.
- Quality control methods and procedures.
- Special emphasis will be on the assembly of furniture, including:
 - organization of assembly,
 - use of powered hand tools,
 - construction and use of jigs,
 - use of assembling presses and clamps,
 - control of assembled products,
 - internal transport of parts and assembled products.
 - distribution and use of compressed air (water separation, oiling, pressure control).

Comparing the practice in the factories visited with the situation in the Pilot Furniture Plant, and with the furniture industry in the DPR of Korea, the trainee will be able to introduce some more efficient production means and methods in the Pilot Furniture Plant, and better understand and accept the expert's recommendations given during the project's implementation.

2. Mr. Li Yong Ho, Production Manager (PFP)

The attention of the trainee will be focused on technology and organization of machining in the production of solid wood furniture as follows:

- Setting of woodworking machines and controlling of accuracy.
- Selection, control and setting of woodworking tools for machining operations,
- Correct use and operation of woodworking machines,
- Organization of working areas,
- Safety measures on woodworking machines.
- Internal transport within the machining section of the factories,
- In-process quality control,
- Use of jigs for machining operations,
- Use of automated and semi-automated machines,
- Gauges and measuring instruments used in wood machining operations,
- Time study and establishment of time standards for machining operations (actual work on two examples).

The fellow should learn advanced production methods and be able to implement them in the Pilot Furniture Plant to an extent corresponding with the existing conditions.

3. Mr. Kim Pyon Chol, Team Leader in the surface finishing department.

The training will be focused on surface finishing of solid wood furniture, as follows:

- Surface finishing technology and equipment for finishing solid wood furniture, especially: spray booths, spray guns, drying tunnels, lacquer sanding tables etc.
- Correct use of surface finishing equipment.
- Selection and preparation of working blends of finishing materials, including environmental measures.
- Preparation of surfaces to be finished,
- Surface finishing operations and conditions of the air for drying lacquers.
- Selection of sanding papers and sanding of primers,
- Control of finished surfaces,
- Fire fighting equipment and measures in surface finishing rooms,
- Environmental measures and their control.
- Packaging of finished products.

Since the surface finishing operations in the Pilot Furniture Plant are presently performed in a rudimentary and very expensive way, the trainee should learn more advanced methods of furniture finishing and contribute to the improvement of this technology, safety and environment in the Pilot Furniture Plant.

4. Expert's assistance

The furniture production expert will accompany the fellows and conduct the group training in order to explain all technical and organizational aspects of furniture production in the factories visited, to point out the most important details and technological solutions which could be applied in the DPR of Korea, and to check that the fellows have understood what they have seen. Daily discussions will be held to answer the fellows' questions, to widen their knowledge on certain topics and to suggest to them what could be implemented in the Pilot Furniture Plant and in the Korean furniture industry and how to proceed to do it.

ANNEX X

LIST OF TRAINEES

1. Course on Wood, affiliated products and other materials used in the production of solid wood furniture
 1. Kim Yong Taek (M)
 2. Kim Gi Un (M)
 3. Kang Li Ryong (M)
 4. Li Yong Ho (M)
 5. Li Chol Su (M)
 6. Kim Myong Ok (F)
 7. Kim Sung Ryoe (M)
 8. La Do Li (M)
 9. Li Dong Jin (M)
 10. Li Gyong Chol (M)
 11. Kim Song Nam (M)
 12. Hong Zae Hak (M)
 13. Choe Ryong Ik (M)
 14. Li Hyong Ha (F)
 15. Kim Byong Chol (M)
 16. Kim Ha Chol (M)
 17. Li Yong Hi (F)
 18. Suo Hyo Sun (F)
 19. Paek Yong Bok (F)
 20. Zang Gil Hya (F)
 21. Choe Yang Ho (M)
 22. Zo Song Hi (F)
 23. Kim Zong Ho (M)
 24. Paek Gi Yong (M)
 25. Choe Gyong Son (F)
2. Course on Quality control in the production of solid wood furniture.
 1. Kim Gi Un (M)
 2. Paek Gi Yong (M)
 3. Li Yong Hop (M)
 4. Gyang Li Pyong (M)
 5. Kim Byong Chol (M)
3. Course on tools, jigs and measuring instruments used in the production of solid wood furniture
 1. Kim Gi Un (M)
 2. Zong Gyong Li (M)
 3. Gyang Li Pyong (M)
 4. Lim In Bock (M)

ANNEX XI

NAMES OF COUNTERPART STAFF WHO WORKED WITH THE EXPERT

Mr. Kim Ha Chun	Managing Director of the Pilot Furniture Plant (PFP)
Mr. Kim Li Yong	Chief Engineer (PFP)
Mr. Kim Gi Un	Deputy Chief Engineer (PFP)
Mr. Choe Sin Jun	Deputy Chief Engineer, General Bureau for Building Materials
Mr. Ko Ju Chol	Senior Officer in the General Bureau for Cooperation with International Organizations
Mr. Li Yon Ho	Production Manager
Mrs. Kim Hye Nam	Interpreter
Mr. Yu Su Huan	Driver

ANNEX XII

SUBSTANTIVE OFFICER'S COMMENTS

The expert has carried out a successful mission. The four training manuals he has prepared - which will be issued as separate technical reports - are, like their predecessors, useful and down-to-earth.

The work programme he has proposed is realistic, except that, judging by the technological level of current production, it is premature to speak of an ecological assessment. What has to be done by the project is first to get the production shifted from the "mechanized craft" and artisanal level to serial production. New surface finishing methods, a drying procedure that can be controlled (as against the current flue gas heating system), dust extraction etc. have to be introduced - funds permitting - and subsequently, when their introduction has been successfully achieved, the project will be able to assess the ecological impact. Needless to say, every effort will be made to ensure that the processes introduced will not be harmful to the ecology, but, for example, the insistence by the management that they could not fund the purchase of a larger boiler to permit controlled drying of timber on the one hand, and the imperative need to have kiln dried timber for the production led to the expert having to modify the existing kilns using flue gas as a source of heat. This is neither ecologically sound, nor does it permit well controlled drying. (This type of kiln, if not monitored continually, can result in fires and even poison workers by inhalation of smoke.)

Although not stressed specifically in the report, the factory is suffering from an acute shortage of wood raw materials. It is hoped that this problem will be overcome before the expert's return mission so that he may proceed with the training programme and the introduction of serial production methods as foreseen in the project document.