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ASSISTANCE IN THE DEVELOPMENT OF JIGS FOR FURNITURE PRODUCTION

SI/MEX/89/801

THE UNITED MEXICAN STATES

Terminal report*

Prepared for the Government of the United Mexican States
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of Horatio P. Brion
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EXPLANATORY NOTE

The monetary unit of the United States of Mexico is the Peso (\$). The current official rate of exchange for the Mexican Peso is Mex \$2,970 = US\$1.00.

The following acronyms are used in this Report:

| | |
|------------|--|
| AIDIMA | - Asociación de Investigación y Desarrollo de la Industria del Mueble y Afines, Valencia, España |
| CANACINTRA | - Camara Nacional de la Industria de Transformación, México D.F. |
| CONALEP | - Colegio Nacional de Educación Profesional Técnica, Ticoman, México D.F. |
| CNC | - Consejo Nacional de Empresas Campesinas, México D.F. |
| EEC | - European Economic Community |
| FAO | - Food and Agriculture Organization of the United Nations, Rome, Italy |
| LANFI | - Laboratorios Nacionales de Fomento Industrial, Edo. de México, México |
| UNAM | - Universidad Nacional Autónoma de México, Coyoacan, México D.F. |
| UNDP | - United Nations Development Programme, New York City, U.S.A. |
| UNIDO | - United Nations Industrial Development Organization, Vienna, Austria |
| U.S.A. | - United States of America |

A hyphen between numbers (e.g., 1 - 5) indicates the full range involved, including the beginning and end points.

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

A comma (,) is used to indicate thousands, millions, billions.

The following symbols and/or abbreviations are used in this report:

| | |
|----------|---|
| cm. | - centimetre, 1/100th of a meter |
| cu. m. | - cubic meter, metric unit of volume |
| EMC | - Equilibrium Moisture Content |
| hr. | - hour |
| hrs. | - hours |
| HSS | - high speed steel |
| kgs. | - kilograms, metric unit of weight, 1000 grams |
| m. | - meter, metric unit of length |
| MC | - moisture content |
| MF | - Melamine Formaldehyde; a catalytic type of adhesive used in the furniture industry, using melamine as the primary component, is thermo-setting and has a very high resistance to humidity |
| m-hrs. | - man-hours, unit of work performed |
| mm | - millimetre, 1/1000th of a meter |
| No., no. | - number |
| pcs. | - pieces |
| PVA | - Polyvinyl Acetate; a type of adhesive commonly used in the furniture industry, white in colour, not moisture-resistant; it is thermo-plastic and dries by the evaporation of its solvents |
| RPM | - revolutions per minute |
| S2S | - surfaced on two sides; referring to a wooden board whose two faces have been planed smooth |

- S3S - surfaced on three sides; referring to a wooden board whose two faces and one edge have been planed smooth
- S4S - surfaced on four sides; referring to a wooden board whose two faces and two edges have been planed smooth
- TCT - Tungsten Carbide Tip; a hard metal alloy used to reinforce the cutting edges of tools
- UF - Urea Formaldehyde; a catalytic type of adhesive used in the furniture industry, using urea as its primary component, which is thermo-setting and which has good resistance to humidity
- ° - degrees, a circular unit of measure of angles
- φ - diameter
- / - per; meaning "for each"
- % - per cent; 1/100th part of a whole

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I. INTRODUCTION

1.1 Project background

In 1989 the Mexican furniture industry was estimated to be composed of approximately 2,700 manufacturing firms, excluding the tiny carpentry shops whose main activity is the repair of household furniture and furnishings. An estimated 62% could be classified as belonging to the micro-industry level; while another 33% would belong to the small-scale level of operations. About 4% may be classified as medium-scale production operations. Thus, approximately 1% of the industry operated at the large-scale levels of manufacturing activities. In terms of production volume, the small-scale furniture factories contributed about 50% of the total national sales, followed by large-scale manufacturers at about 19%, the remaining 31% having been sold by the micro- and medium scale sectors of the industry. The aggregate sales was estimated at US\$717,000,000 (MEX\$2,130,150,000 millions) for the year 1989¹.

Approximately 92,000 workers were directly employed by the furniture industry, 52% of whom worked in the small-scale industry sector, 27% in the micro-industry sector, and the remaining 8% in the large-scale industry sector. In the same year, it is interesting to note that 22,747 workers were employed by 237 firms engaged in assembling furniture with both metal and wooden components. On the other hand, it should be noted that during the period 1985-1989 the actual sales of the furniture industry suffered a decrease of 43%, and the number of manufacturers and workers also decreased by 54% and 47%, respectively².

The furniture industry of Mexico is predominantly in the hands of the private sector with only about 1% of the firms being parastatal establishments. The industry is also Mexican in ownership, because less than 1% of the total investments came from foreign sources³.

In 1989, the export of Mexican furniture products has risen to a total of US\$ 42,634,800; of which about 95% were exported to the United States of America. The exporting firms were concentrated on the border areas of Mexico, and partly by the large-scale manufacturers. The export participation of the micro- and small-scale furniture producers were insignificant. Approximately 2% of the total volume of furniture exports were sold to Central American countries, about 1% to Europe, and the remainder to other countries. A very encouraging growth in exports of Mexican furniture products, 28%, was registered during the period 1985-1989⁴.

¹ CANACINTRA "Estudio de posición que presenta la industria nacional fabricante de muebles; acuerdo de libre comercio México - Estados Unidos de América". México D.F., 1991, pp. 1-2.

² Ibid., p. 2.

³ Ibid., pp. 2-3.

⁴ Ibid., pp. 4-5.

The current Mexican government administration wishes to modernize the country's production systems through more determined support of the private sector as the major propelling agent of the development programme. This move is very timely, for with the recent approval of the Free-Trade Agreement between the United States of America, Canada and Mexico, the export potential of Mexico's furniture industry could be better realized, it being a labour-intensive industry.

Previous studies indicated that among the various factors involved in the programme to increase furniture productivity and improve product quality, with a corresponding reduction in production costs, the concept and eventual implementation of "serial production" techniques is greatly needed by the industry. To help achieve this, the use of production jigs and fixtures being the main vehicle for serial production operations need to be propagated in the Mexican furniture manufacturing industry.

UNIDO, in cooperation with CANACINTRA, has therefore embarked in Project No. SI/MEX/89/801, entitled "Assistance in the development of jigs for furniture production". The project was implemented in two phases: Phase I during the period 4 August to 17 September 1989; and Phase II from 1 April to 7 June 1991.

1.2 Project objectives

The fundamental objective of the Project is to demonstrate the use of jigs for serial production. Complementary objectives for Phase II of the Project involve:

- (a) To install and operate the demonstration equipment purchased for the project as per request of the Consultant who served under Phase I of the Project;
- (b) To provide a two-day technical assistance to the remaining twenty furniture companies; and

To prepare a Manual on the manufacture and use of jigs for serial furniture production, which could be used as a new teaching method by the counterpart, and to prepare as well the corresponding visual aids.

More detailed descriptions of the missions during the two phases of the Project are given in Annexes I and II. (Annex I consists of the job descriptions of the two experts and Annex II lists the contacts made during their missions.)

1.3 Project participation and general activities

A total of 4 man-months were used during both phases of the project: 1.6 man-months during Phase I and 2.4 man-months for Phase II.

1.3.1 Phase I

The first phase of the project was implemented in 1989, when UNIDO sent Pietro Borretti to Mexico for the purpose of conducting a demonstration workshop on jigs fabrication and uses in the furniture industry. Ad hoc technical assistance (on the use of jigs in furniture production) was given

to five furniture firms. Other complementary technical assistance activities (such as specifications for necessary equipment, revision in furniture designs to allow serial production and use of production jigs, etc.) were also provided to the participating firms.

More detailed description of the activities of the Expert for Phase I of this project is given under section 2.1 of this Report, and in the technical report entitled "Preliminary findings of the first phase (document DP/ID/SER.A/1524).

1.3.2 Phase II

Activities under Phase II of the project started with a breakfast conference with top officials of the Furniture Group of CANACINTRA on 2 April 1991. Bearing in mind the general objectives of the second phase of the project, a tentative scheme of delivery of "technical know-how" on the design, fabrication and proper use of production jigs and fixtures was presented by the Expert during the breakfast conference. The Furniture Group took a unanimous position that two days of assistance to each furniture firm would not be enough to help them realize the importance of jigs in their production operations. They added further that neither would they learn when and how to fabricate jigs in their quest to attain "serial production" levels in their production operations. Moreover, it was held that providing technical assistance to 20 factories at 2 days each would result in almost nothing, since travel time would take up about 30% to 45% of the Expert's time, the factories being far apart and scattered in different areas of Mexico D.F., and considering that traffic problems in the city would further reduce the expert's available time. Thus, it was decided that a group of eight firms, more or less representing a cross-section of the Mexican furniture industry be, identified and invited to participate in Phase II of the project. Furthermore, the Furniture Group requested that quality in the transfer of "technical know-how" be given priority over quantity of firms which will be the beneficiaries of the planned transfer of technology.

The expert requested, and was granted, half-day visits to the eight participating firms, in order to assess their facilities, their key factory personnel, and the degree of urgency needed to solve the problems that would require the use of production jigs and fixtures. The resulting schedule and description of technical assistance activities given to the participating firms are described in more detail in the following sections of this Report.

II. TECHNICAL ASSISTANCE SCHEME AND "KNOW-HOW" TRANSFER ACTIVITIES.

2.1 Project Phase I

The principal objective of this phase of the project was to introduce appropriate jig-making "know-how" as a means to:

- expedite wood processing operations
- ensure accuracy of wood machining operations and attain interchangeability of component parts,
- optimize quality of wood-machined surfaces, and
- contribute to safety in wood-machining operations.

The following paragraphs summarize the activities carried out during this phase of the project. More details are given in the technical report

entitled "Diseño y uso de escantillones y dispositivos en plantas de fabricación de muebles y ebanisterías" (document DP/ID/SER.A/1525).

2.1.1 Two-Day Course at CANACINTRA

A two-day course was conducted by the expert at CANACINTRA on jig design, jig making and jig applications. The course was attended by some 45 persons, representing about 20 companies. The following topics were covered during the course:

- (a) Definition of jigs:
- (b) Purpose of jigs:
- (c) Applicability of jigs to artisanal and industrial operations:
 - jigs for use in handtool operations.
 - jigs for use in power-tool operations.
 - jigs for use in wood-machining operations.
 - jigs for use in assembly operations;
- (d) Types of jigs for various wood-machining operations such as: routing; spindle-moulding; sawing; surface planing;
- (e) Assembly jigs operated by pneumatic cylinders;
- (f) Types of clamps for machining operations;
- (g) Proper working drawings as a pre-requisite for accurate jig work; and
- (h) Measuring instruments for controlling accuracy of jig work.

2.1.2 Factory Training Sessions

Short training sessions were conducted by the expert at selected factories and the Colegio Nacional de Educación Profesional Técnica (CONALEP) to review again the main topics dealt with at the CANACINTRA two-day course, so as to extend the training benefit to a wider group of technicians. The following factories were included in the extension of the original programme: P.M. Steel, Fyli, Deca, Gamma, Industria Columbaire, D.M. Nacional, Stylos and Cocinas Provel. The training sessions also covered trouble-shooting in other particular aspects of plant operations as, for example, engineering of wood products for serial production and introduction of proper machine lubrication.

2.1.3 Ad Hoc Technical Assistance to Furniture Factories

The expert provided *ad hoc* assistance varying from two to four days to the following furniture factories: P.M. Steel, Mueble, Fyli, Deca, Stylos, Gamma, Cocinas Provel, Industria Colombaires and D.M. Nacional.

The assistance consisted of: initial factory visits to identify individual capabilities and requirements in jig making and select in each factory one or more jig making exercises to be undertaken as part of the project. Specifications of jig-related equipment were also provided - such as clamps, machine accessories and cutting tools - to be purchased to cover particular needs. Further factory visits followed to review progress made and recommend improvements and/or modifications of jigs as required.

2.1.4 Visits to Training Institutions

The main woodworking training institutions located in Mexico D.F. were visited by the expert in order to identify a school which could host demonstrations on jig making and applications to be carried out by the expert

on his return mission to Mexico in Phase II of the project. The following institutions were visited:

- (a) Colegio Nacional de Educacion Profesional Tecnica (CONALEP-Ticomán):
- (b) Instituto Politecnico Nacional:
- (c) Centro de Estudios Cientificos y Tecnologicos; and
- (d) Instituto de Capacitacion de la Industria de la Construccion.

The Colegio Nacional (CONALEP-Ticomán) was found to be the only institution in Mexico D.F. equipped with machinery suitable for the purpose of carrying out the envisaged jig demonstration activities in Phase II of the project. In fact, CONALEP is the only technical school with a potential to carry out proper training for wood machinists. Furthermore, it is equipped with comprehensive metal working facilities and could therefore produce clamps and other jiggling accessories for the industry.

2.1.5 Selection of Equipment for Purchasing under the project

CONALEP-Ticomán is equipped with a good set of basic woodworking equipment, some of which have never been utilized at the time of the expert's visit for lack of proper accessories, cutting tools and adequate operating know-how. Furthermore, none of the supervising personnel had had any experience in jig making. Therefore, the expert has prepared a listing with specifications of a number of cutting tools, jig-making items and machine accessories to be purchased with the funds available under the project. The selection has been made with the following purpose:

- (a) To allow demonstration work to be conducted at CONALEP-Ticomán in Phase II of the project, on the use of jigs in woodworking operations;
- (b) To lay the basis for converting CONALEP-Ticomán into a pilot centre for institutional training of skilled wood-machinists for the furniture and joinery industry;
- (c) To provide samples of imported jig making accessories to be reproduced for the industry in the metal working machine shop of CONALEP-Ticomán;
- (d) To provide samples of imported cutting tools of appropriate design (meant for spindle-moulding and routing operations) for possible production locally by the UTEMEX company.

All the equipment to be purchased under the project is meant for use on two particular types of machines already installed at CONALEP-Ticomán, which are:

- (a) The Swedish-made spindle moulder EJICA type F-4-M; and
- (b) Four brand new Italian-made routers, SAMCO.

2.1.6 Meeting at LANFI

The meeting at the Laboratorios Nacionales de Fomento Industrial (LANFI) was arranged by the UNIDO Director Mr. I. F. Contreras to discuss the possibility of establishing a furniture testing facility. The meeting was attended by LANFI's Director General Mr. J. S. Estera, Ms. Ana Stefanovich also of LANFI, Messrs. A. Mariscal and A. Ruiz Galindo of CANACINTRA and Mr. J. Martinez, IMAC's Acting Director. LANFI's testing facilities of relevance to the furniture industry include equipment to test wood mechanical properties and surface resistance.

The main conclusion of the meeting was that the role of LANFI in setting up and operating a regular programme of furniture testing for the industry would be dependent upon the outcome of a mission to be undertaken by AIDIMA's consultants already recruited under a UNDP-funded project.

2.1.7 Visit to FESTO Pneumatic S.A.

The purpose of the visit was to investigate the possibility of introducing basic low-cost automation techniques in the furniture industry. It was found that the FESTO company, besides distributing a wide range of pneumatic equipment for applications in the various industrial sectors, is also engaged in conducting practical-oriented courses on low-cost automation based on the utilization of pneumatics. During the expert's debriefing at UNIDO-Vienna, it was agreed with Mr. Bassili that FESTO could possibly extend its training activities to the furniture industry by utilizing as a reference the UNIDO manual on low-cost automation, publication No. ID/154 Rev.1, a copy of which was left by the expert with Mr. A. Mariscal of CANACINTRA.

2.1.8 Visit to UTEMEX S.A.

The UTEMEX company is one of Mexico's leading manufacturers of machine cutting tools for the furniture and joinery industry. It also operates a comprehensive tool-maintenance service. The discussions here centred on the possibility of introducing cutting tools with improved cutting characteristics - particularly those for use on spindle moulders. It was agreed in this respect that UTEMEX would have access to the sample cutting tools purchased under the project for use in demonstration work at CONALEP-Ticomán.

2.1.9 Visit to Leon Weil S.A.

This company distributes a range of toggle clamps of Mexican manufacture, part of which is suitable for use in the furniture industry. Samples of such clamps were purchased and their possible use was illustrated by the expert during the factory visits.

2.1.10 Proposal for the Creation of Quality Label for Mexican Furniture

During the course conducted at CANACINTRA, the expert had highlighted the importance of introducing a quality label for Mexican-made furniture as a means to certify the quality of the product in the endeavour to promote furniture exports to the U.S.A. markets. The expert's recommendation in this respect was to seek the assistance of the Swedish Furniture Research Institute that has developed the Mobelfakta label, which is widely used in the Scandinavian countries.

2.1.11 Preparation of a Programme for Technical Services to the Furniture Industry

In spite of the various activities already undertaken and to be undertaken with respect to the provision of technical services to the furniture industry, no attempt had been made up to the time of the expert's mission to elaborate a co-ordinated programme of technical services to cover all the critical requirements of the sector. Further in discussions on this subject with Messrs. A. Mariscal and A. Ruiz Galindo of CANACINTRA and J. Martinez of IMAC, the expert presented reference tables (see Annex III) on the

Development of Technical Services for the Furniture Industry covering the following areas:

- (a) Research and Testing Services;
- (b) Quality Certification Services;
- (c) Information Services;
- (d) Consultancy Services; and
- (e) In-service Training.

2.1.12 Advice on Furniture Engineering

During the factory visits, the expert found that one of the main problems of the industry as a whole was the lack of furniture engineered for serial production and a rational use of raw material. Thus trouble-shooting advice was provided by the expert in this respect. In one particular instance, structural modifications resulted in a simplified process and a reduction of 450 kgs in the material content in the manufacture of a standard desk.

2.2 Project Phase II

2.2.1 Manpower Training Institutions

2.2.1.1 Colegio Nacional de Educacion Profesional Técnica (CONALEP), Ticoman, Mexico D.F.

This is one of the more than 250 branches of the CONALEP system of vocational schools located in the urban and industrial centres of Mexico. The woodworking course offered in CONALEP-Ticoman is part of a general training programme to prepare the students for some form of trade or vocation after graduation from school.

The woodworking shop training facilities were visited by the expert on 22 April 1991. The teaching staff discussed the woodworking classes and the scope of skills they hoped to develop among the students as they work on their shop projects. The curricula for the four different courses in woodworking were evaluated and found to be more craft-oriented than industry-oriented.

Lectures (during the mornings) on the need for design and fabrication techniques, and the use of production jigs and fixtures were given to two different groups of students on 23 and 24 April. The most promising (and interested) among the two groups were invited to join the UNIDO-CANACINTRA Training Team. Similarly, the faculty members most interested in jigs and fixtures were also invited to join the Training Team.

During the afternoons of 23 and 24 April, the students and teaching staff were given demonstrations on the use of the various components and accessories for jig making purchased by UNIDO for CONALEP (through CANACINTRA). Work on a project assignment (production jig for shaping coat hangers on a vertical spindle moulder) was started on the 24 April. Work on the jig was resumed and completed on 5 June after the CONALEP members of the Training Team had acquired sufficient experience during the Team's activities of providing technical assistance on jigs fabrication to the industry participants of the project. The completed shaping jig was found to be satisfactory.

2.2.1.2 **Universidad Nacional Autónoma de Mexico, (UNAM), Coyoacan, Mexico D.F.**

The Universidad Nacional Autónoma de Mexico is one of the leading schools of higher learning in the country. UNAM offers graduate and post-graduate courses in a number of disciplines. Among others, UNAM offers courses in Engineering, Medicine, Political and Social Sciences, Industrial Design, etc. The Institute of Industrial Design offers specialization in furniture design and production. The graduates of the Institute find challenging jobs both in industry and other training institutions. The woodworking shop of the Institute has the basic machinery and facilities for training industrial designers. However, the Institute's course in industrial production of furniture products remains to be revised and improved to make it more industry-oriented.

2.2.2 Quality Control Testing Facilities and Services

Two institutions were visited to determine the possibility of using their facilities in quality control activities for Mexico's furniture industry. Both institutions are now providing the testing needs of the country's industries in fields other than furniture.

2.2.2.1 **Laboratorios Nacionales de Fomento Industrial (LANFI), Estado de Mexico**

Two visits were made to LANFI, on 4 and 7 April. The "Promotor de Tecnología" and the Chief of Graphic and Industrial Designs discussed the services offered by LANFI to industry. However, when the expert requested to be shown the testing facilities, he was informed that it would take some time to prepare for such a visit and that CANACINTRA would be informed when the visit could be made. Up to the time of his departure, LANFI had not informed CANACINTRA when a visit to their testing facilities could be made by the expert.

As reported by the expert sent by UNIDO during the first phase of the project, it was the Chief of Graphic and Industrial Designs section who was sent to Spain, under a fellowship grant by AIDIMA, to train in the techniques of quality control for finished furniture products, sometime in 1989. The Graphics and Industrial Designs Section Chief informed this expert that no follow-up activities were ever made in this aspect of the industry since his return to Mexico.

2.2.2.2 **Institute of Materials Testing, UNAM**

The materials testing facilities of UNAM, operating under the College of Engineering, were visited on 16 April 1991. The facilities were found to be very modern. Sample reports on materials testing projects for the metal and plastics industries shown to the expert indicated that the Institute has ample experience in serving industry. The top officials of the Institute indicated that they could also serve the country's furniture industry. The facilities of the Institute were found to be adequate for testing the physical properties of wood, particle board and other wood-based panels used by the furniture industry. Similarly, properties of other raw material inputs of for the furniture industry can be tested; e.g., properties of paints, adhesives and the corresponding extenders and fillers, strength and durability characteristics of furniture hardware and fasteners, etc.

UNAM was invited (and it accepted) to send a faculty member and/or one of its promising students to participate in the UNIDO-CANACINTRA Training Team for the Design, Fabrication and Use of Production Jigs and Fixtures.

2.2.3 Technical Assistance to the project Participants

Technical assistance to the project participants was provided during the period 4 April to 31 May 1991. Situations in factory operations which need improvement were identified and pointed out to top production officials of the participating firms during the half-day visit to each firm. Corresponding solutions to the problems thus identified were also indicated by the expert. The major portion of the technical assistance, of course, involved the training of selected key workers of the participating firms to identify situations which can be improved by the use of production jigs and fixtures, design the jig and/or fixture, fabricate the jig and/or fixture, and use the jig and/or fixture properly during production operations. The expert was ably assisted in this task by a UNIDO-CANACINTRA Team, which was organized for the purpose.

Materials for the preparation of the manual on the design, fabrication and use of production jigs/fixtures, a specific requirement of this mission, was collected during the course of the training activities.

More details on the technical assistance activities are given in later sections of this Report.

2.2.3.1 **Industria Colombaire S.A. Prol. La Viga 175, Mexico D.F.**

The Industria Colombaire, S.A., is a small firm specializing in the manufacture of furniture accessories and furnishings. It is semi-mechanized, but the production techniques revolve around craftsmen's skills. Limited "serial" production is attained when the order for furniture products warrant so.

The firm employs a varying number of workers, from 20 to a maximum of about 50 during peak loads. The labour turnover is high. This is reflected in the low quality and low productivity of the manufacturing operations.

The firm begged-off participating in the jig fabricating activities of the project because of unexpected personnel and production problems.

2.2.3.2 **Gamma Baños y Cocinas Integrales, S.A. de C.V., Prol. Manuel Acuña 142 esq. Rey Maxtla, Mexico D.F.**

This firm specializes in the manufacture of kitchen cabinets and bathroom furnishings produced to fit specific household situations. The wooden component of the product lines are made by Gamma, in conjunction with the suppliers of other kitchen and bathroom appliances.

The factory has a total complement of 35 employees, of whom 5 are in administration, 9 are highly skilled workers and the rest are semi-skilled and unskilled employees.

Current facilities permit an annual capacity of about Mex\$ 10,000 million worth of products. However, during 1990, only a total of Mex\$ 2,100 million worth of products were produced.

The factory is in the process of remodelling and the machinery complement is being modernized and its lay-out being modified.

The following factory personnel were trained (for four days) in the identification of situations requiring the use of production jigs and fixtures, the design, fabrication and use of jigs and fixtures:

- Sergio Calderon Ramirez, Production Head
- Felix Matias Lira, Shop Supervisor
- Antonio Alva, Foreman, and
- Alicia Columba, Designer/Draughtsman

A total of four situations were identified to need the use of jigs: one in the machining section and three in the assembling section.

The Director for Production, Mr. Manuel Said, participated during the last two days of the training activities.

Only one jig was designed and fabricated for the drilling of dowel holes on the sides of the kitchen cabinets, according to the "Sistema 32" specifications which allow only about 0.3mm tolerance on the location of the dowel holes.

2.2.3.3 Stylos S.A. de C.V., Ave. Santamaria No. 2, Parque Industria, Lerma, Edo. de Mexico

This firm specializes in bedroom furnishings, office cabinets and other household and office furniture accessories. The major raw material input is particle board laminated with either melamine or urea-formaldehyde impregnated sheets.

Technical assistance was scheduled for four days. However, the firm had difficulties providing the training team with transportation. Thus the technical assistance activities were cut to two days. The remaining two days were devoted to training activities at CONALEP-Ticomán.

Upon request by the firm's management, the problem of squareness in the construction of drawers was studied and the corresponding assembling jig was designed and started to be fabricated. The wooden components of the jig were completely fabricated on the second day of the allotted assistance period. However, assembly of the jig could not be completed due to the lack of a metal turnbuckle which was the major component of the jig. The firm was unable to provide the turnbuckle, even though it was verified by the expert and members of the training team that turnbuckles of various sizes were available in most of the city's hardware and mill supply stores.

In view of the aborted assistance technical activities, the expert was not able to secure the corporate and operating data from the key officers of the firm.

2.2.3.4 Muebles Fyli, S.A. de C.V., Calle 4 No. 216 local 1 y 2, Col Granjas, San Antonio, Del. Ixtapalapa, Mexico D.F.

This firm specializes in the manufacture of office and library furniture and furnishings. The factory has a monthly capacity of 1800 units of

bookshelves, office desks, etc., but, on the average, only 800 units are currently produced monthly on the average.

The factory has a total complement of 50 workers, 35 of whom belong to the administrative and management sections, two are technicians, eight highly-skilled, 16 skilled and the rest are either semi-skilled or unskilled workers. The factory is beset with a high 8% labour turnover rate.

Its output is sold totally on the domestic market. The major raw material input is solid wood (pine, mahogany and, sometimes, oak), with occasional use of particle board and plywood in selected components.

The following factory personnel were trained for four days in the identification of situations requiring the use of production jigs and fixtures, the design, fabrication and proper use of the jigs and/or fixtures:

- J. Arturo Mugica Garcia, Product Development Head.
- J. Victor Sanchez Garcia, Production Manager.
- Gerardo Moreno Cruz, Chief, Patterns/Template Section, and
- Alfredo Carmona Estrella, Assistant, Product Development Group.

A total of 17 situations were identified (see Annex III) as needing the use of production jigs and fixtures. A total of 5 jigs were designed and 4 were fabricated.

Other technical matters taught to the key personnel of the factory involve the technique of rehabilitating used sanding belts (which can extend the life of the sanding belts to at least 3 times the current usage life); the method of checking the correctness of sharpening planer and shaper knives, saws and bits, among other things.

2.2.3.5 Acabados en Madera Deca S.A. de C.V., Av. Hidalgo No. 12, 56530 Ixtapaluca, Estado de Mexico

This firm is principally engaged in finishing operations on products produced by its sister firms, Muebles Fyli S.A. and Tanfa, S.A. Tanfa specializes in the manufacture of chairs, out of pine wood, principally, with particle board and plywood being used in seats and back rests of some chair models. Tanfa S.A. is located right beside Acabados, hence, technical assistance was provided to both factories without much additional input from the training team.

DECA, the shorter name for Acabados en Madera Deca S.A., has a total complement of 111 employees. The Administrative and Management Division has 25 employees. There are 6 technicians, 6 highly-skilled and 6 skilled workers in the production plants. The rest are semi-skilled and unskilled workers. The firm is also beset by a high 15% labour turnover.

All the factory's output is sold on the domestic market.

The following factory personnel were trained for four days in the identification of situations needing the use of production jigs and fixtures, the design, fabrication and proper use of the jigs and/or fixtures:

- Adon Sanchez Garcia, Chief of the Department of Machining and Chair Production
- Mauricio Perez Sagaon, Assistant, Technical Development Group, and
- Romeo Jimenez Enriquez, Production Assistant.

A total of 15 situations (see Annex III) were identified as needing the use of production jigs and fixtures, two of them in the finishing operations, the rest in the machining and assembling operations. A total of 6 jigs were fabricated and improved, and another 3 were designed, to be fabricated immediately after the technical assistance period for the firm.

The technique of rehabilitating sanding belts and the method of checking the correctness of sharpening planer and shaper knives, saws and bits, among other allied activities, were taught to the trainees.

2.2.3.6 **Commercial D M. Nacional S.A. de C.V., Calz. San Juan de Aragon 439, Mexico D.F.**

This firm specializes in the manufacture of office furniture. It has two distinct production lines, one line for chairs made of solid pine wood, and the other line, for the manufacture of office tables, filing cabinets, etc. made of particle board laminated with FORMICA or veneer sheets.

The factory employs no less than 200 workers, 8 of whom are in the Management and Administrative Division; 15 are in the Supervisory Group; 9 are technicians; and the rest are either production workers or assigned to non-productive activities.

Actual average output is about 1100 units of furniture items (office desks, filing cabinets, tables, etc.); 213 sets of office furniture and 980 chair products per month. These represents about 50% of the installed capacity of the factory. All the factory output is sold on the domestic market.

The technical assistance activities to this factory were limited to the solid wood chair production line, inasmuch as there was already a German expert who was providing them technical assistance for the wood-based panel furniture line.

The following factory personnel were trained for five days in the identification of situations requiring the use of production jigs and fixtures, and their design, fabrication and proper use:

- Ignacio Hernandez R., Industrial Designer
- Nazario Cruz H., Machine Operator
- Miguel Perez Gomez, Supervisor
- Bernabe Martinez Neira, Machine Operator
- Jesus Perez Cuapio, Manufacturing Assistant

A total of eleven situations were identified as needing the use of production jigs and fixtures, all in the machining and assembling sections of the chair production line. A total of four jigs were designed and fabricated. Another three jigs were designed and awaited fabrication by the end of the technical assistance period.

The technique of rehabilitating used sanding belts and the method of checking newly-sharpened knives, bits and saws were also taught the trainees.

2.2.3.7 Mueble S.A. de C.V., V. Carranza No. 14, Pte de Vigas, Tlalneplantla, Estado de Mexico

This firm specializes in office furniture and furnishings production. Similar to D.M. Nacional, Mueble has two distinct production lines: one for wood-based panel products, and the other, for the production of chairs from solid wood.

The factory employs 140 workers, 5 of whom are in the Management and Administration Divisions; 4 are in technical and supervisory positions; another 2 are in highly-skilled jobs, 17 are skilled workers, and the rest are either in the semi-skilled or unskilled category.

The current factory capacity is estimated at 100 units per day for both lines and the actual sales average at about MEX\$ 1,400 million per year. All output is sold on the domestic market.

The following factory personnel were trained in the identification of situations requiring the use of production jigs and fixtures, the design, fabrication and proper use of the jigs/fixtures:

- Jesus Sanchez Gomez, Chief, Quality Control Department.
- Heron Cabrera, Chief, Time-Motion Studies Department.
- Vicente Figueroa, Chief, Production Control.
- Liliana Silva Lecona, Analyst, Time-Motion Studies Department.
- Jose Luis Cruz, Senior Machine Operator, Leadman, Woodworking Shop Annex

Special emphasis in the economic justification of the use of production jigs and fixtures was given to Liliana Silva, since this topic is in her line of work.

A total of 17 situations (see Annex III) were identified to need the use of production jigs and fixtures: four in the finishing section, six in the assembling operations and the rest in the machining department. Six production jigs were designed and components were fabricated for four of them. Another jig was designed for checking newly sharpened knives, bits and saws; and its components were obtained from used items such as a drill chuck, ball-bearings etc., while the wooden components were fabricated from off-cuts of oak boards. However, further assembling work on the jigs was delayed by the hold-up of the company in which the payroll was stolen during the middle of the last working day of the technical assistance period for the firm. Thus, only one jig was assembled, while the rest were ready for assembling, and were scheduled to be completed immediately after the end of the technical assistance period.

2.2.4 The UNIDO-CANACINTRA Technical Assistance and Training Team

Based on experience in previous UNIDO projects involving the transfer of technical "know-how" to furniture industries in developing countries, a training team was formed to help the expert expedite and make more effective the contemplated transfer of technical "know-how".

2.2.4.1 Team Objectives and Composition

The training team was composed of the following:

| | | |
|---|--|----------------------|
| - | H.P. Brion. Expert on Jigs and Fixtures. UNIDO | Team Leader |
| - | B. Palmerin S.. CANACINTRA Staff Officer | Coordinator/Liaison |
| - | R. Dallal F.. CANACINTRA | Interpreter |
| - | F. Cruz S.. Faculty Member. CONALEP | Trainee-Group Leader |
| - | L. Reyes T.. Senior Student. CONALEP | Trainee-Group Leader |

The Training Team was intermittently augmented by trainee volunteers: Miguel Rojas N. and another student from the Instituto Politecnico Nacional during the technical assistance activities at D.M. Nacional S.A.; Eduardo Novoa R., a faculty member of the Industrial Design Institute, UNAM, and two students from the same school, during the technical assistance activities at D.M. Nacional S.A. and Mueble S.A. The principal objectives of the training team was to assist the UNIDO expert in training workers assigned by participating furniture firms and facilitate the intensive training activities by learning and eventually helping in the design, fabrication and teaching the proper use of production jigs and fixtures. In this manner, after having learned the techniques themselves, the two participants from CONALEP were made Group Leaders during the technical assistance activities at Acabados en Madera Deca S.A.; Comercial D.M. Nacional S.A.; and Mueble S.A. Thus, the Training Team's work coverage became more extensive and more trainees were effectively trained by them.

2.2.4.2 Accomplishments of the Training Team

The Team's accomplishments may be summarized as follows:

| | | |
|---|---|----|
| - | Total number of firms assisted | 8 |
| - | Total number of situations identified to need jigs and/or fixtures | 67 |
| - | Total number of jigs and/or fixtures designed | 29 |
| - | Total number of jigs and/or fixtures fabricated and put into use | 18 |
| - | Total number of factory personnel trained in various aspects of jig/fixture design, fabrication and use | 24 |
| - | Training Team members: | |
| | Fully trained | 3 |
| | Partially trained | 6 |

2.2.5 Highlights of Technical Assistance Activities at Participating Firms' Factories

The following paragraphs present some of the more significant results of the ad hoc technical assistance activities conducted under phase II of this project.

2.2.5.1 Edge-glued Composed Wooden Base for Routing and Shaping Jigs

The most common material used by the Mexican furniture industry as base for production jigs and fixtures was plywood. In a few instances, jigs were found to be constructed with hard fibreboard bases. Understandably, the useful and effective life of the jigs and fixtures was dictated by the ability of the plywood (or hard fibreboard) to resist both atmospheric and mechanical wear and tear conditions of their use. Correspondingly, the precision derived from the use of such jigs (or fixtures) decreases as the plywood (or fibreboard) base is deformed during repetitive use of the jig (or fixture). Rough handling and improper storage of the jigs (or fixtures), together with

the effects of severe (and/or rapid) changes in atmospheric humidity conditions, were found to have also significantly contributed to the deterioration of the effective and useful life of the jig or fixture, as a result of the warping and/or twisting of the plywood (or hard fibreboard) base.

The expert recommended the use of a base made of edge-glued wooden slats, laminated with a hard synthetic material (e.g., Formica) on the top and bottom of the wooden base. The edge-glued wooden corestock helped increase the stability of the jig base; while the synthetic top and bottom laminate made the jig more resistant to wear and tear during use. The wooden slats composing the base corestock could be made out of off-cuts, edgings and/or trimmings; the bottom and top laminate could be cut from left-over pieces of Formica or other hard synthetic sheeting material. It was further recommended that, wherever possible, the wooden slats should be arranged and composed such a way that the adjacent slats would have alternately opposing grain direction (as shown in Figure 1, below). This technique was found to be very effective in the fabrication of routing and shaping jigs in many tropical countries.

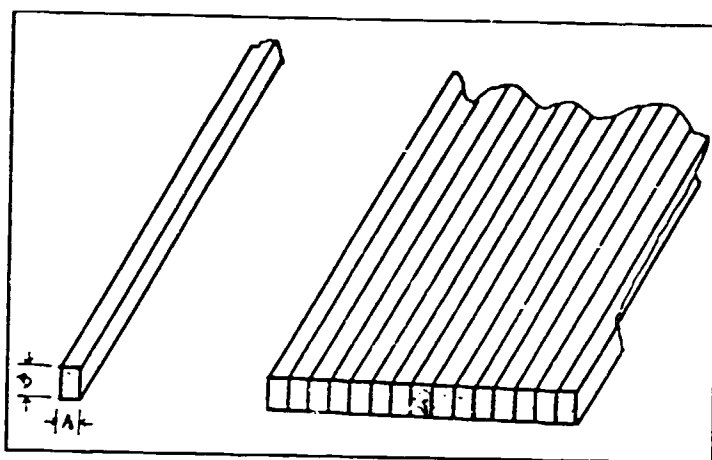


Fig. 1: Production Jig Base made of Edge-glued Wood Corestock.
where: $A \leq 2B$

2.2.5.2 Cutting Table for Radial Arm or Similar Types of Saws

Invariably, the first cut-off operation in the furniture plants (visited under this project) using solid wood as the principal raw material is done on a radial arm (or similar type) saw, with infeed/outfeed table extending to the left and right of the saw. The table top is usually made of plywood or particle board. The saw kerf groove on the saw table top eventually becomes much wider than the saw kerf, resulting in tear-outs on the bottom surface of the workpiece. This condition of the table top requires the replacement of the entire top of the table, which is rather a costly way of repairing a machine table top.

A less costly method of keeping the saw kerf track to the desirable width is by inserting a dovetail shaped spline (or insert) made of hardwood (oak, or some other equally hard wood species) on the table top along the saw kerf track. In this manner, only the spline or insert will have to be replaced when needed. Figure 2 is a schematic diagram of the technique.

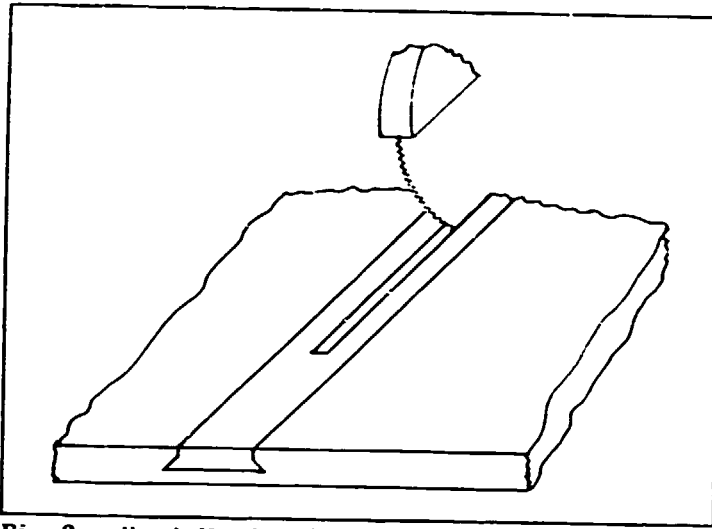


Fig.2: Hard Wood Spline on Table Top Inserted along Saw Kerf Track.

2.2.5.3 Compound Routing or Shaping Jigs

A common practice in furniture factories which have just started to learn "serial production" techniques is to design and fabricate routing or shaping jigs which can handle only one workpiece at a time. This observation also applies to the Mexican furniture industry. The expert introduced the technique of designing and fabricating shaping and routing jigs which can handle two or more workpieces at a time. The following figures show the production jigs designed and fabricated by the participating firms under the guidance of the UNIDO-CANACINTRA Training Team. A similar exercise was conducted at CONALEP-Ticomán, where a shaping jig for coat hangers was designed and fabricated by selected students and instructors.

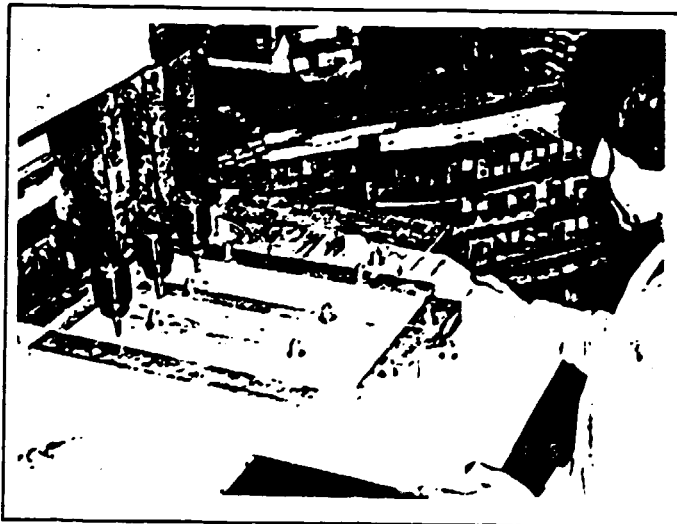


Fig.3: Jig for simultaneous routing of mortises on three workpieces (D.M. Nacional S.A.)



Fig.4: Machine set-up for using shaping jig to machine tenons simultaneously on six chair back legs (D.M. Nacional S.A.)

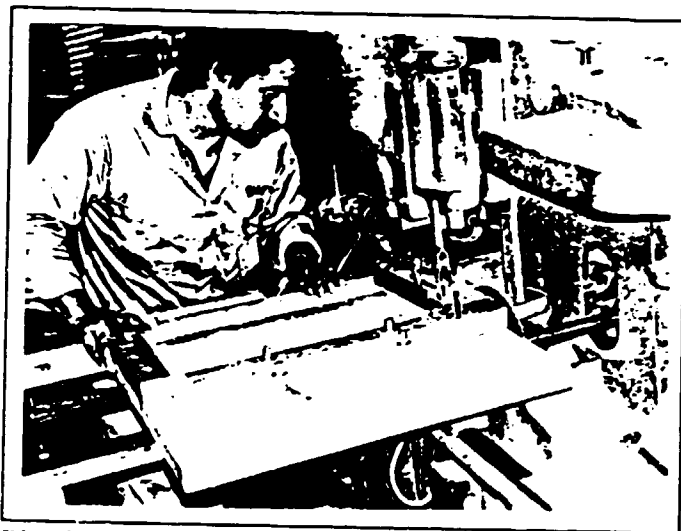


Fig.5: Set-up of single-end tenoner for the use of jig to cut and trim tenons on six chair front legs simultaneously (D.M. Nacional)

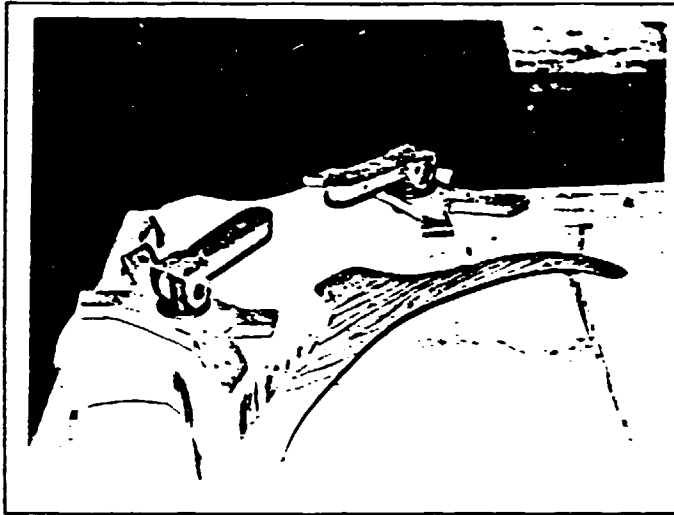


Fig.6: Compound jig for shaping the edges of two coat hangers. (CONALEP-Ticomán)



Fig.7: Compound jig for routing grooves on drawer fronts with the use of wooden eccentrics and stoppers (Muebles Fyli S.A.)

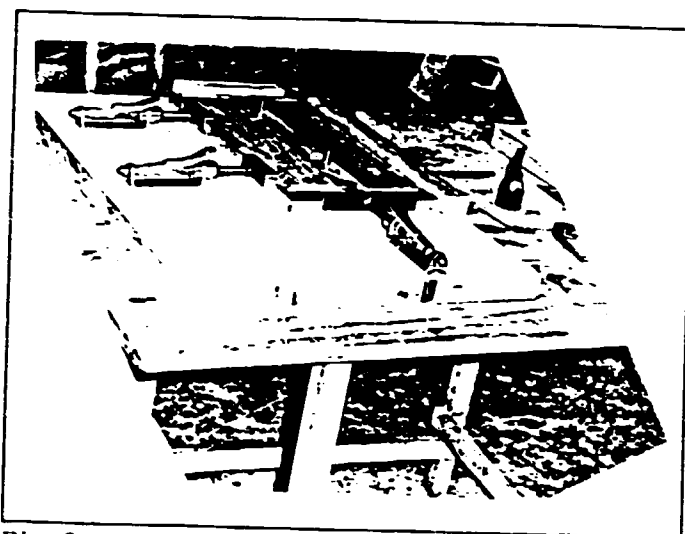


Fig.8: Compound jig for routing grooves on drawer fronts, using toggle clamps and wooden stoppers (Muebles Fyli S.A.)



Fig.9: Jig for routing grooves on drawer fronts, using a combination of wooden eccentric wedge stoppers (Muebles Fyli, S.A.)

2.2.5.4 Spraying Fixtures, Finishing Operations Set-up

Finishing operations can often be rationalized by using spraying fixtures, and outputs can be improved by the use of a set up conducive to decreasing wasted motion of the spray-gun operator. Figures 10 and 11 were the results of such recommendations to one of the participating firms.



Fig.10: Improved rotating spraying stand (Acabados en Madera Deca S.A.)

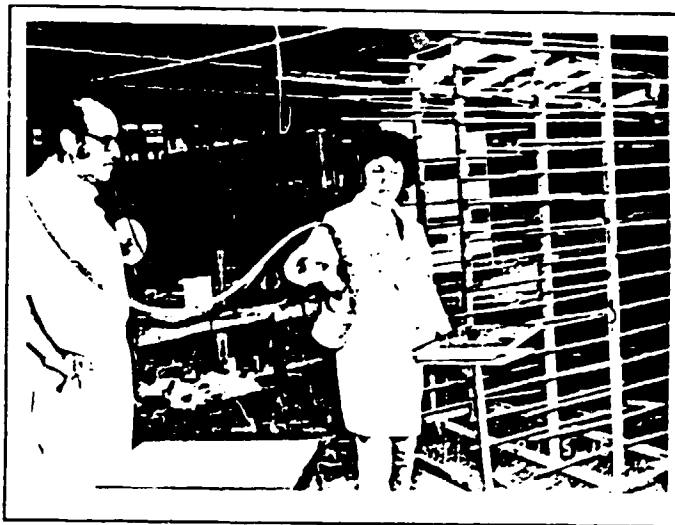


Fig.11: Improved spray station set-up using the improvised spraying stand and existing drying racks (Acabados en Madera Deca S.A.)

2.2.5.5 Improvement of Chair Assembling Operations

Sometimes assembling output and quality can both be improved by adequate preparation of sub-assemblies before the final assembly of the complete chair. This technique was applied to the chair assembling section of a participant's firm specializing in the manufacture of office chairs, using solid wood as the principal raw material. The expert was apprised of the high percentage of repair work coming out of the chair assembling line. An analysis of the existing operations indicated that the major cause for the repair work was the use of a chair assembling fixture (see Figure 12) equipped with pneumatic cylinders. The principal faults were: (a) Pressure on the glued joints was

released prematurely, i.e. before the glue had sufficiently set; and (b) there were pressure points in the assembling jig which did not have counter-stoppers, thus giving rise to loosely joined components. The incidence of repairs was significantly decreased when a chair side composed of a rear leg, a front leg, a seat rail and an arm rest with the use of a properly designed and fabricated sub-assembling jig (see Figures 13 and 14). This revision of the assembling sequence of operations allowed the glue in the sub-assembly to set properly before the final assembling of the chair on the chair assembling fixture shown in Figure 12.

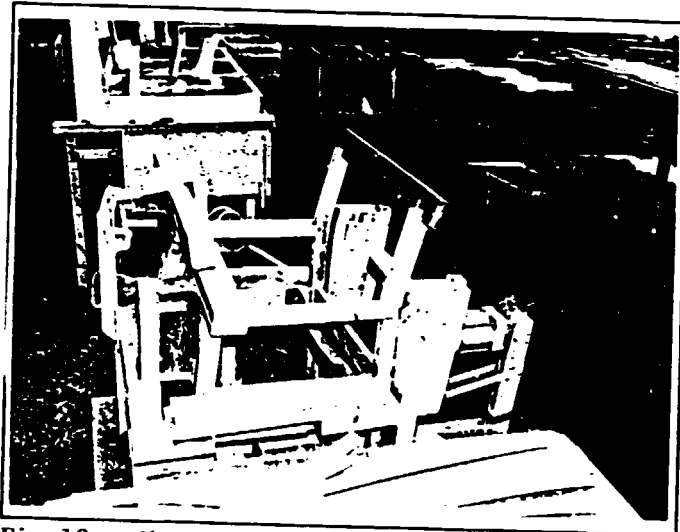


Fig.12: Chair assembling fixture with pneumatic cylinders (D.M. Nacional S.A.)



Fig.13: Jig for assembling chair side sub-assembly (D.M. Nacional S.A.)



Fig.14: Chair side sub-assembly held in place by steel straps to allow proper setting of glue in joined components (D.M. Nacional S.A.)

2.2.5.6 Improved Drilling/Routing Jig

It is possible to simulate certain specific drilling/routing operations involved in a pre-determined furniture manufacturing system like the "Sistema 32", while waiting for the arrival of the machine assigned to do the job, and at the same time prevent stoppage of the manufacturing operations. This was shown in the case of Gamma Baños y Cocinas Integrales S.A., when the factory could not afford to stop operations to wait for the arrival of the multi-spindle boring machine which was expected to give the desired boring precision of 0.3mm, required by the use of compound woodscrew (with plastic anchor nut) on components made of melamine-laminated particle board. The machining tolerance was attained by the use of a properly designed drilling/routing jig on an overhead heavy duty router. Figure 15 shows the improvised drilling/routing jig using wooden eccentrics, fixed and movable stoppers; while Figure 16 shows the machine set-up using the improvised machining jig.



Fig. 15: Improved drilling/routing jig (Gamma Baños y Cocinas Integrales S.A.)

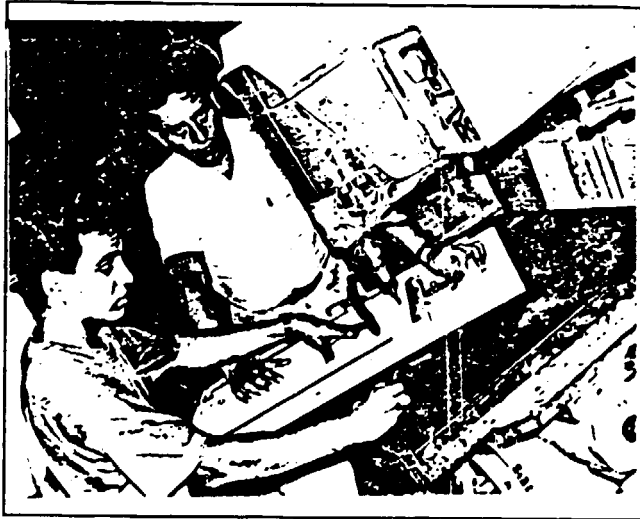


Fig.16: Router set-up using the improvised jig (Gamma Baños y Cocinas Integrales S.A.)

2.2.5.7 Effective Use of Frame Press with Pneumatic Cylinders

Four of the participating firms had frame presses equipped with a number of pneumatic cylinders arranged in pairs or sets to allow location of pressure points on selected areas of the furniture piece being assembled. Only one of the four could attain desirable outputs from the frame press as it was located to allow access to both sides of the press. The other factories located their frame presses near the factory walls, thus allowing access to only one side

of the frame press, limiting their effective use. The expert's assistance was sought by the Production Manager of Muebles Fyli S.A. to obtain more effective use of their frame press. The first move recommended by the expert was the relocation of the frame press, away from the corner of the factory building to allow access to both sides of the press (see Figure 17).

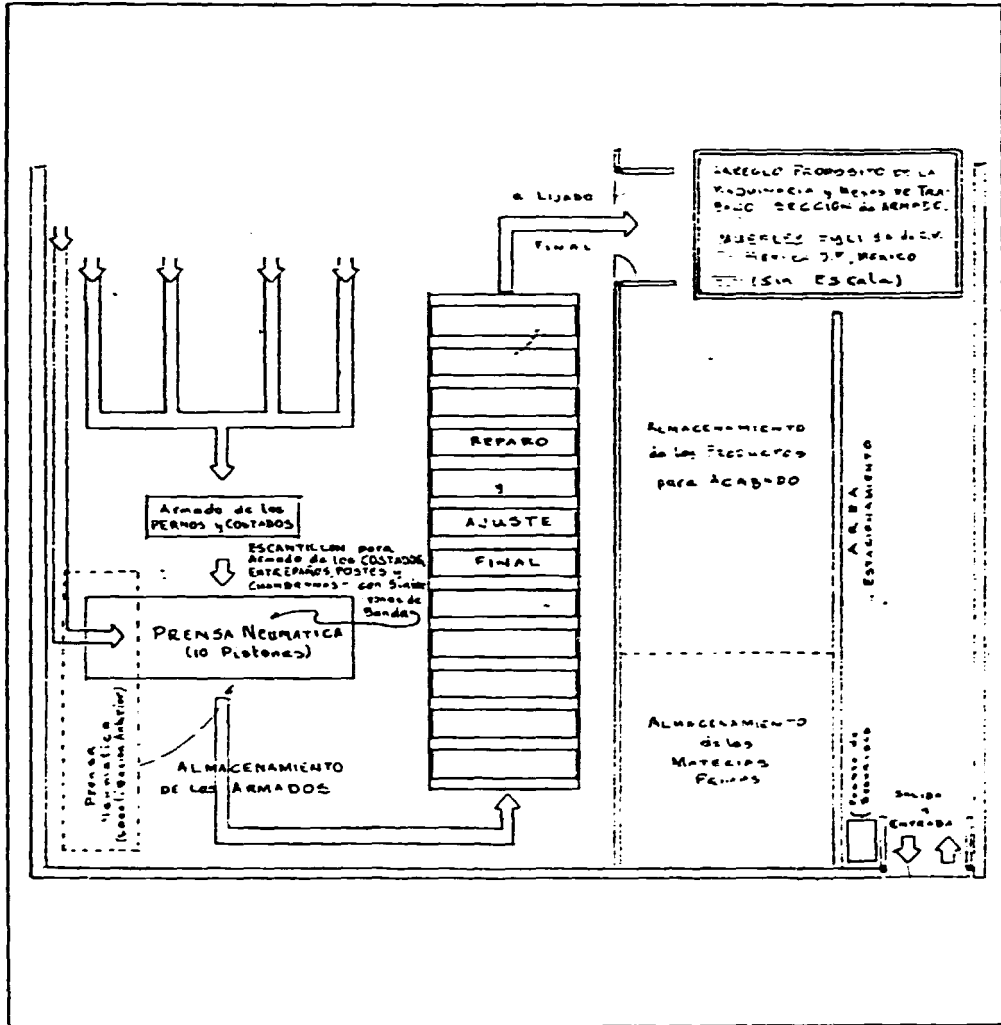


Fig.17: Recommended relocation of the frame press (Muebles Fyli S.A.)

The next step was to design an assembling fixture (see Figures 18 and 19) which would allow optimum use of the frame press.

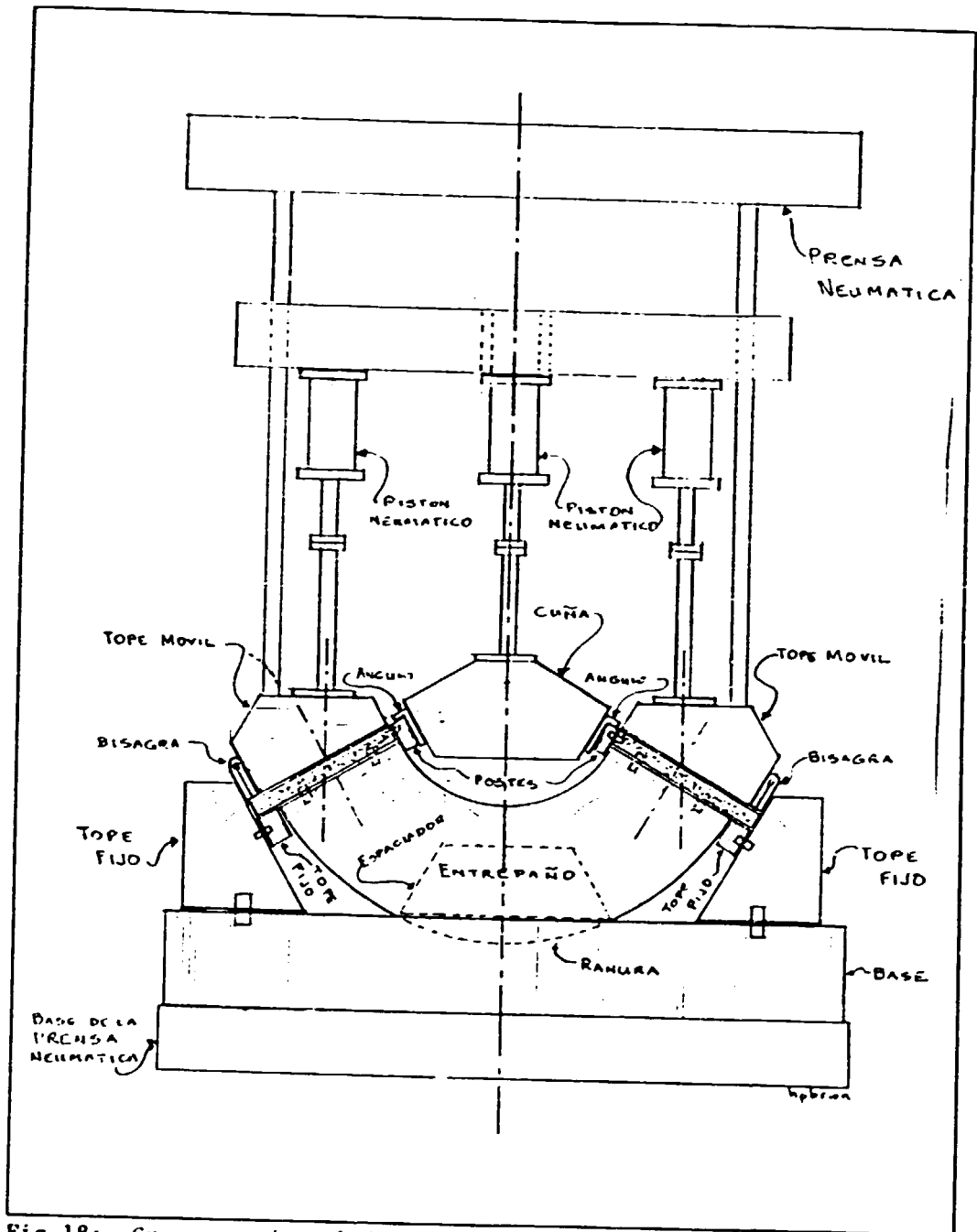


Fig.18: Cross-section of the fixture for assembling corner bookshelves on the frame press. (Muebles Fyli S.A.)

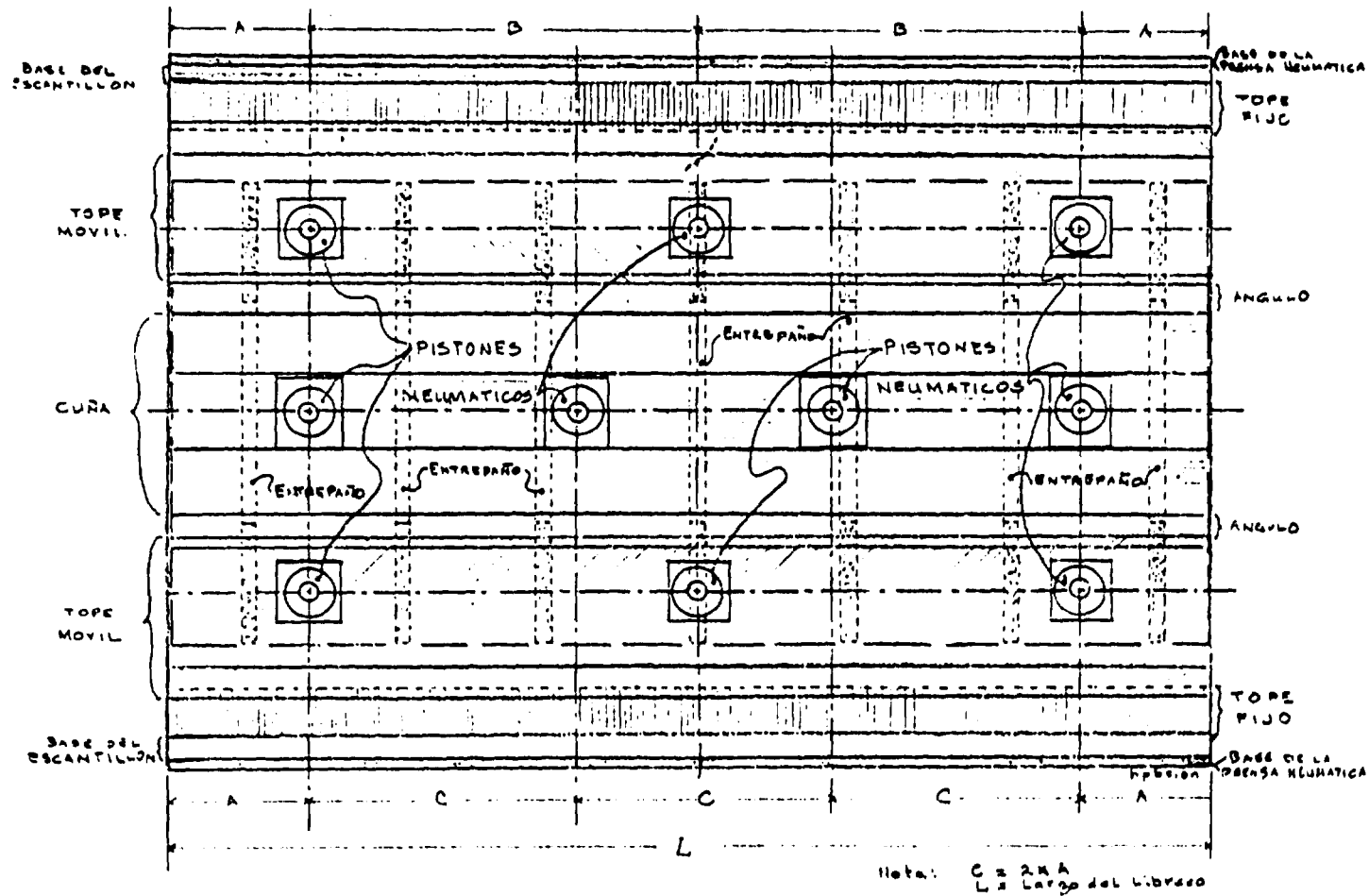


Fig.19: Distribution and location of pneumatic cylinders in the frame press for using the assembling fixture of figure 18. (Muebles Fyli S.A.)

2.2.6 The "Course" projects

During the mini-seminar on the design, fabrication and use of production jigs and fixtures held on 12 and 15 April 1991, at the Stylos factory in Lerma, Estado de Mexico, the participating firms agreed that "course" projects (preferably prototypes of selected furniture items) will be manufactured and presented at the closing ceremonies on June 7.

2.2.6.1 Course project Objectives and Mechanics of Implementation

The principal objective of the exercise was to apply the knowledge gained by the participating firms during the technical activities phase of the project. As a corollary, the exercise was intended to encourage cooperation among members of the furniture industry, thus, possibly laying the groundwork for specialization and complementation activities within the industry in the future.

The mechanics of the exercise involved the following:

- i. The participating firms were divided into two groups: one group was formed by firms specializing in the manufacture of solid wood furniture; the other group was composed of firms predominantly engaged in the production of wood-based panel type of furniture items.
- ii. Each group chose the "course" project: the solid wood furniture manufacturers chose an office chair; whereas the other group chose a dresser stool for their project. Group leaders were elected by the respective groups.
- iii. The pieces of furniture were designed and corresponding production jigs and fixtures were identified, designed and fabricated according to the guidelines learned during the technical assistance phase of the project.
- iv. The designs of both the furniture pieces and corresponding production jigs were discussed and agreed upon during a series of meetings among the group members and the expert.
- v. At least three sets of component parts of the two pieces of furniture were fabricated, as assigned to each participating firm. The furniture items were assembled during the closing ceremonies on 7 June.

2.2.7 Preparation of a manual on design and use of jigs and fixtures in furniture and joinery plants.

Horatio P. Brion, prepared, as part of his activities under PHase II, the 70 page manual in Spanish for use by the industry as well as in CONALEP Institutions.

2.2.8 The Project Closing Ceremonies

The project closing ceremonies were held during the early evening hours of 7 June in the main Conference Hall of the CANACINTRA building. Mr. Roberto V. Sarmiento, President of the Furniture Group of Industries presided over the ceremonies. Top officials of CANACINTRA, led by the Vice-President

(representing of the President who was on an official trip to Europe at the time), attended the ceremonies. The Chief Representative of the European Economic Community (EEC) in Mexico was the Guest Speaker for the evening. Member firms of the three groups of furniture manufacturers, led by the respective head of each group, together with prominent members of the groups, attended the closing ceremonies. The media (radio, TV and newspapers) was well represented at the ceremonies.

The Vice-President of CANACINTRA noted that the idea presented by the exercise could very well be a significant step in the country's efforts to develop the export potential of Mexico's furniture manufacturing industry. He further pointed out that the results of the evening's exercise supported CANACINTRA'S efforts to promote the concept of specialization and complementation within the industry which will eventually lead to the practice of sub-contracting, an industrial situation which will help maximize the use of the furniture industry's existing production facilities and capacities.

The Chief Representative of EEC in Mexico praised CANACINTRA and congratulated its furniture manufacturing member firms on their latest efforts to demonstrate the capability of the industry to engage in export-oriented production operations. He noted that the concept of specialization and complementation, as demonstrated in the "course" projects will help the industry attain a competitive position, both in price and quality, in the international furniture market.

The furniture firms and technical institutions participating in UNIDO project SI/MEX/89/801 were given Certificates of Participation. The members of the UNIDO-CANACINTRA Technical Assistance and training team were also presented Certificates of Participation.

The main attraction of the evening's activities was the presentation of the "course" projects manufactured by the two groups of participating firms (see Section 2.2.6). Group A presented, in "knocked-down" form, a dresser stool, designed and manufactured with the middle income group as the target market. The dresser stool was primarily made of particle board with melamine sheet facing. The EEC Chief Representative in Mexico was requested to assemble the first unit. Figure 20 shows the assembled dresser stool. A lady from the audience was asked to assemble a second unit of the dresser stool to demonstrate the simplicity of the design and the ease with which it can be assembled by a housewife (see Figure 21).

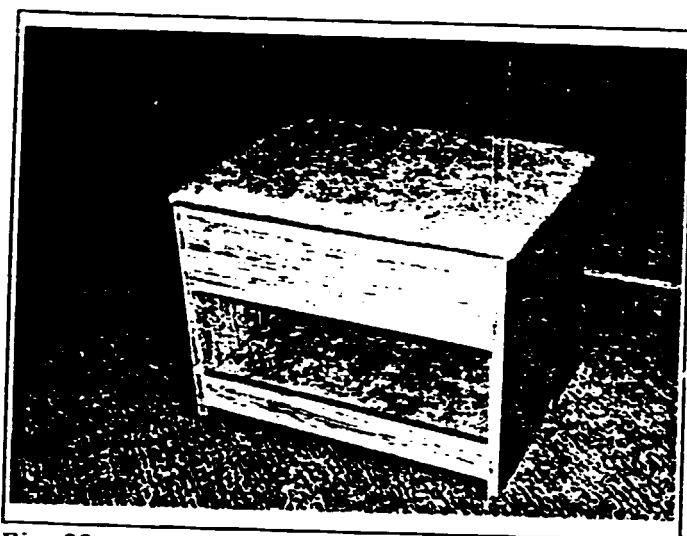


Fig.20: Dresser stool designed, fabricated and presented by Group A.



Fig.21: A lady assembling the second dresser stool.

The participating firms from Group B presented an office chair, with solid wood as the principal raw material. The chair seat and back rest were both upholstered. The "knock-down" chair was properly packed for export purposes (see Figure 22). The President of Muebles Fyli S.A. de C.V. was requested to assemble the office chair (see Figure 23).

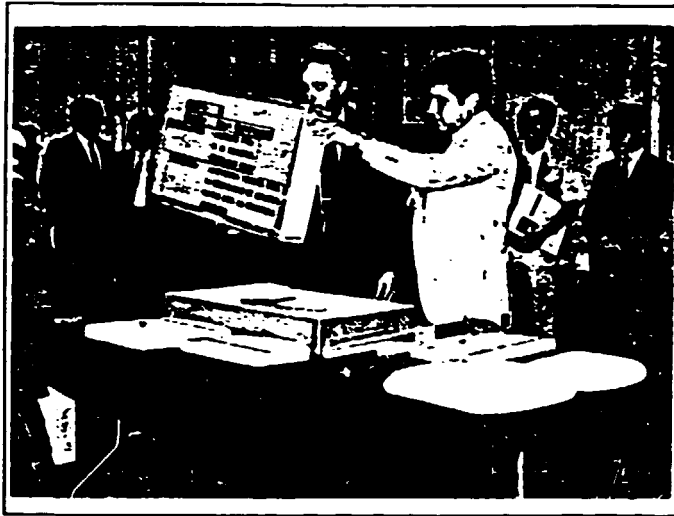


Fig.22: Group B's export pack for the office chair.

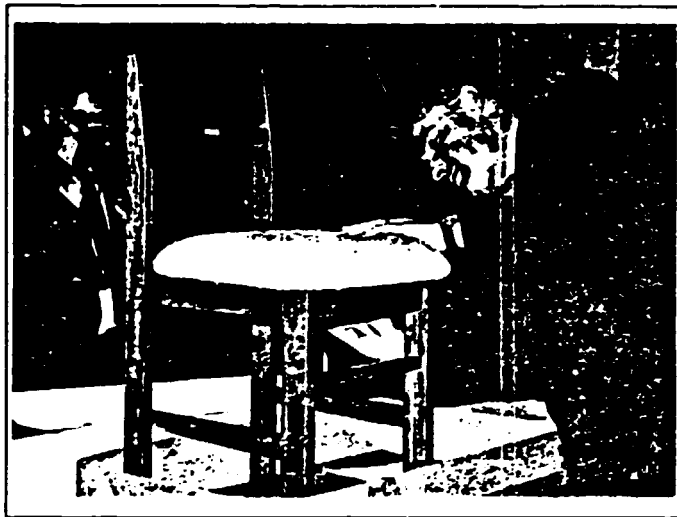


Fig.23: Group B's office chair being assembled.

2.2.9 Other Technical Assistance Activities

The expert was also requested to provide technical assistance other than those related to the design, fabrication and use of production jigs in the furniture and joinery industry of Mexico.

2.2.9.1 **The Processing and Utilization of Coconut Wood**

Lectures on the processing and utilization of coconut wood, as developed by the Philippine Coconut Authority's Centre for Coconut Research, which received technical assistance from both FAO and UNIDO, were given on the following occasions:

- 6 April Training Seminar for CNC, Rural/Provincial Officers. CNC Main Offices. Mexico D.F.
- 6 April Monthly Meeting of the Furniture Group. CANACINTRA, Mexico D.F.
- 18 May Municipal Officers and State Officials. State of Guerrero. Cultural Hall, Acapulco

2.2.9.2 Trouble-Shooting Sawn Timber Supply Problems

During the technical assistance activities to the D.M. Nacional S.A. de C.V., it was discovered that a major source of problems in the design of jigs and fixtures was the unsatisfactory properties/characteristics of the sawn timber supplied to the firm. This situation was brought to the attention of the Management immediately. The expert, having had experience in the operations of sawmilling facilities and the trade of sawn timber, was requested to assist a group of D.M. Nacional officials in discussing the problems with the firm's main supplier of sawn timber, the Maderas Pinelli, S. de R. L. de C.V. in Durango, Estado Durango. The expert flew to Durango with the officers of D.M. Nacional, where discussions with the top officials of the Pinelli firm came out to be potentially beneficial to both firms. Appropriate recommendations were made to the D.M. Nacional officials on the proper handling and warehousing of sawn timber.

III. CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

3.1.1 Current State of Development of the Furniture Industry in Mexico

The seven factories which participated in phase II of the project represent a good cross-section of the furniture industry in Mexico: Colombaire S.A. de C.V., the smallest; and Mueble S.A. de C.V., the largest, in terms of product lines and production volume. Nevertheless, none of the firms can be classified as "medium-scale" according to international standards. However, the combined operations of the sister firms Muebles Fyli S.A. and Acabados de Madera Deca S.A., may be rated as "medium-scale" enterprise under international standards.

The following conclusions are therefore presented on the basis of the expert's experience with the participating firms, and assuming that the seven firms he assisted are truly representative of the Mexican furniture and joinery industry:

- i. Technical assistance in the manner delivered during the second phase of the project benefitted only a very small portion of the industry. Considering that there are about 2,600 registered furniture firms (according to CANACINTRA estimates), it is indicated that future technical assistance, in order to be more effective and attain a certain degree of coverage, should be directed through a national institution or agency, either already existing or yet to be established, which in turn can relay the technology thus transferred to a larger number of furniture firms in the country;
- ii. Invariably, the delivery of knowledge on the design, fabrication and use of production jigs and fixtures to the participating firms was

hampered by the lack of three major skills which form the backbone of any furniture (or woodworking) industry. These skills are: (a) Woodworking Millwright, (b) Woodworks Industrial Designer, and (c) Industrial Finishing Technician. These skills are described in more detail in Annex IV of this Report:

- iii. From the management/supervision point of view, delivery of the technical "know-how" under phase II of the project was also hampered by the ill-defined existence of floor-supervisory force. This situation led to indecision of the higher management to designate the qualified personnel to whom the "know-how" should be transferred; and
- iv. Transfer of know-how was further delayed by the lack of and, in many instances, the long time it took to procure the materials needed in the fabrication of the production jigs and fixtures.

Current efforts by CANACINTRA to establish and make operational as soon as possible the Instituto del Mueble, A.C. (IMAC), whose objectives and general scheme of operations are given in Annex V, is a positive step towards minimizing the problems encountered in the delivery of technical "know-how" to the industry, as described in the preceding paragraphs.

The rapid development of the furniture industry of the country can be further speeded-up by existing training institutions, CONALEP and UNAM, both of which have branches already established and operational in almost all states. CONALEP has facilities, but lacks trainers, to train workers for the industry. Furthermore, its training programme needs to be revised to make it more industry-oriented. While UNAM has the facilities and the corps of instructors to train trainers for the furniture industry, its course of studies also needs to be made industry-oriented.

It is further observed that a working arrangement among IMAC, CONALEP and UNAM should be able to provide the properly trained work force for the industry within the shortest possible time.

The following further findings, from the point of view of the industry's development, product sourcing and, eventually, the establishment of a desirable Quality Label system for the country's furniture industry are presented for immediate action:

- i. Standard specifications for the industry's raw material inputs are non-existent;
- ii. Monitoring and control of raw materials and finished products standards for the furniture industry are both non-existent in spite of the fact that testing facilities for raw materials exist in some of the country's training institutions (e.g., UNAM) and the government's research institutions (e.g., LANFI);
- iii. Furniture design is predominantly foreign in origin (mostly copies or adaptations of European designs). If the country has intentions to benefit strongly from the Free-Trade Agreement between the United States of America, Canada and Mexico, market orientation of Mexico's furniture industry will have to be re-oriented towards the American market; and

- iv. While a rudimentary form of specialization in wood-based panel products exists, a similar situation is not found in the solid wood furniture sector of the industry.

3.1.2 Existing Development Plans and Industry Strategy

It appears that the overall development plans being followed by CANACINTRA for the furniture industry is based, to a large degree, on the recommendations of a committee which did an industry study financed by the European Economic Community (EEC) - see Annex VI. Although the implementing activities are well into the second phase of the development programme, the organization and start-up of IMAC appears to be behind schedule. Talks with CANACINTRA officials regarding the start-up of IMAC indicated that the lack of adequately trained and experienced personnel with adequate knowledge of the problems of the furniture industry is the main cause of this delay.

3.1.3 The Instituto del Mueble, A.C. (IMAC) and its Initial Industry Service Activities

One of the more immediate objectives of IMAC is to provide the furniture industry with technical services relative to the training of the industry's workers, technical assistance in the monitoring and control of product quality and the raw materials inputs of the industry, as well as identifying products for export and the corresponding markets and marketing strategy to promote the product in foreign markets. Other than the video training tapes and the few testing instruments for finished furniture products acquired (through the help of UNIDO) during the phase I of this project, IMAC does not have the basic and minimum complement of equipment to provide adequate training service to the industry personnel, nor provide quality control services to the industry. Furthermore, IMAC still has to recruit and provide for the adequate training of technical personnel who would perform such services as needed by the industry.

On top of all, IMAC needs assistance in recruiting and/or training top management personnel, orient them to the needs of the country's furniture industry and familiarise them with the techniques of delivering technical assistance effectively.

3.2 RECOMMENDATIONS

In view of the foregoing, the following recommendations are submitted for immediate and appropriate action:

3.2.1 Technical Assistance to Mexico's Furniture Industry

The design, fabrication and proper use of production jigs and fixtures, together with all other technical knowledge needed for the development of the Mexican furniture industry to desirable export levels, should be provided in follow-up activities through IMAC.

3.2.2 Organization and Activation of IMAC

In conjunction with technical assistance activities of other international aid agencies, UNIDO should be requested to provide IMAC with the following expertise:

3.2.2.1 **Project Management Expert, Furniture Industry Development**

IMAC is urgently in need of assistance, both technical and management in nature, in starting up the institution's activities and setting up a desirable management system for the institution. It is recommended that an expert be provided by UNIDO for the purpose. The expert will also be expected to train a counterpart, and serve the project for at least one year. The Job Description and terms of Reference for this expert are given in Annex VII.

3.2.2.2 **Fellowships in Specific Skills Urgently Needed by the Furniture Industry**

Among others, three major skills urgently needed by the furniture industry are not available in the country. Among the eight factories which were visited during phase II of the project, no one possessing any one of the three skills was available. These skills are: Woodworks Millwright; Woodworks Industrial Designer and Woodworks Finishing Technician. It is recommended that IMAC request assistance from UNIDO or other sources to provide experts in these three skills in the near future, as soon as IMAC has finalized its programme of technical assistance to the furniture industry. However, there is nobody in CANACINTRA or IMAC who is currently in a position (or with the technical training and experience) to assimilate the "know-how" that these experts will attempt to transfer to the furniture industry of Mexico.

It is therefore recommended that three fellowships (one for each skill) be provided by UNIDO, in order to provide the necessary local talent who will be in a position to assimilate the "know-how" and eventually disseminate these to the furniture industry under the programme of technical assistance to be implemented by IMAC.

The requirements for the three skills and the corresponding fellowship training programme are given in Annex VIII.

3.2.2.3 **Experts for IMAC in Woodworks Millwright Activities, Woodworks Industrial Designing and Woodworks Finishing Technician Activities**

It is recommended that as soon as the fellows trained under the above-mentioned Fellowship Programme return to Mexico, after a successful training period, IMAC should request UNIDO or any other appropriate international agency or bilateral donor to provide an expert in each of the three industry skills listed above.

The Job Description for each position is given in Annexes IX, X and XI.

3.2.3 Industry Personnel Training Aids and Technical Servicing Facilities

3.2.3.1 **Video Training Films**

The current stock of video training films at the IMAC library should be strengthened with more tapes of specific interest to the various sectors of the country's furniture industry. Annex XII gives a list of video tapes recommended for immediate purchase for or by IMAC/CANACINTRA.

3.2.3.2 Spare Parts for Training Machinery at CONALEP, Ticoman, Mexico D.F.

The accessories and tools for fabricating production jigs and fixtures purchased by UNIDO for CONALEP, Ticoman, under phase I of this project could not be fully utilized because the routers and vertical spindle moulders do not have the accessories to allow the former's use on the machines. It is therefore recommended that the machinery spare parts recommended for purchase during phase I of this project be purchased for CONALEP, Ticoman. Annex XII also gives the list of the machinery accessories recommended to be purchased. This need should be given top priority.

3.2.3.3 Equipment for Industry Technical Servicing Activities

To start with, the following activities may be offered by IMAC to Mexico's furniture industry:

- i. Determination of Moisture Content of sawn timber and veneer at source;
- ii. Determination of specific properties of paint/finishing materials important to the finishing operations of the industry, such as: viscosity, solids content, adhesion, print resistance, mar resistance, etc.
- iii. To support export-oriented operations, basic testing equipment for properties of packaging materials and packaged/crated furniture, not available in the existing packaging testing and research laboratory at LANFI, should be purchased.

The machine accessories, training video films, and testing equipment in the corresponding Annexes are listed in an order of priority.

ANNEX I



ANNEX I

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT OF THE GOVERNMENT OF MEXICO

ASSISTANCE IN THE DEVELOPMENT OF JIGS FOR FURNITURE PRODUCTION

JOB DESCRIPTION

SI|MEX|89|801|11-01(J-12209)

| | |
|--------------------|--|
| Post title | Expert in jigs for furniture production |
| Duration | Four months (split mission) |
| Date required | |
| Duty station | Mexico City with eventual travel in the country. |
| Purpose of project | To demonstrate the use of jigs for serial furniture production |
| Duties | <p>1. <u>Phase I: (6 weeks)</u></p> <p>(a) Prepare, jointly with the counterpart, the physical arrangements and demonstration workshop on jigs production and uses in the furniture industry.</p> <p>(b) To select participants from about 25 furniture companies.</p> <p>(c) To run a two-week course on use of jigs for serial furniture production.</p> <p>(d) To provide two-day technical assistance to five furniture companies.</p> <p>(e) To draw up detailed technical assistance specifications for the equipment to be provided by UNIDO (UNIDO HQ)</p> <p>2. <u>Phase II: (10 weeks)</u></p> <p>(a) To install and operate the demonstration equipment</p> <p>(b) To provide two-day technical assistance to the remaining twenty furniture companies.</p> <p>(c) To prepare a manual on the manufacture and use of jigs for serial furniture production, which could be used as a new teaching method by the counterpart, as well as the corresponding visual aids.</p> |

- Qualifications** Engineer or wood technologist with long experience in plant management, experience in developing countries and in training desirable.
- Language** Spanish preferred, English acceptable.
- Background information** The Mexican furniture industry has been endeavouring to increase its limited exports mainly to the USA, which in 1987 imported about US\$ 2,500 million worth of wooden furniture. A major problem is the deficient use of jigs for serial furniture production, a critical factor to increase furniture productivity and product quality while reducing production costs. This problem and other related activities were discussed by a UNIDO staff member expert in wood processing with CANACINTRA on several occasions. Now, the new Mexican Government is endeavouring to modernize its production system through the support of the private sector as the main engine of economic growth. In view of the good export potential of Mexico's furniture industry, the Government has requested UNIDO's assistance in demonstrating how to develop and use jigs in serial furniture production.

PROJECT OF THE GOVERNMENT OF MEXICO
 ASSISTANCE IN THE DEVELOPMENT OF JIGS FOR FURNITURE PRODUCTION

JOB DESCRIPTION

SI/MEX/89/801/11-02 (J-12209)

- Post title:** Expert in jigs for furniture production
- Duration:** 2.4 months
- Date required:** January 1991
- Duty station:** Mexico City with eventual travel in the country
- Purpose of project:** To demonstrate the use of jigs for serial furniture production.
- Duties:**
- (a) To install and operate the demonstration equipment purchased for the project as per the request of the expert who served under 11-01.
 - (b) To provide two-day technical assistance to the remaining twenty furniture companies.
 - (c) To prepare a manual on the manufacture and use of jigs for serial furniture production, which could be used as a new teaching method by the counterpart, as well as the corresponding visual aids.
- Qualifications:** Engineer or wood technologist with long experience in plant management, experience in developing countries and in training desirable.
- Language requirements:** Spanish preferred, English acceptable.
- Background information:** The Mexican furniture industry has been endeavoring to increase its limited exports mainly to the USA, which in 1987 imported about US\$ 2,500 million worth of wooden furniture. A major problem is the deficient use of jigs for serial furniture production, a critical factor to increase furniture productivity and product quality while reducing production costs. This problem and other related activities were discussed by a UNIDO staff member, expert in wood processing, with CANACINTRA on several occasions. Now, the new Mexican Government is endeavoring to modernize its production system through the support of the private sector as the main engine of economic growth. In view of the good export potential of Mexico's furniture industry, the Government has requested UNIDO's assistance.

demonstrating how to develop and use jigs in serial furniture production.

An expert (11-01) travelled to Mexico and prepared, with the counterpart, the physical arrangements and demonstration workshop on jigs production and uses in the furniture industry. He selected participants from about 25 companies. He ran a two-week course on the use of jigs for serial furniture production and provided two-day technical assistance to five furniture companies. He drew up detailed technical assistance specifications for the equipment to be provided by UNIDO.

ANNEX II

LIST OF PERSONS MET
(PHASES I & II)

Phase I

- | | | |
|----|--|---|
| 1 | Mr. Antonio Mariscal President | Consejo Coordinator de la Industria Mueblera, CANACINTRA Av. San Antonio 256 03849, Mexico, D.F. Tel. 563-34-00 CON |
| 2 | Mr. Jame Martinez N. Acting Director | IMAC c/o Consejo Ind. Mueblera |
| 3 | Mr. Armando Ruiz Galindo Director | International Relations Division, CANACINTRA |
| 4 | Mr. David Islas Martinez Director | Consejo Coordinator de la Industria Mueblera, CANACINTRA |
| 5 | Mr. Alejandro Elizalde R. Project Officer | " |
| 6 | Mr. I. Contreras SIDFA | UNIDO/UNDP P.O.Box 6719 06600 Mexico, D.F. Telex 1771055 FAX 254-72-35 |
| 7 | Mr. I. Raisanen JFO | " |
| 8 | Mr. Francisco Sobrino B. General Manager | - Muebles Fyli, S.A. de C.V. Calle 4 No, 216 Local 1y2 Col. Granjas San Antonio 09070 Mexico, D.F. - Acabados en Madera Deca S.A. Av. Hidalgo no. 12 56530 Ixtapaluca Edo. de Mexico Tel. 20215 |
| 9 | Mr. Arturo Mugica G. Production Manager | Muebles Fyli |
| 10 | Mr. Oscar Sobrino C. Managerial Staff | Meubles Fyli |
| 11 | Mr. Abel Sanchez G. Technical Director | Acabados en Madera Deca S.A. |

- | | | |
|----|--|--|
| 12 | Mr. Jesus Andrade A. Production Control Head | " |
| 13 | Mr. Nestor L. Castillo F. Designer | " |
| 14 | Mr. D.I. Mauricio S. Designer | " |
| 15 | Mr. Antonio Mariscal S. Industrial Manager | - P.M. Steele S.A. del C.V. Lago Alberto 282 11320, Mexico, D.F. Tel. 203-64-00 Fax. 345-03-90 |
| 16 | Mr. Felipe Romero H. Production Supervisor | P.M. Steele S.A. de C.V. |
| 17 | Mr. Vicente Teodoro Figuera N. | " |
| 18 | Mr. Alfonso Rosas A. General Manager | MUEBLA. S.A. de C.V. |
| 19 | Mr. Carlos Rivera M. Production Manager | " |
| 20 | Mr. Jame Martinez N. Director General | STYLOS Av. Santana No 2 Parque Ind. Lerma, Edo de Mexico Lada 91-728-50600 |
| 21 | Mr. Ricardo Madrid M Factory Manager | " |
| 22 | Mr. Genaro Ponce G. Designer | " |
| 23 | Mr. Humberto Cruz M. Sales Manager | Industria Colombaire S.A. Prol. La Viga 175 Mexico 04230, D. F. Tel. 581-48-77 |
| 24 | Mr. Arturo Godinez Production Manager | " |
| 25 | Mr. Jorge Mariscal General Manager | GAMMA, Banos y Cocinas S.A. Prol. Manuel Acuna 142 02730 Mexico, D.F. Tel. 56 01 64 |
| 26 | Mr. F. Fernando Ricalde A. Production Manager | " |
| 27 | Mr. J. Ignacio Barrera L. Architect | " |

- 28 Ms. Dolores Godoy " Designer
- 29 Mr. Amando Santiago " Production Supervisor
- 30 Mr. Alfredo Medina F. Tre Ficos S. A. General Manager Insurgentes Centro 14 Entre Edison y Fuente de Alvarado, Mexico 4, D.F. Tel. 546-17-13
- 31 Mr. Juan Antonio Vega Cocinas Provel, S.A. de C.V. General Manager P.O. Box 60484 Mexico 18, D.F. Tel. 516-08-63
- 32 Mr. Jaime Velaquez del C. " Director General
- 33 Mr. Ignacio Galicia " Production Supervisor
- 34 Mr. Diego Fuentes " Machining Foreman
- 35 Mr. Jesus Fonseca J. D.M. Nacional S.A. de C.V. Plant Manager Calz. San Juan de Aragon 439 577-21-22 Mexico 14, D.F. Tel. 577-38-57
- 36 Mr. Arturo Carbajal B. " Design Manager
- 37 Mr. Jesus Fuentes M. " Jig maker
- 38 Mr. Pablo Rojas S. " Tool Maker
- 39 Mr. Alfredo Medina F. Tre Ficos S.A. Director Insurgentes Centri 14 Entre Edison y Fuente de Alvarado, Mexico 4, D.F. Tel. 546-17-13
- 40 Mr. Dario Solis Carpentería y Ebanistería Production Manager Canela No 460 Mexico 8, D.F. Tel. 657-14-58
- 41 Mr. Jose Luis Fonseca Instituto Politécnico Nacional Director Constituyentes 813 Col. Belen de las Flores Tel. 5-15-23-13

- 42 Mr. David Aranda A.
Co-ordinator External
Services
Centro de Estudios Científico
"WILFRED MASSIEU"
Av. de los Maestros 217
Cosco de Santo Tomas
Cod. Postal 11340, Mexico, D.F.
Tel. 547-71-08
- 43 Mr. Roberto Axotla M.
Director
Colegio Nacional de Educación
Técnica (Conalep Ticoman)
Calle de la Borrasca Av.
Acueducto, Unidad Residencial
Acueducto de Guadalupe,
Mexico, D.F.
Tel. 392-76-65
- 44 Mr. Jose M. Yanez M.
Department Head,
Technology Activities
"
- 45 Mr. Jaime Nieto H.
Woodworking Instructor
"
- 46 Mr. Mario Avila C.
Woodworking Instructor
"
- 47 Mr. Ramon Gonzalez C.
Woodworking Instructor
"
- 48 Mr. Francisco Cruz C.
Woodworking Instructor
"
- 49 Mr. Alfonso Cedillo V.
Training Head
Instituto de Capacitación de
la Industria de la Construcción
P.O. Box 01780, Mexico D.F.
Tel. 683-61-37
telex 1764138
- 50 Mr. Jose Antonio
Esteva M.
General Director
Laboratorios Nacionales
de Fomento Industrial
(LANFI)
P.O. Box 41-537, Mexico, D.F.
Tel. 589-01-99
- 51 Ms. Ana Stefanovich H.
Director of Industrial
Promotion
"
- 52 Mr. Gerardo Valdes D.
Training Manager
FESTO Pneumatic, S.A.
Av. Ceylan No 3
Col. Tequesquahuac
54020 Tlalnepantla, Edo. de Mex.
Tel. 3-90-71-00
Telex 17-2365 FESTME
fax 390-71-00

LIST OF INDUSTRY AND GOVERNMENT OFFICIALS INTERVIEWED
Phase II

i. In the Furniture Industry

CAMARA NACIONAL DE LA INDUSTRIA DE TRANSFORMACION (CANACINTRA)
Av. San Antonio 256, Col Ampliacion Napoles
Delegacio Benito Juarez, 03849 Mexico D.F.

C.P. MAURICIO FLORES GUZMAN, Presidente de la Sección de
Fabricantes de Muebles para Oficina
Lic. DAVID ISLAS, Gerente del Consejo Coordinador de la
Industria Mueblera
Lic. ARMANDO RUIZ GALINDO URQUJDI, Director de Asuntos
Internacionales
ROBERTO SARMIENTO V., Jefe del Grupo Industria Mueblera

Industria COLOMBAIRE, S.A.
Prol. La Viga 175, Mexico D.F.

Lic. HUMBERTO CRUZ MANCIILLA, Gerente General

D.M. NACIONAL S.A. de C.V.
Calz. San Juan de Aragon 439 y 544 Bis, 07070 Mexico D.F.

Lic. ARTURO CALDERON SOLEDAD, Gerente de Abastecimientos
Ing. LUIS MIGUEL CASTILLO PEREZ, Gerente de Ingenieria
de Planta
ANDRES DELGADO GOMEZ DEL VILLAR, Jefe del Ingenieria
del Producto
Ing. BRUNO VASQUEZ ESPINOSA, Gerente Ingenieria de Calidad

GAMMA BAÑOS Y COCINAS INTEGRALES, S.A. de C.V.
Prol. Manuel Acuña 142 esq. Rey Maxtla, 02730 Mexico D.F.

D.I. MANUEL SAID, Direccion de Producción
HUMBERTO PATIÑO S., Gerente de Servicios

Mueble, S.A. de C.V.
V. Carranza No. 14, Pte. de Vigas, Tlalnepantla,
Estado de Mexico

Ing. ALFONSO ROSAS ARELLANO, Gerente General

MUEBLES FYLI, S.A. de C.V.
Calle 4 No. 216 Local 1 y 2, Col Granjas San Antonio,
Mexico D.F.

J. ARTURO MUGICA GARCIA, Gerente de Producción
ABEL SANCHEZ GARCIA, Gerente Asesoría Técnica
Ing. JUAN VICTOR SANCHEZ GARCIA, Gerente de Planta
C.P. BENJAMIN SANTIAGO PEREZ M. Gerente General

II. From Government agencies/institutions

COLEGIO NACIONAL DE EDUCACION PROFESIONAL TÉCNICA.
 PLANTEL TICOMAN. Calle de la Borrasca S.N..
 Unidad Acueducto de Guadalupe. Mexico D.F.

Ing. TOMAS HINOJOSA BALBOA. Director
 Ing. JOSE M. YAÑEZ MIRON. Jefe del Depto. de Actividades Tecnologicas

CONSEJO NACIONAL DE EMPRESAS CAMPESINAS
 Sor Juana Inez de la Cruz No. 116. Col Santa Maria de la
 Ribera. C.P. 06400 Mexico D.F.

Lic. PEDRO VALDEZ RUIZ. Secretario Técnico

LABORATORIOS NACIONALES DE FOMENTO INDUSTRIAL
 Av. Industria Militar 261. 53390 Naucalpan de Juarez.
 Estado de Mexico

Biol. ARACELI MERCADO M., Promotor de Tecnologia
 D.I. JOSE ANTONIO SALVATIERRA O., Jefe del Departamento de Diseño
 Grafico e Industrial

UNIVERSIDAD Autónoma DE MEXICO
 Ciudad Universitaria. Coyacacan 04510 Mexico D.F.

D.I. LUIS EQUIHUA ZAMORA, Coordinador General, Centro de Investigaciones
 de Diseño Industrial, Facultad de Arquitectura
 Ing. JOSE DE JESUS CAMACHO SABALZA, Secretario Técnico, Instituto de
 Investigaciones en Materiales
 D.I. EDUARDO NOVOA R., Diseñador Industrial y Instructor, Centro de
 Investigaciones de Diseño Industrial, Facultad de Arquitectura.

III. In allied industries

Ing. ROBERTO MIRANDA F., Division de Recubrimientos de Madera, BASF
 Pinturas + Tintas S.A. de C.V., Poniente de 150 No. 750 Col Industrial
 Vallejo, 02300 Mexico D.F.

EDUARDO FUHRKEN PINELLI, Director General, Maderas Pinelli, S. de R. L.
 de C.V., Carr. Panamericana Km 1044, AP. Post 522, Rudrango Edo. de
 Durango, Mex. 34000

ERNESTO NOLI ZALDIVAR, Ejecutivo de Cuentas Especiales, Division
 Corrugado Cerro Gordo, Smurfit Carton y Papel de Mexico, S.A. de C.V.,
 Km. 15 Carr. Mex-Laredi, 55540 Sta. Clara, Estado de Mexico

ANNEX III

REFERENCE TABLES - DEVELOPMENT OF TECHNICAL SERVICES
FOR THE MEXICAN FURNITURE INDUSTRY

- I. **RESEARCH AND TESTING**
 - 1.1 **Function of Service**
 - 1.1.1 Selection and/or adaptation of standard specifications to evaluate the most important performance characteristics of finished furniture as well as materials used in furniture manufacturing;
 - 1.1.2 Development of **Ad hoc** standard as required;
 - 1.1.3 Testing of furniture prototypes as a design tool to eliminate potential defects;
 - 1.1.4 Testing of standard furniture as a basis to granting quality labels according to the following performance factors:
 - (a) Strength
 - (b) Durability
 - (c) Surface Resistance and Quality of Finish
 - (d) Function (Ergonomics)
 - (e) Stability
 - (f) Quality of Material and Precision of Work;
 - 1.1.5 Testing of furniture materials (panel boards, lacquers, upholstery materials, adhesives, etc.) as a basis to granting certification on quality of materials.
 - 1.2 **Institutional Relationship**
 - 1.2.1 LANFI
 - 1.2.2 SECOFI
 - 1.2.3 IMAC
 - 1.2.4 CONSEJO Industria MUEBLERA
 - 1.3 **External Inputs**
 - 1.3.1 Assistance by the Spanish Furniture Research Institute, AIDIMA, (UNDP Funding) to identify organization structures, testing facility requirements and operating cost of the proposed furniture research and testing centre;
 - 1.3.2 1.5 month training of a LANFI engineer at AIDIMA prior to the fielding of consultants in Mexico (UNDP Funding);
 - 1.3.3 Supply of furniture testing equipment (source of funding to be identified); and
 - 1.3.4 Provision of short-term consultants to assist in the establishment of the testing services (This could be followed up by Phase II of the Spanish Assistance).
 - 1.4 **Local Inputs**
 - 1.4.1 Two counterpart engineers who will be responsible for the operation of the research and testing services once these become operational
 - 1.4.2 Testing building facilities; and

- 1.4.3 Existing testing equipment at LANFI for testing wood mechanical properties and for testing surface resistance.

II. QUALITY CERTIFICATION SERVICES

2.1 Function of Service

- 2.1.1 Selection and/or adaptation of a furniture quality assurance system;
- 2.1.2 Issuing of Quality Labels to furniture tested by the testing service (Ref. 1.1.4); and
- 2.1.3 Quality certification of furniture materials.

2.2 Institutional Relationship

- 2.2.1 IMAC, in cooperation with
- 2.2.2 SECOFI, and
- 2.2.3 Procuradoria del Consumidor.

2.4 External Inputs

- 2.4.1 Assistance on the part of the Swedish Furniture Research Institute (2 man-month consultancy) in setting up the quality certification service (possible funding by UNIDO).

2.5 Local Inputs (Not identified)

III. INFORMATION SERVICE

3.1 Function of Service

- 3.1.1 Technical inquiry service dealing with specific manufacturing topics and/or problems. Service to be initially provided on a cross-link arrangement with leading overseas institutions dealing with furniture industry development;
- 3.1.2 Periodic newsletter with abstracts of technological developments; reviews of new types of equipment; reviews of new designs, etc.
- 3.1.3 Library of overseas literature relating to the furniture industry, with particular emphasis on studies and publications issued by overseas furniture development institutions;
- 3.1.4 Library of leading furniture industry periodicals;
- 3.1.5 Clearing house for joint venture opportunities with foreign partners; and
- 3.1.6 Organization of overseas study tours to keep abreast of technological and design development in other countries.

3.2 Institutional Relationship

- 3.2.1 IMAC
- 3.2.2 INFOTEC

3.3 External Inputs

- 3.3.1 Assistance on the part of the Spanish Furniture Research Institute (2 man-month consultancy) in setting up the information service (Grant of Spanish Government);
- 3.3.2 Two-month training at AIDIMA of IMAC'S Technical Manager; and
- 3.3.3 UNIDO assistance to be sought.

3.4 Local Inputs

- 3.4.1 Counterpart personnel; and
- 3.4.2 Library facilities.

Note: A full-time technical manager should be appointed to oversee all IMAC service activities. He should have a woodworking background.

IV. CONSULTANCY SERVICES

4.1 Function of Service

- 4.1.1 Provision of advisory services covering critical manufacturing aspects relevant to the furniture industry as a whole.

Subjects requiring priority:

- Jig design and applications as a means of improving productivity and quality⁵;
- Development of furniture design structures suitable for serial production;
- Quality control management;
- Wood finishing⁶;
- Plant organization;
- Product and process engineering⁷;
- Low-cost automation and installation and maintenance of pneumatic systems⁸; and
- Merit rating and wage incentives as a means to improve labour performance.

4.2 Institutional Relationship

- 4.2.1 CANACINTRA, and
- 4.2.2 IMAC

⁵ See 4.3.1 and 4.3.2.

⁶ See 4.3.3.

⁷ See 4.3.4.

⁸ See 4.3.5.

4.3 External Inputs

- 4.3.1 UNIDO Consultants⁹
- 4.3.2 Supplies
- 4.3.3 USA Consultant (Bilateral Aid)
- 4.3.4 AIDIMA Consultant
- 4.3.5 FESTO Technicians

4.4 Local Inputs

- 4.4.1 Counterpart Personnel
- 4.4.2 Local expertise to cover other subjects

V. IN-SERVICE TRAINING

5.1 Function of Service

- 5.1.1 Short-term, part-time institutional training on critical wood machining techniques for skilled labour already employed in the industry. Training to cover, among others, the following subjects:
 - efficient use of basic woodworking machines
 - appropriate utilization of machine accessories
 - appropriate selection and utilization of cutting tools for machining operations
 - jig design and applications

- 5.1.2 Use of low-cost automation in wood machining and assembly operations¹⁰.

5.2 Institutional Relationship

- 5.2.1 CONALEP
- 5.2.2 FESTO

5.3 External Inputs

- 5.3.1 Overseas training of a woodworking instructor¹¹.
- 5.3.2 Additional basic woodworking equipment for training and demonstration purposes.

5.4 Local Inputs

- 5.4.1 Training personnel
- 5.4.2 Training facilities

⁹ On-going UNIDO project SI/MEX/89/801; demonstration work to be conducted in phase II with the aid of the jig-making equipment purchased by UNIDO under the project. This relates also to 4.3.2.

¹⁰ Short-term in-service training on low-cost automation to be conducted by FESTO on the basis of the UNIDO publication ID/154 Rev.1 on the subject.

¹¹ Source of funding to be identified. This relates to 5.3.2. also.

ANNEX IV

TECHNICAL SKILLS URGENTLY AND IMMEDIATELY NEEDED
BY THE MEXICAN FURNITURE INDUSTRY

Among others, the following are the technical skills which the Mexican furniture/joinery industries need immediately and urgently if they are expected to develop at a desirable pace:

A. WOODWORKING MILLWRIGHT

Among the technical skills required by this position in the furniture/joinery industries, the principal skills are:

- i. Adequate knowledge and capability to set up woodworking machines in order to enable the production of the desired wooden components on the machine;
- ii. The design, fabrication and proper use of production jigs and fixtures in order to attain increased output, improved product quality and to assure better safety to the machine operator; and
- iii. Sufficient knowledge and skill to sharpen cutting tools (saws, knives, bits, etc.) and keep them in a proper working condition.

B. WOODWORKS INDUSTRIAL ENGINEER

The principal function of the Woodworks Industrial Designer is to translate a given aesthetic presentation (picture, sketch, formal drawing, etc.) of a furniture/joinery product into parameters commonly used in the manufacture of woodwork products (working drawings etc.) based on his knowledge of desirable tolerances, machining allowances etc., in all stages of production operations. Knowledge of the principal woodworking characteristics of various timber species is also required, and a working knowledge on adhesives, abrasives and finishing material systems. He should also be familiar with the basic types of hardware and fasteners used in the industry, and their application to woodwork products.

C. WOODWORKS FINISHING TECHNICIAN

This position requires adequate knowledge of the properties of each component in finishing material systems, as well as the most effective and economic means of applying each of them on the surfaces of the wooden product. It is also required that the technician should be knowledgeable about the characteristics of modern finishing machinery and equipment, together with the knowledge to maintain them and keep them in good working condition. He should also be familiar with the fire-hazard properties of finishing materials and he must possess adequate knowledge of standard fire-prevention and fire fighting techniques commonly installed and/or practised in modern finishing plants.



OBJETIVOS DEL IMAC.

El Instituto del Mueble, A.C., tiene como objetivos los siguientes:

- Ser agente promotor de sistemas de capacitación, enseñanza y orientación técnica de programas educativos para los trabajadores y empresarios afines con la industria del mueble.
- La asesoría y gestoría en la tramitación y obtención de registro de inversiones patentes y marcas y derechos de autor.
- Actuar como centro de auxilio e investigación en las especificaciones de materias primas, tecnología tanto nacional como extranjera siendo evaluador sistemático de la calidad de las principales materias primas y analizador de pruebas contra las especificaciones, su aplicación y su uso de acuerdo a las directrices de las secciones de Cámara, especialistas en dichos muebles en general actuar como foro permanente a nuevas tecnologías, maquinaria, diseño de materiales benéficos al sector.
- Analizador sistemático de la producción de materia prima, evaluándola y proyectando contra consumos industriales, para ser así preventor de escases y disparador automático de planes emergentes.
- Centro de investigación, análisis, asesoría estadística, información, promoción, publicidad, integración, organización, dirección y control de la mercadotecnia en todo lo relacionado con la industria del mueble.
- Ser un órgano orientador a nuevos inversionistas muebleros o a los actuales industriales, para la atinada realización de proyectos.
- La investigación y desarrollo de diagnóstico de productividad de las empresas.
- El desarrollo de investigaciones motivacionales y comportamiento del consumidor.



- El proyecto y desarrollo de organización de empresa.
- Ser un permanente promotor de diseño industrial, promoviendo al diseñador - "estudiante universitario" como al despacho o diseñador profesional.
- Podrá actuar de neutral y justo calificador en disputas de calidad de materias primas entre proveedor y fabricante mueblero.
- Actuar entre el Instituto Nacional del Consumidor y el industrial mueblero como auxiliar técnico.
- Mantenerse actualizado de las tendencias internacionales de organismos como el FIRA (Furniture International Reserch Asociation).

ANNEX VI

PROGRAMA DE ASISTENCIA TECNICA PARA LA INDUSTRIA
DEL MUEBLE EN MEXICO

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ANEXO A
TERMINOS DE REFERENCIA

1. OBJETIVOS Y CONTENIDOS DE LA ACCION ESPECIFICA DE ASISTENCIA TECNICA EN EL SECTOR DEL MUEBLE.

1.1 Introducción.

Este proyecto responde a una solicitud mexicana fechada el 18/9/90 (carta presentada por SECOFI) y se inscribe en el marco del acuerdo existente entre la CEE y México desde 1975, y se efectuará sobre la base de la línea presupuestal 990.

En este contexto, se preveen programas de asistencia técnica cuyo objetivo consiste en favorecer la consolidación de la economía mexicana y el desarrollo de su comercio a nivel internacional.

El gobierno mexicano mantiene como objetivo prioritario conservar los PME, y en particular las relativas al sector mueblero.

Con este fin fue creado en noviembre de 1986 el IMAC (Instituto del Mueble). Su propósito consiste en ofrecer al sector del mueble la posibilidad de informarse, de reestructurarse y de mejorar la calidad de sus productos, con miras a consolidar su posición en el mercado interno y externo, con especial atención al potencial exportador.

En Europa y en particular en España e Italia, la industria del mueble está a la vanguardia y se encuentra consolidada, lo que permite establecer un programa adecuado de asistencia técnica por parte de la CEE en favor de México, considerando igualmente las oportunidades que podrían presentarse para la exportación de parte de empresas europeas, tecnologías y maquinaria para desempeñar el trabajo del mueble. Los objetivos y los contenidos específicos de una primera iniciativa de asistencia técnica se describen a continuación.

1.2 Objetivos y contenido del proyecto de asistencia técnica.

Los objetivos esenciales del proyecto consisten en otorgar el apoyo necesario a la consolidación y el desarrollo de la industria mexicana del mueble.

Con este fin, se favorecerá prioritariamente:

- El conocimiento y las exigencias del mercado.
- El conocimiento normativo necesario para tener acceso a los mercados internacionales.

- La adquisición de tecnologías modernas para mejorar la calidad de los productos y la eficacia de los procesos de producción.

A esto se añade un programa de asistencia técnica que incluye los siguientes elementos:

- Elaboración de un marco macro-económico del sector, de sus fortalezas y de sus problemas, con particular referencia a la situación y a las tendencias del mercado y de la demanda interna y externa,

- Análisis de los criterios cualitativos requeridos por el mercado europeo y el marco normativo correspondiente,

- Definición del contenido, métodos y recursos del IMAC, a fin de que ese organismo pueda lograr sus propios objetivos institucionales,

- Organización de encuentros entre empresarios mexicanos y europeos del sector, sobre la base de proyectos específicos previamente identificados con miras a lograr la realización de proyectos conjuntos, intercambios comerciales, etc.,

- Organización y realización de un programa de formación con argumentos de mercadeo y tecnologías productivas en favor del IMAC y de los empresarios mexicanos del sector,

- Seguimiento del desarrollo de los contactos iniciados durante los encuentros entre empresarios,

- Verificación de los efectos de la iniciativa en función de las eventuales modificaciones o de las iniciativas posteriores.

Este proyecto debería desarrollarse a lo largo de doce meses en el curso de 1991.

México por su parte se compromete a poner a la disposición de los consultores del proyecto toda la infraestructura, la información y el apoyo logístico necesario para el buen desarrollo del mismo.

2. ACCIONES PROPUESTAS Y OBJETIVOS.

Programa de asistencia técnica a ser iniciado a finales de 1990 en colaboración con la Feria de Milán, las asociaciones de categoría en el sector del mueble y el IMAC, articulado en tres fases.

2.1 Objetivos de la Fase 1

En una primera fase, preparatoria, dos consultores europeos expertos en el sector del mueble, visitarán México con el objetivo de :

- Elaborar un marco macro-económico del sector del mueble con atención especial a sus problemas y a sus tendencias comerciales y tecnológico-productivas,

- Verificar las funciones, los recursos y la organización del IMAC,

- Identificar aproximadamente a 25 operadores mexicanos interesados y capacitados para participar en las fases siguientes del programa, y en particular en los encuentros bilaterales entre empresarios.

Un consultor europeo estudiará, en Europa, las diferentes problemáticas vinculadas a los aspectos normativos de la producción del mueble.

2.2 Objetivos de la Fase 2

En el curso de la fase 2, se organizará una "Convención" empresarial en Milán, entre los operadores mexicanos identificados en la fase anterior y los operadores europeos que trabajan en la industria del mueble y/o las instalaciones y tecnologías relativas.

La Convención se llevará a cabo durante la Gran Feria del Mueble (13/17 abril 1991) que es la más importante de Europa en su rama.

Con tal fin, los consultores europeos, en estrecha colaboración con las asociaciones nacionales europeas del sector, procederán a:

- Llevar a cabo las acciones necesarias con divulgación,
- Identificar a los operadores europeos (aproximadamente 100) interesados en los proyectos identificados anteriormente y por lo tanto en la Convención,

- Selección de los conferencistas,

- Organización de la logística de la Convención,

- Organización de los encuentros bilaterales entre empresarios mexicanos y europeos,

- Activar un primer banco de estadísticas de los proyectos mexicano-europeos en el sector de la fabricación de muebles.

2.3 Objetivos de la fase 3

En el curso de esta fase proponemos esencialmente:

- Predisponer un plan organizacional del IMAC, que defina sus funciones, estructuras, métodos y recursos a fin de que pueda lograr de manera satisfactoria sus propios objetivos institucionales,

- Elaborar y ejecutar un plan de formación para actualizar a los dirigentes y funcionarios del IMAC y de las empresas interesadas sobre argumentos de mercadeo, los asuntos relativos a la normalización y a la certificación de la calidad y a la tecnología productiva en la producción y venta de muebles,

- Evaluar y fomentar el desarrollo de los contactos entre empresarios mexicanos y europeos iniciados durante la Convención,

- Verificar los resultados y los efectos de todo el programa de asistencia técnica a fin de destacar los elementos de reflexión y las ideas para las eventuales modificaciones sucesivas, para facilitar iniciativas posteriores de parte de la Comisión Europea en favor de México. Por ejemplo, cabe pensar en la eventual organización de una nueva edición de la Convención en Valencia, España, en 1992, durante el Salón del Mueble, para una prolongación del programa más allá de las fechas previstas.

Con este fin, los consultores europeos visitarán México para acordar los detalles de las acciones programadas y efectuar las actividades necesarias.

3. METODO DE TRABAJO

3.1 Fase 1

3.1.1 Actividades preparatorias:

- Preparación del plan general de trabajo (primera versión),

- Contactos y coordinación con las asociaciones de categoría, el IMAC, los consultores y colaboradores europeos,

- Asignación de tiempos y recursos para cada actividad,

- Elaboración del marco relativo al estudio macroeconómico sobre el sector de la industria del mueble en México,

- Definición del cuadro de admisibilidad de los proyectos,
- Elaboración de un plan de trabajo definitivo (check list operativa).

3.1.2 Misión a México

- Estudio/verificación de la organización de los recursos del IMAC,
- Estudio, con la colaboración de las fuentes locales, sobre la situación macro-económica del sector de la industria del mueble en México,
- Difusión de la información relativa a la Convención de empresarios,
- Acopio, evaluación y preselección de los proyectos de coinversión, intercambios comerciales, acuerdos de producción, intercambios de tecnología, panfletos, etc,
- Identificación de empresarios mexicanos del sector interesados en participar en las siguientes fases del programa de asistencia técnica.

3.1.3 Primeras evaluaciones e informes.

- Elaboración del estudio sobre el estado y perspectivas de la situación macro-económica del sector (industria mexicana del mueble),
- Selección definitiva de los proyectos admitidos dentro del marco de la Convención,
- Invitaciones a 25 empresarios mexicanos seleccionados para participar en la Convención,
- Redacción y presentación a la Comisión del informe sobre la primera fase.

3.2. Fase 2.

3.2.1 Actividades Preparatorias

- Establecimiento del plan general de trabajo,
- Contactos con las asociaciones de categoría y preparación de una lista de correspondencia,

- Asignación de recursos y determinación de los tiempos de trabajo, dentro del plan de trabajo definitivo (check-list operativa),

- Difusión de la iniciativa y de los proyectos ante los empresarios europeos,

- Selección e invitación de empresarios europeos interesados en la Convención,

- Elaboración del banco de datos de los proyectos y del software,

- Integración de proyectos seleccionados en el banco de datos.

3.2.2. Organización de la Convención.

- Definición del programa detallado de las reuniones,

- Selección de conferencistas,

- Arreglo de los detalles relativos a la organización y al desarrollo de la Convención:

- Estructura,

- Recepción y acogida,

- Servicio de prensa,

- Secretarías y traducción simultánea,

- Términos de "preguntas" sobre el banco de datos,

- Elaboración de un cuestionario a ser distribuido entre los participantes.

3.2.3. Desarrollo de la Convención e informe.

- Realización de conferencias,

- Puesta en marcha de encuentros entre empresarios,

- Recolección y revisión de los cuestionarios distribuidos,

- Redacción y presentación a la Comisión del informe sobre la segunda fase.

3.3. Fase 3.

3.3.1. Actividades Preparatorias.

- Establecimiento del plan general de trabajo,
- Contactos con las asociaciones de categoría y el IMAC para definir los detalles de las actividades sucesivas,
- Asignación de recursos y tiempos de trabajo con la elaboración del programa definitivo (check-list operativa),
- Elaboración de una propuesta de esquema sobre la organización del IMAC y sus funciones, estructura y recursos,
- Preparación de un programa de formación en materia de comercialización de normas de calidad y de tecnologías productivas para el IMAC y los empresarios del sector,
- Establecimiento de un plan de trabajo y de reuniones en México,
- Preparación de un cuestionario relativo al seguimiento de los contactos y negociaciones entre empresarios mexicanos y europeos.

3.3.2. Actividades Realizadas en México y en Europa.

- Discusión y elaboración de un plan de organización del IMAC y exposiciones eventuales ante autoridades superiores,
- Discusión y elaboración, con el IMAC y las asociaciones locales de categoría, del programa de formación y del cuestionario,
- Desarrollo del programa de formación:
 - En México,
 - Ante empresas, asociaciones y foros europeos
- Exposición y redacción del cuestionario con la ayuda de visitas a empresarios mexicanos y europeos.

3.3.3. Evaluación e Informe

- Evaluación de los resultados derivados de los contactos entre las asociaciones y empresas, así como de los cuestionarios,

- Elaboración y presentación a la Comisión de:

- Informes sobre la tercera fase

- Informe final del programa completo.

4. RECURSOS

Iª FASE:

1 jefe de proyecto

1 consultor experto en problemas de comercialización y estudios macro-económicos

1 consultor experto en normas de calidad y tecnología productiva en la industria mueblera

1 consultor experto en comercio internacional y relaciones industriales europeas

1 consultor para actividades operativas y de secretariado.

IIª FASE:

1 jefe de proyecto

1 consultor experto en la organización de congresos y conferencias (Feria de Milán)

1 consultor experto en problemas de comercio internacional y relaciones industriales

3 consultores para actividades operativas y de secretariado.

IIIª FASE:

1 jefe de proyecto

1 consultor experto en manejo industrial (IMAC)

1 consultor experto en tecnología productiva en la industria del mueble

1 instructor para los programas de formación

2 consultores para actividades operativas y de secretariado.

Para el conjunto del proyecto, la Feria de Milán en colaboración con sus propias estructuras utilizará, además de los servicios de sus sociedades vinculadas, otras estructuras tales como la AIDIMA, las Cámaras de Comercio, la Federlegno, los Institutos de Comercio Exterior, etc., así como otros organismos e instituciones. Esta enumeración no es obviamente exhaustiva.

5. CALENDARIO

- | | |
|-----------------------------------|---|
| Diciembre 1990: | - definición del proyecto - contactos institucionales |
| Enero 1991 a Abril 1991 | - check list operativa - definición de acuerdos institucionales - contactos con los beneficiarios, el IMAC y las asociaciones profesionales - análisis macro-económico - investigación y control de los proyectos mexicanos - análisis de los aspectos normativos relacionados con la calidad. - correspondencia - identificación de empresas mexicanas y europeas - organización de los viajes |
| Abril 1991 | Convención de Milán |
| May/Jun 1991 y Sep/Oct 1991 | - plan de organización del IMAC - programa de formación en comercialización y tecnología productiva - cuestionario/correspondencia Convención - desarrollo del programa de formación en favor del IMAC - evaluación e informe - análisis de los resultados |
| Noviembre 1991 | - redacción del informe final |

6. ELEMENTOS BASICOS DE LA CONVENCION

- Organizador** - Feria de Milán
- Patrocinador oficial** - Comisión de las Comunidades Europeas
- Fechas previstas** - abril 1991
- Duración** - tres días
- Lugar** - Sala Convegni - Feria de MILÁN
- Participantes** - 150 personas aproximadamente
- aproximadamente 100 operadores europeos
 - operadores financieros, personalidades de la CEE y políticos nacionales, asociaciones de categoría
- Idiomas oficiales** - las publicaciones de los encuentros serán en francés y en español
- Durante los encuentros, los intérpretes disponibles realizarán la traducción simultánea durante las sesiones plenarias y la traducción consecutiva durante las reuniones de trabajo.

PROYECTO DE MODERNIZACIÓN DEL SECTOR FABRICANTE DE MUEBLES DE MADERA ENFOCADO A LA EXPORTACIÓN
 CUADRO COMPARATIVO DE LAS PROPUESTAS DE SECOFI CANADINHA Y DE LAS COMUNIDADES EUROPEAS

PROPUESTA SECOFI-CANADINHA

PROPUESTA DE LAS COMUNIDADES EUROPEAS

OBJETIVOS

Fortalecimiento de la infraestructura y reestructuración del sector mueblero mexicano a través del Instituto del Mueble S.C. (IMAC), y mediante un programa piloto.

Especial importancia a la consolidación y desarrollo del sector a través de un programa de asistencia técnica en colaboración con la feria de Milán.

DURACION DEL PROYECTO

18 meses para una primera etapa de exportación hacia E.U. y segunda etapa se enfocaría a la exportación hacia Europa.

Doce meses de 1991.

METODOLOGIA

Partes complementarias:

- Reforzamiento de la infraestructura del sector a través del Instituto del Mueble.
- Reestructuración del sector mediante un programa piloto.

Tres fases:

- Visita de expertos europeos a México.
- Organización de una convención en Milán entre operadores mexicanos y operadores europeos.
- Formación de dirigentes y funcionarios del Instituto Mexicano del Mueble, contactos entre empresarios mexicanos y europeos, evaluación de resultados.

ACTIVIDADES

- Integrar un comité directivo (SECOFI, ind. mueblera).
- Integrar equipo de consultores y especialistas.
- Reclutar y capacitar el personal para el IMAC.
- Desarrollar instalaciones adecuadas para el IMAC.
- Seleccionar empresas para el programa piloto.
- Diseñar la estrategia comercial.
- Trabajar con cada una de las empresas.
- Organizar y administrar la asistencia a High Point.
- Asimilar la experiencia generada por el programa piloto y difundirla a nivel nacional por parte del IMAC.

Fase I:

- Preparación del plan y contactos.
- Misión a México.
- Primeras evaluaciones y reporte.

Fase II:

- Plan general de trabajo, asignación de recursos.
- Organización de la Convención.
- Desarrollo de la Convención y reporte.

Fase III:

- Plan general de trabajo, contactos con el IMAC, programas de formación.
- Plan de organización del IMAC.
- Evaluación y reporte.

- COSTO

Costo total: 518 600 ECU
 Préstamo solicitado a la CE: 492 400 ECU

Costo a cargo de la CEE: 300 000 ECU
 Costo a cargo de la feria de Milán: 25 000 ECU

ANNEX VII

JOB DESCRIPTION

Post Title: Project Management and Technical Services Expert

Duration: One Year (with possibility of extension)

Date Required: As soon as possible

Duty Station: Mexico City, with eventual travel in the country

Purpose of project: To assist the Mueblera Group, CANACINTRA, in organizing and conducting the start-up activities leading to technical services to the furniture industry of Mexico, through IMAC.

Duties:

- (a) To provide advice and assist the Mueblera Group, CANACINTRA, in organizing the personnel set-up and working systems of IMAC;
- (b) To set up technical services system to serve the furniture industry of Mexico, within the objectives and operating capacities of IMAC;
- (c) To train his counterpart and the key personnel of the management and technical services divisions of IMAC in the effective and successful discharge of their duties and responsibilities; and
- (d) To prepare quarterly reports on the progress of the project.

Qualifications: Engineer or wood technologist with long experience in project and factory management, adequate exposure in the provision of technical assistance (from both recipient and donor standpoints) to furniture/joinery firms and ample experience in training key management and factory personnel.

Language Requirements: Spanish preferred, English acceptable.

Background Information: In line with the country's efforts for more accelerated economic and industrial development, CANACINTRA, through its Mueblera Group, has established the Instituto del Mueble A.C., which is intended to provide technical assistance and marketing advice to the furniture industry of the country. IMAC does not have the managerial and technical personnel to organize an establish the service and management systems required by the proposed operations of IMAC; hence, the need for the services of an expert in these fields.

ANNEX VIII

RECOMMENDATIONS FOR FELLOWSHIPS AND TRAINING PROGRAMME
FOR SPECIFIC SKILLS NEEDED BY THE FURNITURE INDUSTRY
OF M E X I C O

I. WOODWORKING MILLWRIGHT

A. In-Plant or Institutional Training

Three months training at a reputable furniture/joinery manufacturing plant in Spain, Italy or the United States of America, preferably at a medium-scale factory.

B. Study Travel

Two months travel to visit upper small- and medium- scale furniture/joinery factories in Spain, Italy, Denmark and the United States of America in order to observe the more modern developments in millwright activities for furniture/joinery factories.

C. Qualifications for Fellowship

At least five years experience in woodworks machining operations, another three years minimum experience in machine set-up, and another three years exposure in saw-filing, knife-grinding and bit sharpening activities. Adequate knowledge of both the English and Spanish languages.

II. WOODWORKS INDUSTRIAL ENGINEER

A. In-Plant or Institutional Training

Three months training at a reputable furniture industrial design institution in Italy, the United Kingdom or the United States of America.

B. Study Travel

Two months travel to visit major furniture/joinery factories in Europe and the United States of America to observe modern practices in industrial design activities for furniture and joinery products.

C. Qualifications for Fellowship

At least five years experience in actual design of furniture components for production purposes. Basic knowledge of mechanical engineering drafting work. At least two years of college work in Architecture or Civil Engineering desirable. Adequate knowledge of both Spanish and English.

III. WOODWORKS FINISHING TECHNICIAN

A. In-Plant or Institutional Training

Two months training under a formal training course offered by finishing equipment manufacturers (e.g., DeVilbiss, Nordson, Binks, or equivalent institutions in the United States or Europe); another two months training in a woodworks factory finishing plant and an industrial paint manufacturing company in the United States of America; including quality checks on materials and finish coatings.

B. Study Travel

Two months travel to major finishing plants for woodwork products in the United States of America to observe the modern techniques of finishing furniture/joinery products manufactured for the American market. Quality checks on both paint materials and finish coatings are also to be observed.

C. Qualifications for Fellowship

At least five years experience in finishing operations of a furniture/joinery factory. College credits in General and Organic Chemistry desirable. Adequate knowledge of both the English and Spanish languages.

ANNEX IX

JOB DESCRIPTION

Position: Expert in Woodworks Millwright Activities

Duration: Three months (with possibility of extension)

Date Required: To be determined later (upon return of UNIDO (Fellow in Woodworks Millwright Activities)

Duty Station: Mexico City, with travel in the country

Purpose of Project: To assist IMAC in organizing and dispensing technical services to Mexico's furniture/joinery industries.

Duties:

- (a) To organize, with the aid of his counterpart, technical services in the field of machine set-up and machining operations; design, fabrication and proper use of production jigs and fixtures; and the techniques of care and maintenance of cutting tools;
- (b) To train further his counterpart along the skills enumerated in (a); and
- (c) To submit recommendations related to the improvement of this particular aspect of IMAC's industry service operations.

Qualifications: Woodworks technician with adequate experience in machine set-up; design, fabrication and use of production jigs and fixtures and the proper care and maintenance of cutting tools. Experience in personnel training along the skills listed above is highly desirable.

Language Requirements: Spanish preferred; English acceptable

Background Information: In line with the country's efforts for more accelerated economic and industrial development, CANACINTRA, through its Mueblera Group, has established the Instituto del Mueble A.C., which is intended to provide technical assistance and marketing advice to the furniture industry of the country. IMAC does not have the managerial and technical personnel to organize and establish the service and management systems required by the proposed operations of IMAC; hence, the need for the services of an expert in these fields.

ANNEX X

JOB DESCRIPTION

Position: Expert in Woodworks Industrial Design

Duration: Three months (with possibility of extension)

Date Required: To be determined later (upon return of UNIDO Fellow in Woodworks Industrial Design)

Duty Station: Mexico City, with travel in the country

Purpose of Project: To assist IMAC in organizing and dispensing technical services to the furniture/joinery industry of Mexico.

Duties:

- (a) To organize, with the aid of his counterpart, technical services in the field of woodworks industrial design;
- (b) To train further his counterpart, simultaneously with the furniture/joinery industry selected personnel, along the skills described in (a) above; and
- (c) To submit recommendations related to the improvement of this particular aspect of IMAC's industry service operations.

Qualifications: Architect or civil engineer with adequate experience in woodworks industrial design activities. Experience in personnel training in developing countries is highly desirable.

Language Requirements: Spanish preferred, English acceptable.

Background Information: In line with the country's efforts for more accelerated economic and industrial development, CANACINTRA, through its Mueblera Group, has established the Instituto del Mueble A.C., which is intended to provide technical assistance and marketing advice to the furniture industry of the country. IMAC does not have the managerial and technical personnel to organize and establish the service and management systems required by the proposed operations of IMAC; hence, the need for the services of an expert in these fields.

ANNEX XI

JOB DESCRIPTION

Position: Expert in Woodworks Finishing Operations

Duration: Three months (with possibility of extension)

Date Required: To be determined later (upon return of UNIDO Fellow in Woodworks Industrial Finishing Operations)

Duty Station: Mexico City, with travel in the country.

Purpose of project: To assist IMAC in organizing and dispensing technical services to Mexico's furniture/joinery industries.

Duties:

- (a) To organize, with the aid of his counterpart, technical services in the field of woodworks industrial finishing:
- (b) To train further his counterpart, simultaneously with the furniture/joinery industry's selected personnel, along the skills described in (a), above; and
- (c) To submit recommendations related to the improvement of this particular aspect of IMAC's industry service operations.

Qualifications: Chemist or Chemical Engineer with adequate experience in woodworks industrial finishing operations. Experience in personnel training in developing countries is highly desirable.

Language Requirements: Spanish preferred, English acceptable

Background Information: In line with the country's efforts for more accelerated economic and industrial development, CANACINTRA, through its Mueblera Group, has established the Instituto del Mueble A.C., which is intended to provide technical assistance and marketing advice to the furniture industry of the country. IMAC does not have the managerial and technical personnel to organize and establish the service and management systems required by the proposed operations of IMAC; hence, the need for the services of an expert in these fields.

ANNEX XII

**INDUSTRY PERSONNEL TRAINING AIDS AND
TECHNICAL SERVICING FACILITIES**

I. VIDEO TRAINING FILMS (for IMAC)

The following video tapes are listed according to priority ratings related to the current needs of the furniture industry of Mexico. All the video tapes are available at the North Carolina State University. However, they should be purchased locally, as the tapes are already in Spanish and cost less than equivalent imported tapes (based on the experience with the first purchase of training video tapes during Phase I of this project). Orders should be placed for one (1) each of the following tapes, all in BETA NTSC compatible system:

- (a) R22. Furniture Assembly - Wood Casegoods (38 min.)
- (b) R23. Tooling for the Tenoner (62 min.)
- (c) R8. Woodworking Machine Operator Training Program. R8D Variety Saw
- (d) R20. Hazard Communication Program (for the Wood Industry (18 Min.))
- (e) R21. The Basics of Hardwood Lumber Grades (18 min.)
- (f) Wood Furniture Finishing. No. 16 (18 min.)
- (g) Efficient Wood Sanding. Parts 1 & 2. No. 13 & 14. (77 & 60 min. respectively)
- (h) Ways to Cut Costs in Production Woodworking. Nos. 3 & 4 (70 & 60 min., respectively)

II. MACHINERY SPARE PARTS & ACCESSORIES (for CONALEP)

- A. Items required for the spindle moulder, type F-4-M, Brand: EJICA, Sweden:
 - One ea. Cutting Spindle, 30mm diameter, standard type, Order No. FM-4008
 - One ea. Cutting spindle adapter for outer cutters complete with one set of collets for holding cutters with shanks of various diameters, Order No. 49-90120
 - One ea. Spare pressure pads, Nos. 1 to 31; 35 to 40; and 59 (see spare parts pages 28, 60), for vertical and horizontal pressure pads
- B. Items required for Standard Routers and Mini Router, Model N, Brand: SAMCO, Italy:
 - Two ea. Collets for holding router bits of various standard shank diameters (both metric and English system sizes)
 - One ea. Standard adjustable fence

III. EQUIPMENT FOR INDUSTRY SERVICING ACTIVITIES (for IMAC)

One ea. "DELMHORST" Moisture Meter. portable. battery operated. 3-
range scales. with prong hammering device and spare prongs
for saw timber thicknesses 12mm up to 75mm.
One ea. ZAHN Viscosity Cup. No. 2. portable
One ea. ZAHN Viscosity Cup. No. 4. with standard stand
One ea. Wet Film Thickness Gage. Roller Type. 0 to 10 mils or
better
One set Print Test Weights. 1/2 psi to 20 psi
One yd. UNBLEACHED Muslin cloth. 1 yd. wide. single ply (to be
purchased locally)

Note: The last five items are needed for checking the properties
of finishing materials and finished coatings. The viscosity cups
may also be used to check the viscosity of glue mixes.

ANNEX XIII

Comments by the Substantive Officer

The project seems to have achieved its objectives notwithstanding the change of experts between phases I and II, caused by the health condition of the first expert.

The involvement of CONALEP was a sound decision, in so far that one of its staff members was trained in the identification of needs for jigs and fixtures and their design and manufacture. It is foreseen that upon completion, the project would have spent some US\$ 15,000 worth of clamps, gauges, tools etc. for CONALEP to upgrade their machines and permit them to teach this topic with all the necessary facilities. Purchase was stopped due to the freeze within UNIDO of expenditures on SIS projects in 1991. It can hence be hoped that the transfer of technology was not limited to the firms receiving the assistance (as per the original request) but will be introduced to firms in the future through the technicians that CONALEP will train.

We fully endorse the expert's recommendations and wish to stress the need for a rapid creation and full functioning of IMAC. Subject to availability of funds, UNIDO would be very happy to provide this assistance if requested to do so.

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