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28 December 1977
English

DEVELOPMENT OF THE FURNITURE AND JOINERY INDUSTRIES
AND CREATION OF A CENTRE*
DP/YUG/73/006
YUGOSLAVIA .

12 DEC 1973

Technical report: Assistance in industrial engineering

Prepared for the Government of Yugoslavia
by the United Nations Industrial Development Organization
executing agency for the United Nations Development Programme

Based on the work of Desmond P. Oody, expert in
industrial engineering

United Nations Industrial Development Organization
Vienna

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EXPLANATORY NOTES

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

A comma (,) is used to distinguish thousands and millions.

A slash (/) indicates a field season covering part of two consecutive years, e.g. 1975/76.

Use of a hyphen (–) between years, e.g. 1975–1976 signifies the full period involved, including the beginning and end years.

Reference to "dollars" indicate United States dollars, unless otherwise stated.

The monetary unit in Yugoslavia is the dinar (Din). In June 1977 its value in relation to the United States dollar was \$1 = Din 18,35.

The following abbreviations are used in this report:

BiH - Republic of Bosnia and Herzegovina

R.O. - Radna organizacija (working organisation)

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ABSTRACT

This is the second report by the expert in industrial engineering assigned to the United Nations Development Programme /UNDP/ project for "Assistance to the Furniture and Joinery Industries and Establishment of a Centre (DP/YUG/73/006). Basic information is contained in the first report.^{1/}

The conclusion drawn from an assessment of the state of development of the principles and practice of industrial engineering in the furniture and joinery industries in the Republic of Bosnia and Herzegovina, and in particular within the Čipad organization, is that it could be improved considerably.

The first report made an analysis of the furniture industry in BiH and made specific recommendations regarding the industrial engineering aspects of the following:

- products and product design
- production
- manufacturing facilities
- factory organization
- productivity
- management
- standard specifications and quality control
- research and development and
- inter-factory co-operation

Since this second mission followed shortly after the first the situation, although improving, has not changed greatly, and the earlier findings^{1/}, although relevant, have not been repeated in this report. The main purpose of the mission was to assist in the implementation of the recommendations made in the previous report and this work is elaborated in the present report. It refers in particular to two

1/ See report DP/ID/SER.A/106.

of the Šipad Working Organizations, Šipad Radna Organizacija "Majevica" and Šipad Radna Organizacija "Konjuh" which it was intended should be regarded as case studies in integration and rationalization for subsequent implementation in the other Working Organizations, and within Šipad itself.

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INTRODUCTION

The furniture and joinery industries in Bosnia and Herzegovina contribute about 8% of the goods and services produced in the Republic and represent 4% of its exports. An ambitious five-year development plan is being implemented to double the production of furniture to attain a value of Din. 2,000 million and to increase the work force from 6,000 to 9,000 persons. This plan calls for an investment of Din 800 million. Joinery production will increase from Din 200 million to Din 650 million and the work force will triple to reach 4,500 persons. Investment of Din 950 million is foreseen for Joinery plants Šipad, a co-operative forestry industry organization consisting of 126 factories and employing 55,000 persons accounts for 65% of sawmilling and 85% of the final products of the wood industries of Bosnia and Herzegovina. The Government of Yugoslavia, on behalf of that of the Republic of Bosnia and Herzegovina has requested assistance from the United Nations Development Programme /UNDP/ in developing the Republic's furniture and joinery industries.

The assistance being provided in the design of furniture and joinery, production engineering, quality control, computerization documentation and marketing is part of the project "Development of the furniture and joinery industries and creation of a centre /DP/YUG/73/006/ that is being carried out by the United Nations Industrial Development Organization /UNIDO/acting as executing agency for UNDP. The project which began on 1st September, 1974 is scheduled to last for three years and four months. The UNDP contribution is US\$ 555,000, that of the government of Yugoslavia Din 19,247,900.

The long range objectives, as set forth in the project document, are to enable the furniture and joinery industries in Bosnia and Herzegovina initially, and in all of Yugoslavia

eventually, to make a greater contribution to the economy. Immediate objectives are to help the industries to increase the value of their products, to improve quality, to reduce costs of production, to design new products and to forecast market requirements.

The assistance in industrial engineering is being provided to the factories through the Šipad Computer Centre and in collaboration with Šipad Kombinat Department for Research and Development and Šumaprojekt, the Šipad Department responsible for factory planning.

As part of the project, Desmond P. Cody, an expert in industrial engineering was sent on a two month mission, later extended by a further three weeks to assist the National Project Director and the staffs of the Šipad Departments referred to in implementing the recommendations made in the previous report. The mission was carried out from 2nd October to 21st December, 1977. Annex I contains the experts job description. The National Project Director requested that the expert should concentrate on two Working Organizations within the Šipad Organizations, namely R.O. Šipad "Majevisa" and R.O. Šipad "Konjuh". His findings and recommendations in respect of these R.O.'s would then be applied in more general terms to the other R.O.'s with particular reference to closer co-operation in design, production and marketing, leading eventually to full horizontal integration. The Director further requested that three seminars be held by the expert towards the close of his mission to present an exposé of the case studies in the two R.O.'s referred to. These would be for the top management of Šipad, for representatives of senior management of all the Šipad R.O.'s to be held in conjunction with the Yugoslavian Furniture Fair, 21 - 27 November, and finally for the directors of the individual OOURs within the Šipad "Majevisa" and Šipad "Konjuh" groups. The first of these was held on 18th November in Sarajevo, the second on 23rd November and the third on 15 December 1977. Those also in attendance

included factory directors, production management personnel, designers and technical representatives of the Šipad service agencies concerned with the organization and development of the factories. The seminars dealt with the topics covered in this report.

During the course of the mission the expert organized and led two study-tours to factories and technical institutions in the United Kingdom of Great Britain and Northern Ireland. The first, from 22 to 29 October was concerned with furniture production and the second, from 4 to 11 December, was concerned with joinery production. Details of both study-tours are given in Annex 2. The findings of the tours were also discussed at the seminar held in Belgrade, and already referred to.

The personnel directly concerned with the project were:

Mr. M. Pjaca, National Project Director
Mr.M.Trtica, ŠIPAD "MAJEVIQA"
Mr.P.Sulić, ŠIPAD KOMBINAT
Mr.S.Marković, ŠIPAD "KONJUH"
Mr.V.Despot, Wood Technology Institute
Mrs.J.Stanišić, UNIDO Project Secretary

The organizations and factories that were directly involved in the mission or which co-operated with the expert are given in Annex 3.

I. FINDINGS

The situation regarding furniture production must be viewed against a background of continued re-organization and development. Many new plants are in the course of construction, others have only recently started up while still more are undergoing re-construction and modernization. This is being done largely on an individual factory basis, but it is usually part of a development programme which is planned and co-ordinated at Working Organization level.

The indications are that the industry with its well equipped factories and plentiful supply of hardwoods and softwoods has a very promising future particularly with regard to exports. Many problems, however, still remain to be solved before success in this area is achieved and the more important of these, and which require immediate attention include:

- New product design;
- improvement of quality;
- better management and factory organization;
- better industrial training;
- improved productivity and profitability, and
- better marketing and sales
- closer factory co-operation within Working Organizations
- better new factory planning.

In order to make an immediate and worthwhile impact in tackling these problems the expert concentrated most of his activities in one working organization, described in detail later in this report. This R.O. was chosen mainly because: it appeared to be the most representative of those within the Šipad organization; it had a large number /nine/ of individual factories capable of producing a wide range of furniture products; all its factories were within easy reach of each other and; it had already taken the first tentative steps

towards a more rationalized approach to common product, marketing and production policies.

Having familiarized himself with each of the factories involved and discussed the programme with their personnel, it became evident to the expert that despite a commitment to rationalization as enshrined in the R.O. constitution, there was rather less enthusiasm for its implementation, mainly because of real and imagined fears of its outcome and effect at individual factory level. This was a perfectly understandable reaction, particularly since at no stage up to then had any real effort appeared to have been made to spell out precisely what was intended to be meant by this kind of rationalization and integration. Even the top management of Šipad itself was unsure since not only would each factory be involved, but also, and by implication, the local commune from which it sprang and which would always expect it to retain a considerable degree of autonomy.

The expert therefore wishes to emphasize, as he did in his discussions with the management of each OOUR that any proposals or recommendations made by him and the team which worked on the project with him would be subject to the approval of and agreement by each factory, as well as ensuring that it fitted into the context of the Šipad organizational strategy as a whole. The proposals at the initial stages would be for consideration and discussion and would be based on the following:

1. The need of each OOUR to retain its own identity in terms of products and markets.
2. The existing expertise and specialization established by each.
3. The need to avoid competition with each other in products and markets.
4. Design, production and marketing facilities which could be shared with other OOURs to their mutual cost:benefit.

5. Joint in-factory training programmes for all levels of personnel.
6. Joint purchase of raw materials: joint purchase and use of high output and otherwise expensive production equipment.
7. Common storage and transport services.
8. Common servicing of transport, machinery equipment and buildings.
9. Co-ordination of factory development and new factory planning.
10. Joint export activities.

It was further emphasized that any decisions regarding rationalization should be based on sound commercial judgement and on the conviction that such activities could be done better and more cheaply together than separately. Rationalization should not be superimposed from above, by, for example, the Šipad central management, but rather with the assistance and encouragement of the latter. It would evolve over a period of time and would be allowed to develop its own individual characteristics. Above all it would need a real commitment from the OOUR's themselves and a will to achieve its aims and objectives staged over a given period of time.

The team which worked with the expert was:

Mr. H.Mutapčić, ŠIPAD "MAJEVICA", Coordinator
Mr.B.Kapeleti, ŠIPAD "MAJEVICA", Designer
Mr.B.Gojković, ŠIPAD "MAJEVICA", Marketing
Mr.B.Ljubojević, ŠIPAD KOMBINAT

A. THE ŠIPAD ORGANIZATION

The Yugoslav self-management system is still evolving and its practical effects on an organization such as Šipad have not yet reached full function. In 1975 it accepted a new organizational structure which is still being implemented.

At present Šipad consists of a large number of self-managed factories called OOURs /Osnovna Organizacija Udruženog Rada/ which are grouped together geographically into 22 units called Radna Organizacija /RO/. Some common services for the factories and for the ROs are incorporated in two ROs, one for research and development /IRC/, and the other for trade /Šipad-Komerc/.

The remainder of this report is concerned with the participation of two RO's, RO Majevisa - Šipad Brčko and RO Konjuh - Šipad Živinice in the industrial engineering project. R.O. Majevisa specially requested assistance in the preparation of an integration and rationalization programme which would be carried out over the next five years. RO Konjuh, currently engaged in the re-organization of their existing OOURs including the planning of some new factories, requested an assessment of their present manufacturing set-up and advice on how best to improve it in terms of products, production organization and productivity.

B. RO MAJEVICA - ŠIPAD

1. General

RO Majeвица was established in 1975 as part of the Šipad Forestry and Wood Industry Enterprise. It consists of nine individual factories or OOURs as outlined in Table I. These operated as independent units prior to the formation of the RO.

Table I. Majeвица - ŠIPAD OOURs

OOUR	LOCATION	PRODUCTS
1. Bosna	Brčko	Corpus
2. Brčko	Brčko	Upholstery
3. Srebrenik	Srebrenik	Corpus 88
4. Budućnost	Bos. Šamac	Corpus Solid Wood Upholstery
5. Namještaj	Gradačac	Kitchen
6. Stolar	Bijeljina	Corpus
7. Jadrina	Gračanica	Corpus Solid Wood Upholstery
8. 29 Novembar	Orašje	Corpus Upholstery
9. Srbobran	Srbobran	Corpus

The principal aims of integration as interpreted by the OOUR's may be summarized as follows:

- concentration of funds to enable co-ordination of investment;
- co-ordination of product policy, factory development and production programming;
- joint purchasing of equipment and raw materials;
- joint marketing and sales;
- specialization, rationalization and inter-factory co-operation in production.

The following table shows the volume of production in 1976 and the estimated volume for 1977

Table II. Production volume 1976 and 1977

PRODUCTS	UNIT	1976	1977/Estimated/
1. Bedrooms	sets	5,091	5,000
2. Living rooms	"	5,237	10,500
3. Other rooms	"	8,160	10,000
4. Kitchens	pcs.	113,357	160,000
5. Large occasional fur.	"	126,336	142,300
6. Small " "	" "	2,789	5,000
7. Elements	000 Din	441	1,000
Value of production	000 Din.	433,174	580,000
Sales	" "	421,188	580,000
Export	" "	13,520	29,000
No. of employees		2,346	2,440

The total production area of RO Majevisa is 34,710 m² and storage area is 21,451 m². Storage of final products is 13,957 m².

Present value of the main assets is 374,898,606 din.

The following OOURs have plans for factory reconstruction or development to be completed by 1978.

- Bosna - Brčko - total reconstruction
- Brčko - Brčko - new upholstery factory
- Budućnost - Bos.Šamac - reconstruction of production areas and storage
- Namještaj - Gradačac - limited reconstruction
- Jadrina - Gračanica - new storage for finished goods
- 29 Novembar - Orašje - new factory planned
- Srbobran - Srbobran - new factory planned

The following shows the utilization of raw material in RO Majeвица:

- sawn wood /beech/	11,000 m ³
- particleboard	24,000 m ³
- plywood	1,200 m ²
- hardboard	285,000 m ²
- laminates	227,000 m ²
- veneers	1,000 m ³
- glues	400 tons
- lacquers	180 "
- foams	480 "
- textiles	466,600 m

Most of the wood based material is purchased from other Šipad organizations, while the remainder is purchased outside it.

At the outset visits were paid to each of the nine factories involved and a comprehensive investigation undertaken into every aspect of product policy, production and productivity. The results of this investigation are outlined in Tables III to V and these formed the basis for the preparation of subsequent proposals for an integrated development programme for the Working Organization as a whole.

Table III is concerned with each OOUR's current level

of employment, product ranges, production and sales, and gives a brief description of development plans. Table IV analyses the production and storage facilities available or planned and table V summarizes the level of product and production activity in each factory. The latter, in particular, forms the basis for any proposed re-organization and development programme which would in turn be an essential pre-requisite for successful integration and rationalization. Subsequent paragraphs in this report comment on each section of the analysis and make recommendations regarding its development and improvement which would be in line with plans for inter-factory rationalization.

Tab.e III. Individual factory profiles

NO	FABRIKERY	Date estab- lished	Product range	Number employed	Amount of re- construction in 1976 (in 1000 Yugoslav Dinar)	Capital invest- ment in 1976 (in 1000 Yugoslav Dinar)	Countries	Expansion plans
1.	"Wood Tech" "Sremska" "Sremska"	1955	- Bedroom - Living room - Occasional	420	80.845	73.123	1959 Ljubljana Ljubljana	Re-construction planned. Capital cost about 50 million Yugoslav Dinars for purchase of machinery and equipment; services 21; other 7.
2.	"Sremska" "Sremska"	1955	- Studio couches - Sofas - Arm chairs-stuffed over - Arm chairs - Star - Wood (no style)	208	40.847	40.565	-	Re-construction planned. Capital cost about 40 million Yugoslav Dinars for purchase of machinery and equipment; services 21; other 7.
3.	"Sremska" "Sremska"	1976	- Living room - Occasional	160	14.322 (in 1977 will be about 30.000)	8.022	-	Re-construction planned. Capital cost about 14 million Yugoslav Dinars for purchase of machinery and equipment; services 21; other 7.
4.	"Sremska" "Sremska"	1952	- Bed room - Living room - Occasional (styled) - Studio and couches - Arm chairs - show - Bed	501	93.158	95.342	4.232	Re-construction planned. Capital cost about 93 million Yugoslav Dinars for purchase of machinery and equipment; services 21; other 7.
5.	"Sremska" "Sremska"	1958	- Kitchen - Transitional	341	92.322	92.311	11	Re-construction planned. Capital cost about 92 million Yugoslav Dinars for purchase of machinery and equipment; services 21; other 7.
6.	"Sremska" "Sremska"	1958	- Bed room - Occasional	167	16.442 (in 1977 will be about 30.000)	16.442	-	Re-construction planned. Capital cost about 16 million Yugoslav Dinars for purchase of machinery and equipment; services 21; other 7.
7.	"Sremska" "Sremska"	1957	- Living room - Bed room - Sofas - Arm chairs-stuffed over - Arm chairs - show	334	56.614	55.030	-	Re-construction planned. Capital cost about 56 million Yugoslav Dinars for purchase of machinery and equipment; services 21; other 7.
8.	"Sremska" "Sremska"	1957	- Studio couch - Studio couch - Bed room - Arm chairs-stuffed over - Arm chairs - show	150	24.629	24.530	-	Re-construction planned. Capital cost about 24 million Yugoslav Dinars for purchase of machinery and equipment; services 21; other 7.
9.	"Sremska" "Sremska"	1970	- Living room - Occasional	25	8.300	9.000	-	Re-construction planned. Capital cost about 8 million Yugoslav Dinars for purchase of machinery and equipment; services 21; other 7.

Table IV. Summary analysis of individual factories
(Products and production)

	1	2	3	4	5	6	7	8	9
1. GENERAL									
- Satisfactory	C	C	C	C	C	C	C	C	C
- Requires improvement	C	C	C	C	C	C	C	C	C
- Unsatisfactory	C	C	C	C	C	C	C	C	C
2. PRODUCTION									
- Work study	C	C	C	C	C	C	C	C	C
- Production planning	C	C	C	C	C	C	C	C	C
- Production control	C	C	C	C	C	C	C	C	C
- Quality control	C	C	C	C	C	C	C	C	C
- Field inspection	C	C	C	C	C	C	C	C	C
- Waste control	C	C	C	C	C	C	C	C	C
- Machine setting	C	C	C	C	C	C	C	C	C
- Machine maintenance	C	C	C	C	C	C	C	C	C
- Labour utilization	C	C	C	C	C	C	C	C	C
- Production documentation	C	C	C	C	C	C	C	C	C
- Productivity	C	C	C	C	C	C	C	C	C
- Working conditions	C	C	C	C	C	C	C	C	C
3. MANAGEMENT									
- Administrative	C	C	C	C	C	C	C	C	C
- Technical	C	C	C	C	C	C	C	C	C
- Personnel	C	C	C	C	C	C	C	C	C
- Supervisory	C	C	C	C	C	C	C	C	C
- Design	C	C	C	C	C	C	C	C	C
- Information	C	C	C	C	C	C	C	C	C
- Training	C	C	C	C	C	C	C	C	C
- Skilled	C	C	C	C	C	C	C	C	C
- Semi-skilled	C	C	C	C	C	C	C	C	C
- Organisation	C	C	C	C	C	C	C	C	C
- Training	C	C	C	C	C	C	C	C	C
- Productivity	C	C	C	C	C	C	C	C	C
4. GENERAL									
- Work study	C	C	C	C	C	C	C	C	C
- Production planning	C	C	C	C	C	C	C	C	C
- Production control	C	C	C	C	C	C	C	C	C
- Quality control	C	C	C	C	C	C	C	C	C
- Field inspection	C	C	C	C	C	C	C	C	C
- Waste control	C	C	C	C	C	C	C	C	C
- Machine setting	C	C	C	C	C	C	C	C	C
- Machine maintenance	C	C	C	C	C	C	C	C	C
- Labour utilization	C	C	C	C	C	C	C	C	C
- Production documentation	C	C	C	C	C	C	C	C	C
- Productivity	C	C	C	C	C	C	C	C	C
- Working conditions	C	C	C	C	C	C	C	C	C
5. MANAGEMENT									
- Administrative	C	C	C	C	C	C	C	C	C
- Technical	C	C	C	C	C	C	C	C	C
- Personnel	C	C	C	C	C	C	C	C	C
- Supervisory	C	C	C	C	C	C	C	C	C
- Design	C	C	C	C	C	C	C	C	C
- Information	C	C	C	C	C	C	C	C	C
- Training	C	C	C	C	C	C	C	C	C
- Skilled	C	C	C	C	C	C	C	C	C
- Semi-skilled	C	C	C	C	C	C	C	C	C
- Organisation	C	C	C	C	C	C	C	C	C
- Training	C	C	C	C	C	C	C	C	C
- Productivity	C	C	C	C	C	C	C	C	C
6. LABOUR									
- Skilled	C	C	C	C	C	C	C	C	C
- Semi-skilled	C	C	C	C	C	C	C	C	C
- Organisation	C	C	C	C	C	C	C	C	C
- Training	C	C	C	C	C	C	C	C	C
- Productivity	C	C	C	C	C	C	C	C	C

Key:

- 1. SOEIA
- 2. BUKO
- 3. SINGAPORE
- 4. SINGAPORE
- 5. SINGAPORE
- 6. SINGAPORE
- 7. SINGAPORE
- 8. SINGAPORE
- 9. SINGAPORE

Table V. Production and storage areas
(Existing and planned)

No.	Factory or cold storage	Production space		Storage space		Production space		Storage space	
		Corpus	Solid wood elev.	Corpus	Solid wood elev.	Corpus	Solid wood elev.	Corpus	Solid wood elev.
1.	5,035	-	12,000	-	12,000	1,720	1,720	1,720
2.	1,750	700	1,820	-	1,820	1,720	1,720	1,720
3.	3,576	-	430	-	2,576	3,170	400	1,172
4.	1,100	200	1,500	-	4,360	1,560	600	1,940
5.	3,648	1,380	200	-	1,500	1,000	1,000	1,000
6.	4,785	-	1,702	-	4,001	1,534	1,400	1,400
7.	7,776	1,285	4,050	-	5,072	4,000	1,000	1,000
8.	5,600	-	1,300	-	5,000	800	-	1,000
9.	1,410	-	510	-	1,240	900	-	300
		27,549	3,216	3,945	-	32,766	9,644	6,430	48,830
		7,474	13,657	21,431	-	32,766	9,644	6,430	48,830
		34,710	3,945	34,710	-	32,766	9,644	6,430	48,830

Legend:

* - including drying kilns

** - estimated

C. PRODUCTS AND PRODUCT DESIGN

The current range of models in the "Majeвица" range is poorly designed and lacks variety. The design programme for the immediate future, i.e. in 1978, which is outlined in Table VI envisages the retention of some models, the re-designing of others, and the introduction of some new models particularly for export.

The main characteristics of the new design programme shall be as follows:

Corpus Furniture:

1. Modular wall and free-standing storage units with standardized and common vertical and horizontal elements. These will include drawer and door fronts, shelves and carcasses.
2. Dimensioning which shall maximize on board utilization and shall conform to strict functional requirements.
3. Individuality shall be achieved by careful and creative use of panels and by using:
 - a/ solid edge lippings which may be subsequently moulded,
 - b/ veneer and plastic edge bandings,
 - c/ plant-on mouldings,
 - d/ veneers and veneer combinations,
 - e/ foil lamination, pigmented and wood grain imitation,
 - f/ pigmented lacquers,
 - g/ fittings and accessories.
4. The programme shall include wall units, sideboards, dressers, shelving systems, bedrooms, hall furniture, kitchens and occasional furniture.
5. Construction will incorporate completely knock-down /KD/ systems for ease of production, assembly, packaging and transport.
6. Designs will include modern and reproduction styling.

Upholstered Furniture

1. Designs will be based on common elements, e.g. seats, arms and backs, to allow for sectionalized production and ease of assembly.
2. While the traditional studio couch or convertible will continue to be produced in modified form, a new range will be introduced using replacement springing systems and movements for the standard spring unit currently in use.
3. Greater emphasis will be placed on loose cushioning for fully upholstered settees and armchairs.
4. A new range of "show-wood" seating will be introduced featuring modern and antique styling, and emphasizing quality beech.
5. Covering materials will include cotton, wool and synthetic fabrics, real and imitation leathers and those chosen by customers.
6. Springing system will include suspension platforms resilient webbing and serpentine "no-sag" springing.
7. Upholstery frames shall be standardized both structurally and dimensionally and greater use shall be made of particle board and other board materials in their construction.
8. Greater use will be made of latest developments in sewing techniques, buttoning and quilting.

Solid Wood Furniture

Solid wood furniture shall be confined to the production of upholstery frames, frames for "show-wood" seating, and elements such as door and drawer fronts used in the production of kitchen furniture, and in certain types of living room furniture and contract /hotels/ bedroom furniture.

Partitioning System

This would be a modular system of standard wall panelling which is produced in completely knock-down form and is suitable for hospitals, offices and other similar institutions.

The main features of the proposed system (which would be produced under licence) are as follows:

- a/ It is completely flexible in application and will suit any variety of circumstances.
- b/ It can be adjusted to suit most ceiling heights.
- c/ It incorporates flat panelling, storage modules and provisions for doors and door frames.
- d/ Sound insulation is at an acceptable level.
- e/ It is produced in natural wood veneers and wood grain imitation p.v.c. foils.
- f/ Both metal and plastic fittings are proprietary.

Children and teen-age furniture

This will include storage units such as wardrobes, dressing tables, chests of drawers, baby cots, baby preparation tables, study desks, and toy chests.

The main features of this range are as follows:

- a/ It will be produced from particle board finished in pigmented lacquer and p.v.c. foil, with some solid wood elements.
- b/ It will be completely knock-down /KD/ in construction.
- c/ It will be produced in modular form with many common elements which can be arranged according to customer preferences.

Home Office

This is a new and special design within the corpus range which is particularly suitable where living space is confined and good storage facilities are essential. It incorporates the following

features:

- a/ good storage facilities for all home office requirements including provision for filing system, documentation, storage, typewriter and writing table.
- b/ When open it is a desk and when closed appears like a small storage cabinet.
- c/ It occupies very little space.
- d/ It is produced in particle board and finished in a natural wood veneer.

Quality

All models shall be produced to an acceptable level of quality and shall be in accordance with those standards laid down by the Yugoslavian Bureau of Standards.

Annex 4 gives the production programme for each COUR for 1978. It represents the first stage in the rationalization of design and production and is in line with that outlined in Table VI.

Table VI. Proposal for product policy and design rationalisation

CODE	PROPOSED PRODUCT RANGE	INDIVIDUAL COURS
A	FREE-STANDING BEDROOMS WITH EDGE VENEERED PANELS	Bosna Brčko Buduć. "29.nov." Jadrina Namješ. Srbob. Srebren. Stolar *
B	FREE-STANDING BEDROOMS WITH SOLID EDGE-LIPPED PANELS	*
C	VENEERED BEDROOM CORPUS FURNITURE	*
D	FIVE-STAR IN SHELVES FOR STORAGE AND DISPLAY	*
E	COMPLY BY PUCK DOWN WALL UNITS WITH EDGE VENEERED PANELS	*
F	2-1/2-DRAWER UNITS WITH SOLID EDGE-LIPPED PANELS	*
G	STYLIC WALL UNITS	*
H	SHAVING SYSTEMS AND ROOM DIVIDERS	*
I	MODULAR FITCHER UNITS AND COMPLETE KITCHENS	*
J	PARTICULAR SYSTEM: PLAIN AND WITH STORAGE	*
K	SLEEPING COUCHES AND ARM CHAIRS	*
L	FULLY UPHOLSTERED SETTEES AND ARM CHAIRS (SUITES)	*
M	BURN-WOOD SUITES AND ARM CHAIRS	*
N	SOLID WOOD FRAMES FOR M	*
O	SOLID WOOD FRAMES FOR L	*
P	UPHOLSTERED BEDS AND BEDHEADS	*
Q	COLOURED BEDROOM AND LIVING ROOM CORPUS FURNITURE	*
R	COLOURS MESSURY AND CHILDREN'S FURNITURE	*
S	OCCASIONAL STORAGE UNITS (EG. PULL-OUT BEDS)	*
T	BEDROOM CORPUS WITH SOLID ELEMENTS AND VENEERED PANELS	*
U	LIVING ROOM CORPUS WITH SOLID ELEMENTS AND VENEERED PANELS	*
V	HOME OFFICE STORAGE UNITS	*

D. DESIGN CO-ORDINATION AND PRODUCT DEVELOPMENT

Most factories within the group engage the services of a designer and have some kind of product development facilities. Neither function, however, is clearly defined nor adequately catered for and has tended to become at worst an afterthought and at best a necessary evil. Furthermore, a glance at the total range of items produced establishes clearly the need for design co-ordination so that the competition between members, to which reference has already been made, is eliminated.

Having established clear-cut areas of product activity for each individual factory as e.g. that outlined in Table VI, it would be the function of the design co-ordinator to ensure that this is translated into a totally rationalized design programme which would reflect the needs of the market as well as suiting the production facilities of each factory. While it may not be necessary for each to have its own designer, and in all likelihood he or she may be able to work effectively in three or four factories, it will however be essential for each factory to have its own drawing office staffed with at least one or two technicians, and its own prototyping facilities. These two activities should be located close to each other since complementary activities are carried on in each, and the latter should be fully equipped with tools, work-benches and basic processing equipment. Only highly experienced craftsmen should be employed at prototype making and product development.

The design co-ordinator will himself be working in close co-operation with the marketing manager, and together they will evolve a design and marketing policy consistent with the needs of the marketing sector at which the RO is aiming. This will be particularly significant in respect of exports and will at the same time provide an opportunity for accelerated introduction of new designs which might appear less urgent in relation to the domestic market.

Marketing

It is not within the expert's terms of reference to deal with the marketing aspects, and in fact these have already been the subject of another report which could have relevance in the present circumstances. Nevertheless since design, product development and marketing are so closely intertwined it may be of value to repeat the basic principles of a realistic marketing approach.

This should begin with an analysis of the product lines and should include the following phases:

1. Trends in sales volume by item and territory
2. Competitive advantages both weak and strong
3. Gross margins, thus identifying more important items
4. Completeness of line, indicating wasted sales efforts
5. Prices
6. Product diversification
7. Quality, indicating complaints and returns
8. Design and styling
9. Identification by branding
10. Packaging

Then follows a study of the market since successful marketing of a product requires a good product, properly priced and an effective method of selling and distribution. Information about the market may be secured from two sources /a/ a study of the internal records of the organization and /b/ the analysis of data from external sources. Suggestions of the marketing information which should be available are the following:

1. Data on present customers and their characteristics
2. Seasonal or cyclical characteristics.
3. Market potentials, i.e. a determination of reasonably expected sales volume over a given period.
4. Customer purchasing habits.
5. Competitive activity
6. Technical advances.

Having developed a sound marketing plan with the help of the above information it then becomes a matter of examining the effectiveness of reaching that market. This in effect is sales management and should include the following:

1. Selection and training of salesmen.
2. Selection of channels of distribution and method of sales.
3. Determination of sales quotas.
4. Sales territories and routing of salesmen.
5. Advertising and sales promotion.
6. Salesmen's compensation.
7. Price policies
8. Distribution costs.

The expert recommends that particular attention be paid to the reports ^{2/} on marketing prepared by his UNIDO colleague which details an appropriate marketing strategy.

E. PRODUCTION FACILITIES

Apart from buildings and services, this may be subdivided into three main categories, panel production for use in corpus furniture, solid wood production for framed furniture and upholstery.

Panel production

A weakness common to all panel producing factories is the arrangement for initial panel break-down. Most firms are well equipped for veneering, edge-treatment and dowel boring, and this is somewhat at variance with the supply of raw panels on which they depend for subsequent high speed production. Either vertical wall saws or manually operated double and/or single cut-off squaring saws are used. Both these and the men who operate them are the main bottleneck

^{2/} See UNIDO/ITD.330.

which can only be solved by the introduction of automatic or semi-automatic handling and processing equipment.

Factors which influence the selection of a suitable cutting method include:

- the number of panels to be cut,
- the accuracy of the cut,
- the original dimensions of the panels,
- the quality of the sawn edge, and
- the final dimensions and complexity of cutting plans.

On an individual factory basis there would not appear to be sufficient justification for choosing automatic stacking and panel sizing equipment. Since, however, there are no less than six and possibly seven factories involved, the situation alters radically and now there appears to be adequate justification. It may even be said to be the only realistic solution since all the factors referred to are present, and there would be little problem in accommodating the equipment in any one of the factories. Following upon the acquisition of such numerically controlled panel sizing machine, would be the introduction of computerized cutting. The preliminary processing can be carried out by the computer centre and its main advantage is that it can define the optimum cutting plan or the best compromise possible between the cost of preparing and implementing a given cutting plan and the additional yield per panel to be obtained. Such an acquisition on a joint purchasing and usage basis would have the further effect of releasing valuable space in each factory. Cut panels would be delivered in packages and introduced directly into production.

The choice of location for this equipment may also be influenced by the need to introduce foil lamination into production. The proposed design and production programme envisages this for OCUR Srbobran in conjunction with the production of a partitioning system. This will necessitate the purchase of a full-size foil /P.V.C./ laminating plant

whose excess capacity could be delivered to Srebrenik for subsequent dimensioning and delivery wherever it is needed. A further logical development would be the purchase of Vee-grooving equipment for certain types of corpus production and would again fit in very well with the other equipment recommended.

All factories concerned with panel veneering should immediately introduce wood-grain imitation plastic edging as a replacement for wood veneer. The former is now available in a variety of finishes, is easily applied, since all edge-banding machines are fitted with edging magazines, and it eliminates the difficult and time-consuming job of finishing edges manually after curtain-coating.

Both OOURs Bosna and Budućnost must provide for solid edge treatment of particle board and since their current edge-banding machines are not suited to this purpose, they must seriously consider the purchase of solid edge-lipping machines and/or radio-frequency edge lipping equipment. The latter has the advantage of providing the opportunity for greater flexibility in design and is therefore recommended.

OOUR Namještaj will eventually use melamine-faced particle board for all its carcass work in the production of kitchens and at that stage could provide itself with valuable additional space by transferring its lacquering and drying plant to Srbobran which at present does not have one.

Reference was made in the previous report to the chronic congestion experienced in most factories visited by the expert, and Majeвица is no exception in this regard. It is generally caused by poor factory layout, unsatisfactory use of space, a high reject rate and poor material handling arrangements. In reviewing the latter, greater attention should be paid to the suitability of particular

items of handling equipment for particular purposes. This should apply not only to the movement and transfer of work-in-progress, but also to the handling of finished goods. For example, all fully assembled storage units should be kept on castorized bogeys, and fully upholstered suites can easily be moved about as well as protected from damage on double-decker frame trolleys. Both types can be stackable and will thus take up little room. The maintenance system of each factory should include that of pallets, bogeys, and transfer systems and since the two former usually have a limited life cycle would also include periodic replacement.

Solid Wood Production

This will be concerned mainly with the production of "show-wood" arm chairs and settees, table frames, frames for upholstery, solid wood elements for special designs and a limited range of chairs. The factories involved in this aspect of production are Brčko, Budućnost and Jadrina. All three are also engaged in the production of upholstery, but the two latter will produce show-wood seating since they already have the appropriate production equipment.

The output from both factories of furniture and frames based on solid wood components should be sufficient for the total needs of Majeвица for the foreseeable future. The latter which will be mainly for the production of upholstery should include in addition to solid wood, particle board, plywood, metal, plastics and combinations. Provision should therefore be made for these alternative materials, both at the design and production planning stages.

Upholstery

The proposal for product rationalization and a degree of specialization envisages the concentration in four factories: Brčko, Budućnost, Jadrina and 29. Novembar. All are already

experienced in this field, are located close to each other and in very many ways can co-operate with each other to their mutual benefit. In all cases consideration will have to be given to the re-organization of their existing upholstery factories or the building of new ones. This is particularly the case for Brčko and 29. Novembar whose present buildings and equipment are totally inadequate.

Budućnost have already had this department replanned by "Centar za razvoj drvne industrije Sl. Brod". Apart from minor amendments which were discussed with the management, the expert agrees with the proposals and urges their implementation at as early a stage as possible. Since the emphasis in all cases will be on large series, high volume output, there is the possibility of establishing flow-line production with greater emphasis on mechanization and improved handling and transport arrangements. As far as equipment is concerned, the fact that the four factories will be co-ordinating their design and production will enable them to jointly store such materials as textiles and foam cushioning, to have a common inspection system for covering materials and common facilities for measuring, marking and cutting. The expert also recommends greater use of loose cushioning systems in both the design and technology of production. This will give greater versatility in the range of models produced and will enable the introduction of such sewing techniques as blind seam profiling, gathering and ruffling, button tufting and quilting. It will also enable the further mechanization of activities including cushion filling and closing, zipping, frame springing, and upholstery assembly.

From the above it may be concluded that careful and detailed planning is essential for modern upholstery production. It was evident to the expert that experience particularly in this field is lacking by both the factory planners and the production personnel in the factories concerned. Further and more concentrated professional advice is needed

and he therefore recommends that any future UNIDO assistance planned for Šipad should place particular emphasis on this aspect of the industry.

F. ORGANIZATION OF PRODUCTION

Since marketing and sales will no longer be the responsibility of individual factories, this should have the immediate effect of releasing personnel to concentrate on the important work of planning and co-ordinating production so as to maximize on capacity, achieve an acceptable level of productivity and produce merchandise which is up to required standards. That this is not the case at present may be deduced from the existing low level of output per worker per annum which averages less than 200 thousand dinars, a figure far below that achieved in other European countries. It may further be deduced from the poor quality of some of the furniture displayed by Majeвица at the recent Yugoslavian Furniture Fair held in Belgrade, and the lack of attention to detail in almost all of it.

Referring to Table No.VI, it will be seen that none of the factories fare very well either in the analysis of the organization of production or in production itself. This is because in both cases they lack formalized and systematic control procedures which would have established a system of production planning and control to which everyone would work. Undoubtedly some form of control does exist, but it is of a rudimentary nature and for factories of the size with which this report is concerned, is not, as already pointed out, effective in dealing with the complexities of production and the demands of quality standards.

It again became evident to the expert that most, if not all, personnel responsible for the planning and control of production are quite inexperienced in this regard. They received little or no training either in its principles or

implementation during their formal studies and since coming to work in their individual factories have had to make do with what they devised themselves. It is therefore time to put things right and appropriate to do so in the context of all the factories so that a common system of production planning and control may be evolved.

This system is defined by the British Standards Institute as "the means by which a manufacturing plan is determined, information issued for its execution and data collected which will enable the plan to be controlled through all its stages".

The particular functions involved in production planning and control are as follows:

1. Development of the manufacturing programme

2. Pre-production planning

involving: product specification

process planning

materials
planning

requirements
scheduling

purchasing and
stock control

3. Planning and control of manufacture

involving: input control { -selection of orders
-scheduling of orders
- loading of process
centres

output control - expediting

4. Inventory control

The design and installation of such a system of planning and control is both time-consuming and exacting. Furthermore, its establishment must be the responsibility of the production management personnel themselves and this is particularly the case in this instance when in so doing they may also achieve an improvement in their furniture production technology, a weakness which is at

the root of their problems. All of the subheadings included in sections 3 and 4 of Table VI need to be familiar to them because they are the basis upon which an effective system of production planning and control is built. They will need skilled advice and assistance in this task and the expert recommends that it should also be included as a matter of priority in any future UNIDO programme in industrial engineering.

Meanwhile there is much that production management can do to help itself. As has been seen, some form of production control is in operation in each factory and can be improved upon by making a careful analysis of it, establishing its strengths and weaknesses and thereby developing a more effective system. Annexe 5 outlines how this may be done and concludes with a note on its relevance to eventual computerization.

In the case of pre-production planning, an aspect which appears to be missing from all factories is a detailed product specification. This would partly explain the poor quality of some products already referred to in an earlier paragraph, and also the lack of attention to detail. This specification, which includes content, form and quality applies not only to products manufactured by "Majevisa", but also to all Šipad products and is therefore also the responsibility of the Research and Development ŠIPAD Kombinat. They should therefore prepare such a document without further delay, and while it will be in line with the standard specifications laid down by the Yugoslav Bureau of Standards, should also spell out in considerable detail its practical application at production level. The expert discussed this with R&D ŠIPAD who have agreed to the proposal.

G. MANAGEMENT AND LABOUR

Management

Table VII gives an analysis of the number and qualifications of the management personnel at Working Organiza-

tion and individual factory level. The most significant aspect of this analysis is the large number of managers and supervisors in each of the job categories who were trained outside the industry and, as far as can be ascertained, whose training had little reference to the specific needs of furniture production. This contrasts quite sharply with the industry in many other European countries where most managers and supervisors are recruited from within the industry itself and the majority have had a craft or technician background. The remainder, with the exception of accountants, marketing and sales personnel, would have been trained specifically in furniture production or design.

This is not to suggest that the employment of engineers, wood or mechanical, is bad for the industry. On the contrary, their advent should bring much needed professionalism to it provided they have come to terms with its craft as well as its science-engineering based background. The craft element is difficult to define precisely, because it is a combination of manual skills acquired over a period of time, an intimate knowledge of such materials as wood and how it should be worked, fabrics, adhesives, and surface coatings. It is also concerned with structural aspects and attention to detail and is acquired by learning, experience and aptitude.

In the case of Majeveica, the quality of its technical and production management in particular, may be judged from that of its range of products. On this basis it is fair to suggest that the management is seen at its weakest, and it is not difficult to escape the conclusion that the root cause is lack of appropriate training. In order to organize and plan production effectively, management must be completely familiar with every aspect of it, and it must then use its management skills to exploit them productively and profitably. These are the skills of work study, production planning, quality control, machine adap-

TABLE VII
ANALYSIS OF R.O. NAUTICA MANAGEMENT PERSONNEL

No.	Job Title	BOSNA BRČKO		SARAJEVO		ZAGREB		SPLIT		Zadarina		Srebrenica		Stolar	Other
		Y.E.	W.E.	Y.E.	W.E.	Y.E.	W.E.	Y.E.	W.E.	Y.E.	W.E.	Y.E.	W.E.		
1.	Director														
2.	Deputy Director														
3.	Chief Engineer (Main Course)														
4.	Chief Engineer (Auxiliary)														
5.	Chief Engineer (Main)														
6.	Chief Engineer (Auxiliary)														
7.	Chief Engineer (Main)														
8.	Chief Engineer (Auxiliary)														
9.	Chief Engineer (Main)														
10.	Chief Engineer (Auxiliary)														
11.	Chief Engineer (Main)														
12.	Chief Engineer (Auxiliary)														
13.	Chief Engineer (Main)														
		788		788		788		788		788		788		788	
		501		501		501		501		501		501		501	
		150		150		150		150		150		150		150	
		341		341		341		341		341		341		341	
		65		65		65		65		65		65		65	
		107		107		107		107		107		107		107	
		n.a. 2/		n.a. 2/		n.a. 2/		n.a. 2/		n.a. 2/		n.a. 2/		n.a. 2/	

Key: Ec. - Economist - 4 years university
 W.E. - Wood engineer - 4 years university
 T.E. - Technical engineer - 4 years university
 ELEC.E. - Electrical engineer - 4 years university
 TNL - Technologist - 2 years university
 TNL.Ec. - Technologist economist
 TNL.W. - Technologist wood
 TNL.Orgs. - Technologist for organization
 TNC.T. - Technician with tech. inst. base
 TNC.T.Ec. - Technician economist
 TNC.T.W. - Technician wood
 TNC.C. - Technician with craft base
 C - Craft workers
 Law - Lawyer - 4 years university
 D.A.P.A. - Diploma of Academy of Fine Arts

1/ Main services at R.O. level for COURS BOSNA, BRČKO and SREBRENICA
 2/ Provides services to all COURS

tation and improvisation, low cost mechanization, machine setting-up and maintenance, value analysis and production rationalization.

Like craft training, much of this has got to be learned within a factory or preferably within a group of factories, and thus there is further opportunity within Majeveica to establish joint training programmes where the experiences of all nine factories may be pooled and shared.

This in-factory training programme can and should begin without delay, for both management and workforce. In the case of the former the expert recommends that it is carried out over the entire year and should begin with a week-long workshop at which training policy would be formulated, specific aspects assigned to individuals in respect of organization, co-ordination, and preparation of specific training modules and a training officer appointed to take complete charge of all training for both management and workforce. This should also provide the best opportunity for initiating production planning and control systems referred to earlier, and during subsequent day-long workshops to be held at fixed intervals progress may be checked and monitored.

The expert was unable in the limited time at his disposal to observe in detail the day-to-day activities of production engineers and supervisors. He nevertheless harbours more than a suspicion that many are not doing the work for which they were originally appointed and tend in many instances to confuse being busy with being profitable. He has already drawn attention to, for example, the almost complete absence of work study, ineffective production planning and low productivity. These are the areas which will always require most attention, and can only be fruitfully exercised by the trained engineer.

Table VIII suggests a management organization format which should be developed by each OOUR on the basis of its

own production programme. Detailed job descriptions should then be prepared and levels of responsibility defined. A good production management team will be a careful blend of engineering and craft know-how. In general the engineer and technologist will concentrate on the organization of production, production planning, work study and machine utilization while craft technicians will be responsible for product development, quality control, progress chasing and supervision. It should be noted that the proposed programme of rationalization will centralize the activities of the commercial and planning departments, releasing personnel to concentrate fully on production.

Labour

The expert has formed a good impression of labour which is hard-working, intelligent and potentially, at any rate, very skilled. If, at present, it is neither as productive nor as quality conscious as it might be, it is less its own fault than that of the absence of skilled direction and good training. Both can be remedied without undue difficulty and in the case of training should be done, as for management, on a formal and planned basis. This is particularly important for those who are joining the workforce for the first time, when care should be taken to integrate them into full production on a staged basis of accumulated skill and experience. This means that a section of each factory should be set aside for training only. It should be supervised by a skilled craftsman and equipped with workbenches, tools and appropriate machines. Training programmes should be devised on the basis of developing good production skills and the special needs of the factory. Learners and apprentices should work for a period in each department in the factory in order to obtain a good over-all knowledge of their industry and they should be

TABLE VIII
MANAGEMENT ORGANISATION CHART FOR EACH OUR



encouraged and supported to attend technical colleges and evening courses.

Phasing the introduction of
integration and rationalization

There can be no hard and fast rules regarding the nature and characterization adopted by any particular RO during its integral growth. Indeed, it would be unwise to set any limits or constraints on its development. Rather should it grow in its own way developing its own identity, while fitting into the strategy of the Šipad organization as a whole. Table IX outlines the areas which may be considered by Majeвица for this purpose. Not all will lend themselves to immediate adoption but there are, as has been emphasized, many areas where immediate co-operation would be to many factories' benefit, and these are the ones which should therefore be incorporated in any programme for the immediate future i.e. 1978.

Those activities which the expert would particularly recommend at this stage include:

- the establishment of a corporate design and product policy;
- concentration by individual factories on specific and non-competing areas of the product policy;
- provision of common storage facilities for finished goods;
- joint purchasing of materials and equipment in conjunction with Šipad-Komerc;
- combining to acquire certain joint production facilities;
- establishing common procedures for factory planning, production planning and quality control;

TABLE IX

ACTIVITIES APPROPRIATE FOR
NATIONALISATION AND REORGANISATION

1. Products: Design and Styling
Designers
Design Development, Draughting
Prototyping
Product Rationalisation
Specialisation and Diversification
Completeness of range
Component Production
Product Testing
Co-ordination with Sipad
Storage
2. Purchasing: Raw materials - ex Yugoslavia
" " - imported
Machinery and Equipment
Storage
3. Production: Low cost mechanization
Special processing, incl. shaping/finishing
Spare capacity
Combined facilities
4. Management: Production and administration documentation
Standard Specification and Quality Control
Pooling skills and ideas
Work study
Incentive payments
Stock control
Factory Planning
Inter-firm comparison
5. Training: Selection procedures
Training programmes for all levels
Inter-factory training
Study tours, scholarship, fellowships
Training officer
Technical information / library
Safety
Research and Development
6. Factory Services: Building Maintenance
Machine " "
Maintenance workshop
Mobile maintenance trucks
Transport, internal and external
Transport maintenance

- common training programmes for all levels of personnel;
- provision of common technical information service;
- combined marketing and sales;
- participation in common computer programming;
- development of existing and new export markets.

The responsibility for the detailed planning, implementation and co-ordination of this programme lies with the Director and staff of RO Majevisa at Brčko. The expert is satisfied that in general the personnel is qualified and suited to the task, but recommends that the team be further strengthened by the inclusion of a financial executive to advise on investment co-ordination, and financial planning. He further recommends that a special joint committee, representative of all the factories involved, be appointed to consider approve and monitor plans for integration and rationalization. This will have the added advantage of ensuring full co-operation from each OOUR as well as keeping it fully informed of progress.

Some fears have been expressed that any form of co-operation among factories, leading to some degree of specialization and improved productivity, will cause some redundancies among the workforce. This is not necessarily the case, and hardly likely to occur in the present instance, where the emphasis is placed firmly on increasing added value to the range of products. The design of products will be expected to improve considerably, and this will be partly achieved by incorporating more labour intensive and higher standards of skills at every stage of production. Secondly, the range of products itself is being widened in order to obtain a greater share of the market, and thirdly there will be a concerted effort to find new and lucrative markets abroad, in order to absorb the anticipated increase

in productivity.

II. FUTURE UNIDO ASSISTANCE

The expert recommends that future UNIDO assistance in industrial engineering be continued along the lines recommended in this and in the previous report.

Particular emphasis should be placed on the following:

- the design and implementation of a comprehensive production planning and control system which would be suitable with minor amendments for all factories;
- the preparation of detailed standard specifications for the design and production of both domestic and contract furniture;
- the introduction of quality control systems at individual factory level;
- the provision of advice and assistance in the planning and operating of chair and upholstery factories;
- assist in the design and establishment of in-plant training programmes for all levels of personnel;
- train counterparts in management procedures, work study and the organization of production;
- provide further advice and assistance in factory integration and production rationalization.

The programme should best be carried out during two two-month periods in order to allow the personnel involved to fully implement the expert's recommendations.

II CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

1. The furniture industry in BiH and particularly within the Šipad organization could have a promising future with regard to exports.
2. Existing factories are generally well equipped and those planned for future development appear realistic if somewhat stereotyped.
3. Particular attention is still required in the fields of design, quality, factory organization, productivity, marketing, training and inter-factory collaboration.
4. Because of concentration on industrial development of furniture production, the position regarding the home market is reaching saturation point and factories will, from now on, have to examine seriously their prospects for increased exports.
5. This will call for a high degree of rationalization of production so as to optimize factory capacity and sell competitively.
6. The prospects for this form of rationalization leading to horizontal integration are particularly opportune at Working Organization level within the Šipad organization.
7. The principles of such integration are enshrined in the constitution of the RO's.
8. To be successfully achieved, however, they require total commitment in the part of each factory involved.
9. Up to now, there appears to have been rather more talk about integration and rationalization than action.
10. This in turn has led to misunderstanding especially at factory level, of the aims and objectives of such rationalization.

11. Most fear a loss of identity in terms of both products and markets and a consequent diminishment of status to that of a production cipher.
12. Such fears need to be allayed by Šipad-Komerc which has a particular responsibility in this regard.
13. RO Majevisa offers great scope for this form of inter-factory collaboration, and the benefits should be apparent within a short period of its commencement.
14. The experience gained and the lessons learned by RO Majevisa should be of considerable help to other RO's attempting a similar programme.
15. The implementation of any proposals for rationalization is neither intended to nor will it result in a reduction of the workforce in any of the factories involved. It will however ensure that the workforce is more productively and profitably employed.

B. Recommendations

The following recommendations should be regarded in the context of the re-organization and development plans prepared by the expert and his team for implementation by RO Majejica over the next five years. These plans are aimed at rationalizing production within the RO, improving output, increasing exports and making the total operation more profitable:

Products

1. A new product policy should be evolved which takes account of the needs of the market served by the RO, the production facilities available or planned, and the need to avoid inter-factory competition.
2. The product policy should then be translated into a design programme which will include the retention of some models, the re-designing of others and the replacement of the remainder by new designs.
3. Particular emphasis should be placed on design for export and the group should seriously consider the retention of an established international designer for this purpose.
4. All design programmes should be co-ordinated at RO level by the permanent design co-ordinator.
5. Designs should as far as possible be standardized in terms of material usage, dimensioning modularity and component interchangeability.
6. Account should also be taken of individual factories with specialized production facilities, producing components for another factory.
7. Design and drawing-office facilities should be provided for each factory.

Product development

8. Each factory should have its own prototyping and product development facilities separated from the main factory and staffed by craftsmen.

9. The physical aspects of production preparation such as dimensioning and processing aids for individual components should also be done in the prototyping workshop.

Raw materials

10. Rationalization of production will enable joint purchase of raw materials with consequent cost savings. This should be availed of in collaboration with Šipad-Komerc.

11. The factories should endeavour to be more selective in their purchase of metal and plastic fittings, cover materials for upholstery, foam cushioning and springing and webbing systems.

12. OOUR Namještaj should endeavour to obtain supplies of melamine-faced particle board for the production of kitchen units.

Production

13. All factories producing panel-based products should jointly purchase automatic sizing equipment, which would be located in one factory for distribution of cut panels to the remainder.

14. They should also jointly purchase foil laminating and vee-grooving equipment for joint production of certain designs.

15. Plastic edging should replace veneered edging on veneered panels, and for certain types of production, facilities for solid wood edge treatment should be introduced.

16. Materials handling arrangements and internal transport systems should be reviewed and more suitable pallets trolleys, bins and lift trucks used.

17. The flooring in some factories is unsuited to such traffic and should be replaced.

18. There should be stricter control of work flow, and waste should not be allowed to accumulate indefinitely.

19. Rationalization of upholstery production should allow, for example, 29.Novembar, to be supplied with frames for upholstery from one of the other OOURs.

20. Production of upholstered frames should also include show-wood frames especially for contract use.

21. All upholstery factories should be re-planned and re-laid out in accordance with modern upholstery technology, and as discussed with individual OOURs.

22. Arrangements should be made for joint purchasing inspection, storage and cutting of upholstery fabrics and cushioning.

23. Upholstery production should include a higher proportion of loose cushioning systems.

24. There should be a common production planning and control system for all factories which should be designed by the production personnel responsible and implemented by them.

25. This should form a major part of any future UNIDO assistance in industrial engineering.

Quality Control

26. All factories should pay much greater attention to product quality and product detailing.

27. In order to assist in this respect, the Research and Development department of Šipad-Kombinat should prepare a detailed quality control specification for furniture production which should be used as a hand-book of quality by all the factories.

Management

28. Professional production personnel should concentrate on the work for which they were trained i.e. the organization of production, and should be less concerned with work which is more correctly that of the supervisors and technicians.

29. Their lack of training and experience in work study, production planning, product development and production technology should be immediately made good by conducting a series of special workshops and seminars at R.O. level on these subjects with the assistance of UNIDO.

30. The functions of the various grades of management should be clearly defined in order to avoid unnecessary overlapping in performance, and to ensure complete accountability.

31. There should be a common in-plant training programme for all levels of personnel within RO Majeveica, and provision for this should be made in each factory.

32. RO Majeveica should take responsibility for co-ordinating the training programme and should appoint a full-time officer to supervise it.

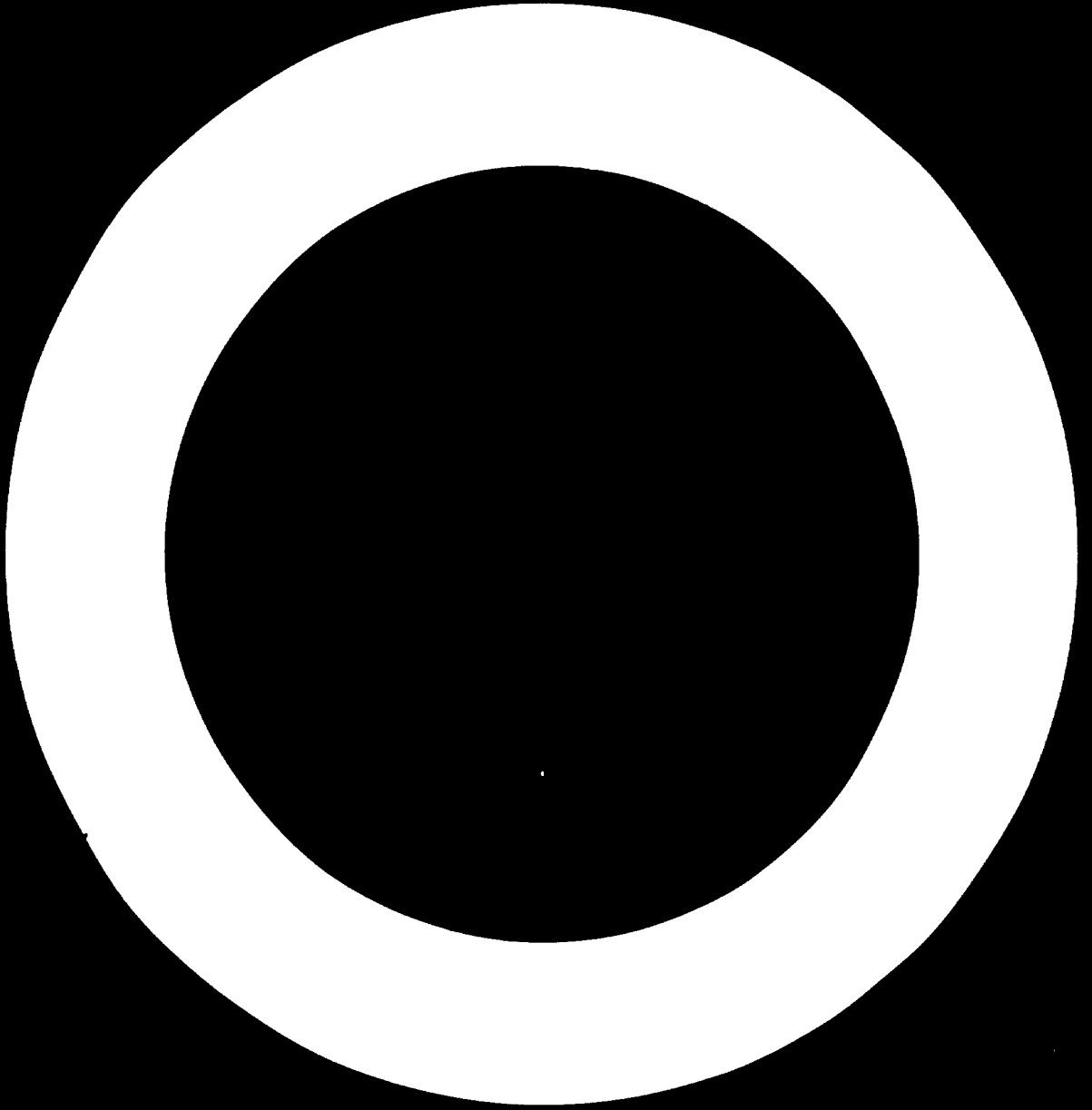
Phasing of integration and rationalization

33. This should be planned for implementation over a period of five years, with the first year concentrating on the development of a common product policy, and combined

activities regarding joint purchasing, sales, in-factory management procedures, training and technical information.

34. The "Majevica" co-ordinating team should be strengthened by the inclusion of a financial adviser.

35. There should be a joint committee appointed which is representative of all the factories involved to advise and monitor plans for the implementation of the integration programme.



ANNEX I

JOB DESCRIPTION
DP/YUG/73/006/11-03/P/31.7.A.

POST TITLE	Expert in Industrial Engineering
DURATION	Two months
DATE REQUIRED	October 1977
DUTY STATION	Sarajevo; with travel in the Republic of Bosnia and Herzegovina.
PURPOSE OF PROJECT	To assist in the development of the furniture and joinery industries of Bosnia and Herzegovina, and the creation of a Centre
DUTIES	<p>The expert will be attached to the SIND computer centre (which will eventually be incorporated in the Centre to be created). He will be responsible to the National Project Director, and will, in collaboration with the Director of the computer centre and its national staff, assess the state of development of industrial engineering in the Republic's furniture and joinery industries and elaborate a plan for the assistance which the computer centre could give to these industries through the consulting service it is intending to create. Specifically, the expert will be expected to:</p> <ol style="list-style-type: none">1. Implement the plan recommended during the first mission completed earlier in 1977.2. Train counterparts from the factories, Subproject and the computer centre in this field.3. Recommend any further measures to be taken by SIND, the Government and/or international organizations to improve the level of industrial engineering in SIND's furniture and joinery plants. <p>The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further actions which should be taken.</p>
QUALIFICATIONS	Industrial engineer with high level experience in consulting to a large number of industries, experience in furniture and joinery industries in particular.
LANGUAGES	English; French an asset.

ANNEX 2

REPORTS ON STUDY TOURS TO ENGLAND

A. FURNITURE GROUP

1. GENERAL

On October 22 1977 a group of production engineers from the furniture industry in Bosnia and Herzegovina (BH) went to the United Kingdom of Great Britain and Northern Ireland for the purpose of visiting factories, training and research institutes concerned with the furniture industry. There were 12 engineers in the party most of whom came from the SIFAB Timber Industry Sarajevo. The group was led by Mr. D.P. Cody, expert in Industrial Engineering UNIDO, and was accompanied by Mrs. Janja Stanisic also of the SIFAB organisation who acted as interpreter. Annex 1 gives the names of participants.

The tour was sponsored by the UNITED NATIONS DEVELOPMENT PROGRAMME, Belgrade in collaboration with United Nations Industrial Development Organisation and was part of the parent project "Centre for the Development of the Furniture and Joinery Industries, Sarajevo" (DP/YUG/73/006). The party returned to Yugoslavia on October 29 1977.

The tour was organised in collaboration with the British Furniture Manufacturers Association Young Management Group, 17 Berners Street, London W1P 4EX. The secretary of the Group is Mr. J.T. Southey.

2. FINDINGS

2.1. Design

- (i) All factories visited employ professionally trained furniture designers who are engaged on a full-time or consultancy basis.
- (ii) All the designs examined reflected a high level of quality and attention to detail. Aspects peculiar to an individual factory were fully reflected in terms of design and assembly inter-compatibility.
- (iii) Usually about six models of the furniture are developed by the factory before a final model is produced. While the model is produced, other market research is planned for production.

- (iv) All factories have design and drawing offices and fully equipped prototyping workshop.
- (v) In addition to at least one designer, each factory employs a technician or draughtsman for design development and production planning.
- (vi) Each factory has its own show-room which is tastefully laid out. Promotional literature such as catalogues and other information leaflets are well designed and the photography is of a very high standard.

2.2. Production

- (vii) In general production facilities i.e. buildings, internal transport, machinery and equipment, are not as up-to-date as those on L.I. Ltd. is because the industry here is relatively new (about 10 - 15 years) whereas all factories visited have been in business at least 50 years.
- (viii) Despite in some cases, cramped conditions, internal organisation was good, reflecting a strong emphasis on production planning, a balanced work plan and good storage and materials handling arrangements.
- (ix) Quality control was found to be very good. It was emphasised by management that even though there is an inspection system, much of the exercise of quality control is made the responsibility of individual workers.
- (x) Greater versatility in design exploitation, particularly in corpus production is achieved by incorporating solid edge lipping in veneered panels (which can be subsequently sanded) and using solid wood elements in conjunction with veneered particle board.
- (xi) Fittings (metal and plastic), accessories and particularly upholstery materials are more varied and of better quality than those available in Yugoslavia.
- (xii) Machine maintenance and machine setting-up procedures are carefully planned in advance of needs. Each factory has a well equipped tool room.
- (xiii) Individual machines have been adapted for specific processes and purpose-made equipment for

machining and transport is a feature of the machine department. A particularly good example of this was the sanding attachment which had been fitted to the "nye" automatic shaping machine.

- (xiv) There appeared to be a low component reject rate, and only materials actually in the course of production were in evidence.
- (xv) Storage of raw materials and finished goods was in two cases reduced to a minimum. One factory delivered each weekly output during the following week, and another had so arranged things that it was never required to carry more than a week supply of hardwoods and sheet materials. Savings in working capital requirements were said to be dramatic.
- (xvi) Production planning and control documentation was much in evidence and explained the effectiveness of management organisation despite what could be regarded in some instances as excessive variety in the models produced.
- (xvii) Production of upholstery although very well organised in one factory is still produced on a "one off" basis i.e. by individual tailoring. Nevertheless the standard is extremely high and the delegates were very impressed by the skills of the cutters, sewers and upholsterers.
- (xviii) Productivity or output per worker is generally high by Yugoslav standards. One factory, for example, employing 60 workers had an output of 6 million pounds sterling per annum. This is probably exceptional, and reflects not only the high unit value, but also the degree of rationalisation achieved. In general it is about ten times the annual wages paid for workers, and materials costs average at about 45% of the ex factory selling price.
- (xix) The ratio of ratio of direct employees to all others is about 4 - in contrast to Romania where it is often 1 to 1.
- (xx) Many factories have fully computerized their administrative and production planning procedures. One factory in the group visited had a centralised 14 cost centres for the production of high quality upholstery which included weekly production, stock and loss information to be extracted. This factory also participated in the U.S.S.R. Computer Area.

2.3. Management

- (xxi) Most factories in the UK are owner-managed and there are fewer engineers than in Yugoslav factories.
- (xxii) Most managers have technical backgrounds, but it was stressed that to be successful they must have a good grasp of finance and administration.
- (xxiii) Most managers have had experience with a variety of factories and all consider it an essential element in developing their management expertise.
- (xxiv) Management places strong emphasis on teamwork in the exercise of effective procedures for design and product development, setting and achieving of realistic production targets, quality control and marketing and sales.
- (xxv) Management considers that there is no substitute for personal supervision, and this aspect coupled with sustained progress-chasing are regarded as the key elements in achieving acceptable levels of productivity.
- (xxvi) Another essential element in effective management is that of remaining abreast of current technological developments in the industry. Most major trade publications, trade literature and for example, the Furniture Industry Research Association's (FIRA) technical bulletins are received at the factory and are circulated to all management staff. Managers constantly attend courses, seminars and trade fairs as well as participating in study-tours abroad.
- (xxvii) A category of management not usually found in Yugoslavia, but considered of great importance in the UK is the furniture technician. He has a high level craft background and receives further training usually at a technical college. His function is to bridge the gap between the top production manager (in our case, the engineer) and the production workers and therefore provides valuable input in the areas of prototyping, product development, production planning and machine utilization.
- (xxviii) Whenever management employs outside consultants to either re-organise an existing factory or plan a new one, it is understood that the consultants will not only prepare detailed work

plans, but will also supervise their implementation to the stage where the productivity targets set by them are achieved. Indeed a large proportion of their fees are withheld by mutual agreement until this stage is reached.

2.4. Research and Development

- (xxix) This is carried out on behalf of the industry by the Furniture Industry Research Association (FIRA) which offers a comprehensive service to the industry.
- (xxx) FIRA provides research, testing and technical and management advisory facilities for furniture manufacturers and their suppliers of materials, components and machinery. It is financed by the furniture manufacturing industry, government contracts and fee earning activities and employs about 85 people.
- (xxx1) At FIRA the following services are provided:
 - (a) Research services, testing and fault finding including:
 - Performance testing and structures;
 - adhesives, materials and finishes,
 - upholstery covers and fabrics,
 - upholstery fittings and suspension systems,
 - ergonomics
 - chemical services
 - machining
 - health and safety
 - testing and trouble shooting
 - (b) Technical Services including:
 - technical inquiries
 - factory planning
 - production, loading and control
 - furniture design assessment
 - pricing
 - costing
 - workshop services
 - (c) Consultations including:
 - library information service
 - technical information, technical bulletins,
 - research reports, new developments,
 - seminars, articles
 - statistical information
 - (d) Marketing services including:
 - analysis of the economic situation
 - research surveys

marketing statistics
techno-economic studies of furniture
industry
consultancy

(c) Computer Bureau including:

budgeting
standard costing
product cost estimating
production planning

2.5. Training

- (xxxii) The industry is well serviced with regard to industrial training at all levels of personnel.
- (xxxiii) Colleges such as the Nottingham College of Higher Education and the London College of Furniture provide pre-graduate and post-graduate courses in Design, Timber Technology, Production Management and Materials Technology. These courses may be of full-time or part-time duration depending on the subject and level. Additional courses are also provided on a "day release" or "block release" basis for apprentices and learners in the furniture industry. Subjects include materials technology, woodmachining and saw doctering, quality control, timber drying and craft courses.
- (xxxiv) In factory training is the responsibility of the Furniture and Timber Industry Training Board (FTTB). This is a statutory organisation with taxes to compel individual factories to establish in-factory training for all levels of personnel. It is operated on a grant-levy basis, each factory paying an annual levy to the Board which is based on a percentage of turn-over and being re-imbursed by way of grant when it had fulfilled its training obligations.
- (xxxv) Each factory has a full time training officer who plans and supervises the factory training programme.
- (xxxvi) Each factory usually sets aside a section for apprentice and learner training. This is a fully equipped area with all the tools and machinery and young trainees in particular spend some time here before being fully integrated into normal production.

3. CONCLUSIONS

- 3.1. Individual furniture factories in the British Furniture Industry are generally small by Yugoslav standards.
- 3.2. Products are professionally designed and manufactured to a high level of quality.
- 3.3. There is a high degree of product sectionalisation with many interchangeable components.
- 3.4. There is good internal factory organisation reflecting experienced and well trained management.
- 3.5. The industry is well advanced in computerisation. Where a factory is large enough it has its own computer, otherwise it uses Computer Bureau.
- 3.6. Productivity is generally high and is accounted for by good management, a high level of skills and a high unit value per product.
- 3.7. The industry enjoys very good research and development facilities.
- 3.8. Industrial training at all levels is a major feature of personnel management.

FOUR WEEKS

- Saturday 22 October Depart Zagreb Airport
Arrival London
Transfer to Kent Palace Hotel.
- Sunday 23 October A.M. Pre-view and discussion re aims
and objectives of tour.
P.M. Visit Queensway Furniture Supermarket.
- Monday 24 October All day visit to London College of
Furniture, London E1.
- Tuesday 25 October A.M. Ticker Bousty Training Centre, High
Wycombe, Buckinghamshire.
P.M. Buckingham College of Higher Education,
High Wycombe.
- Wednesday 26 October A.M. A.S. Furniture Ltd., Harringay, London.
P.M. Nathan Furniture Ltd., Brenton, London.
- Thursday 27 October A.M. A.S. Stephens Ltd., Radnall, Walford.
P.M. Furniture Industry Research Association,
Stevenage, Hertfordshire.
- Friday 28 October A.M. International Woodworking Industries
Exhibition (IWIIE), Exhibition Centre,
Birmingham.
P.M. Review of study-tour and discussion
concerning its implications for Yugoslav
furniture factories.
- Saturday 29 October: Depart London Heathrow
Arrival Zagreb,

LIST OF PARTICIPANTS

<u>Name and function</u>	<u>Radna organizacija</u>	<u>Location</u>
Kasumović, H. Technical Director (Furniture Production)	Radnik	Bos. Gradiška
Ninković, M. Chief of Department (Production)	Krivaja	Zavidovići
Mitrašinović, S. Chief of Production (Production)	Varda	Višegrad
Jusić, S. Technical Director (Production)	Una	Bos. Krupa
Tomas, R. Director Technical Department (Furniture)	Vrbas	Banja Luka
Simeunović, I. Director Furniture Factory	Sana	Sanski Most
Hadjić, M. Director of Factory (Production)	10. avgust	Vlasenica
Guštin, J. Chief Projectin-Designer for Technology in Wood Industries	Šumaprojekt	Sarajevo
Mutapčić, H. Co-ordinator for Development (Furniture Production)	Majevisa	Brčko
Berberović, H. Technical Director (Production of Furniture)	Srebrenik	Srebrenik
Jirota, K. Chief, Department for Development (Furniture Production)	Standard	Sarajevo
Milanović, M. Consultant (Scientific)	IRC	Sarajevo

B. Joinery and timber-framed housing group

1. GENERAL

On December 4 1977 a group of production engineers from the Joinery industry in Bosnia and Hercegovina (Bih) went to the United Kingdom of Great Britain and Northern Ireland for the purpose of visiting factories, training and research institutes concerned with the joinery industry. There were 12 engineers in the party all of whom came from the SIPAD Timber Industry Sarajevo. The group was led by Mr. D. P. Cody, expert in Industrial Engineering UNIDO, and was accompanied by Mrs. Janja Stanisic also of the SIPAD Organisation who acted as interpreter. Annexe 1 to this report gives the names of participants.

The tour was sponsored by the UNITED NATIONS DEVELOPMENT PROGRAMME, Belgrade in collaboration with The United Nations Industrial Development Organisation and was part of the parent project "Centre for the Development of the Furniture and Joinery Industries, Sarajevo" (DP/YUG/73 006). The party returned to Yugoslavia on December 11 1977.

The tour was organised in collaboration with the British Woodworking Federation, 82 New Cavendish St., LONDON W1M SAD. The Secretary of the Association is Mr. Douglas E. Hall.

2. Findings

2.1 Products

(1) The major product areas of the British Joinery Industry are:

- architectural and general joinery
- built-in units
- doors
- structural and component elements
- timber-frame buildings
- windows and door frames

(ii) The main species of timber used in the production of joinery are:

(a) Softwoods : European Redwood (Scots Pine)
Douglas Fir

(b) Hardwoods: Afzelia, Iroko, Utile, Mahogany, Red Meranti and Dark Red Lauan.

Some firms use Canadian Hemlock for the production of framed doors.

(iii) All joinery is produced in accordance with the relevant British Standard Specification, and quality standards are generally very high.

- (iv) All external joinery is treated with preservative and is an integral part of wood processing and utilisation. The compounds most commonly used for the preservation of external joinery are based on organic solvents.
- (v) Standard joinery, particularly doors and windows is shipped fully packaged in shrink-wrapped polythene.
- (vi) Most factories visited averaged about 10% exports which go mainly to the Middle East, Africa and Europe.
- (vii) Because of increased competition mainly from aluminium windows, the industry has recently embarked on a nation-wide promotional programme of wooden joinery.

2.2. Production

- (viii) In general production facilities i.e. buildings, services, internal transport, machinery and equipment are better than those in BiH. This is because the industry is very well established and has a long tradition in the production of quality joinery.
- (ix) Factories are geared for large series production particularly of standard doors, windows and door sets, i.e. finished doors which are pre-hung in their frames and are fully-furnished.
- (x) Production of doors varies between 50,000 and 16,000 per week; windows between 5,000 and 500 per week; and one factory produces 500 timber-framed houses per year and 1000 standard roof trusses per week.
- (xi) Internal organisation was found to be very good in all factories visited. They were spacious, well laid out and had excellent internal and external storage and transport facilities.
- (xii) Quality control was found to be very good. It was emphasised by management that even though there is an inspection system in every factory, quality is ultimately the responsibility of each individual worker.
- (xiii) Even though there is considerable variety in the joinery produced, there is a high degree of rationalisation in production with many common and interchangeable components.
- (xiv) Storage arrangements allow for the stocking in the same physical location for all timber of the same species, section, and length.
- (xv) In order to reduce running costs to a minimum, it is standard practice to ensure that all equipment is fully loaded.
- (xvi) Great emphasis is placed on the effective maintenance of all machinery and equipment.

- (xvi) Some factories were found to have replacements available for such critical machines as glue spreaders, radio-frequency edge lippers, curtain coaters and front and side loaders.
- (xvii) Machine maintenance and machine setting-up procedures are carefully planned in advance of needs. Each factory has a well equipped tool room.
- (xviii) Individual machines have been built or adapted for specific processes and purpose-made equipment for machining and transport is a feature of every machining department. Good examples of this included multi cross-cutters, trimmer for over-size door skins, novel machining in the production of dowels for frame door construction, specially constructed pneumatic assembly benches for bow-window assembly.
- (xix) Of particular interest was the arrangement for pressing door skins. Two types of adhesive are used, the first of which is quick-setting and is applied on a random "spot" basis enabling light machining e.g. trimming to be carried out immediately after pressing. The second is done simultaneously with the conventional glue spreader ensuring slower-setting and permanent adhesion.
- (xx) One factory had a "high performance" department for the repair of damaged or defective components, ensuring in consequence an exceptionally low reject rate.
- (xxi) Machines of particular interest included: a multiple-angle cross-cutting machine for the production of roof trusses; a double-sided edge-lipping machine incorporating radio-frequency for the application of solid wood edge lippings to flush doors; an automatic doweller for framed door production (make: Challoner U.S.)
- (xxii) Production planning and control documentation was in evidence and was reflected in well-ordered production floor.
- (xxiii) One firm which specialises in the production of standard roof trusses and is meeting a demand in excess of 200 m³ per week had introduced machine stress grading of timber to speed up the visual "appearance" grading and to utilise high grade structural timber not otherwise apparent in visual grading.
- (xxiv) This entailed the installation of a fully automatic line consisting of cross transfer chain, a tilt hoist and infeed table to feed a Robinson 300 mm x 100 mm planer/moulder used to regularise the material, where necessary, prior to its handling via a side transfer and "waterfall" turner on to the infeed of a Computer-matic Mark IVo stress-grader. After grading, the timber is automatically sorted into grades and stacked for removal, using a Duckbill stacker.

- (xxv) Productivity, or the annual value of production per worker is high by Yugoslav standards. In one factory specialising in the production of doors, this was approximately £27000. A break-down of the major cost centres is as follows:
- materials 60%
 - factory labour 5%
 - overheads 25%
 - nett profit 10%
- (xxvi) Timber is normally bought in dimensioned to sectional and length requirements. The budgeted waste factor is 10%, but is, in practice, closer to 7%, thanks mainly to machine stress grading and finger jointing.
- (xxvii) Computerisation of administrative and production planning procedures was a feature of many factories visited, and all were large enough to have their own computers.

2.3. Management and Labour

- (xxviii) Most joinery factories in the U.K. are owner managed and generally do not employ university-trained engineers.
- (xxix) Production management invariably comes from the factory personnel, has a technical-craft background and is subsequently trained in management skills.
- (xxx) Most managers, particularly of production, have had experience in a number of joinery factories, and consider it an essential part of their management training.
- (xxxi) Management places strong emphasis on team work in the exercise of effective procedures for product development, the setting and achieving of realistic productivity targets, quality control, marketing and sales.
- (xxxii) Management considers that there is no substitute for direct and personal supervision. This must be allied to sustained progress chasing and together they are the key element in achieving acceptable levels of productivity.
- (xxxiii) Management remains constantly abreast of technological developments through the availability of good trade magazines, and research publications.
- (xxxiv) A category of management not usually found in Yugoslavia but considered to be of vital importance in the U.K. is the joinery technician. He has a high-level craft background and obtains his technician training at a technical college. He is usually concerned with product development and the physical aspects of production planning, and machine utilisation.
- (xxxv) All factories employ full-time training officers who are responsible for all aspects of in-factory training.

- (xxxvi) This emphasis on training is reflected in the high levels of skill and productivity achieved by the workforce.
- (xxxvii) There is a high percentage of female labour employed on work of a repetitive nature and the delegates were very impressed by their dexterity and productivity.
- (xxxviii) Whenever management employs outside consultants to either re-organise an existing factory or plan a new one, they are expected to also supervise the implementation of their plans through to the production stage.

2.4. Research and Development

- (xxxix) This is carried out on behalf of the industry by the Timber Research and Development Association (T.R.A.D.A.) and the Forest Products Research Laboratories (F.P.R.L.). Both offer comprehensive research, technical advisory and technical information services to the joinery and other woodworking industries.

Both organisations also conduct special courses for personnel in the woodworking industries which are concerned with the following:

- product knowledge
- markets for wood products
- timber drying and conversion
- management and supervision
- visual and mechanical stress grading
- noise reduction in factories

Both organisations work closely with the British Standards Institute and the woodworking industry in the preparation of standard specifications and test methods for timber and wood products.

Some factories visited were found to have their own testing and experimental laboratories in which tests are carried on such materials as lacquers, adhesives, fittings, prior to their use in production.

3. Conclusions.

- 3.1. Individual joinery factories in the U.K. are large by Yugoslav standards.
- 3.2. Products are manufactured to a very high standard, which is usually specified by the British Standards Institute.
- 3.3. There is a high degree of specialisation within the major product areas of the industry.
- 3.4. There is good internal factory organisation reflecting experienced and well-trained management.

- 3.5 There are very few university trained engineers in the industry. Most engineers and managers have had a craft background and it is regarded as the best preparation for subsequent management training.
- 3.6 The industry is well advanced in computerisation and most factories have their own internal computers.
- 3.7 Productivity is roughly double that in Yugoslavia, and is accounted for by better equipped factories, and better trained and more experienced management and labour.
- 3.8. A large proportion of female labour is employed by the industry.
- 3.9 The industry is greatly aided by excellent research and development facilities as well as good technical literature.
- 3.10 Effective industrial training for all levels of personnel is a major policy consideration of every factory.
- 3.11 Each factory places very considerable emphasis on marketing, sales and sales promotion.

ITINERARY
and
PROGRAMME OF FACTORY VISITS

Sunday 4 Dec.

Depart Zagreb	JU 210	10.10
Arrive London		12.10
Depart London	BZ 458	20.05
Arrival Newcastle		21.00

Transfer to Durham Crest Hotel

Monday 5 Dec.

08.15 Bursgreen, Durham
10.45 Hills & Sons, Stockton-on-Tees
Windows and Doors
Magnet Ltd. Darlington,
Large-series Flush Door Production,
Transfer to St. George Hotel, Harrogate.

Tuesday 6 Dec.

09.00 John Carr Joinery Ltd. Doncaster
14.00 Vic Hallam Ltd., Nottingham,
Structural Joinery, Timber-frame Housing.
Transfer to Holiday Inn Hotel Leicester.

Wednesday 7 Dec.

08.00 Gimson Ltd., Leicester,
General and Structural Joinery
10.00 Wadkin Ltd., Leicester
Wadkin Ltd., Leicester
Woodworking Machinery Manufacturers
15.00 Transfer to Holiday Inn, Slough

Thursday 8 Dec.

TRADA/Timber Research-Development Assoc. High Wycombe
Transfer to Regent Palace Hotel, London.

Friday 9 Dec.

Crosby and Co. Ltd., Farnham, Surrey
Architectural and General Joinery, Flush Doors, Windows and
Door Frames.
Transfer to Regent Palace Hotel, London.

Saturday 10 Dec.

AM Building Centre London
PM Study Tour Review

Sunday 11 Dec.

Depart London Heathrow	JU 211	12.20
Arrive Zagreb		15.30

~~Kraj~~ End of Tour.

PARTICIPANTS

<u>Name</u>	<u>Company</u>	<u>Manufacturing</u>	<u>Town</u>
1. Mr. Franjo Savaric	Bosna	Prefab Houses	Ilijas
2. Mr. Milan Drakisic	Ostrelj	Joinery Production	Bos. Petrovac
3. Mr. Mehmed Poriscanin	Janj	Prefab Houses	Donji Vakuf
4. Mr. Fikreta Trifkovic	Jahorina	Joinery	Vares
5. Mr. Izet Halapic	Sebesic	Joinery	Travnik
6. Mr. Hasan Salahovic	Sedinac	Joinery	Jajce
7. Mr. Zdravko Topalovic	Sipad-Kommerc	Joinery	Sarajevo
8. Mr. Dragoljub Nedovic	Romanija	Joinery	Sokolac
9. Mr. Osman Bundic	Sipad Kombinac -		Sarajevo
10. Mr. Simo Ilijasevic	Drvar	Joinery	Drvar
11. Mr. Dragutin Remetovic	Konjuh	Joinery	Kladanj
12. Mr. Hamza Ahmed	Irc	Project Design	Sarajevo
13. <u>Miss Janja Stanisic</u>	Sipad	Unido Project	Sarajevo
14. Mr. Desmond P. Cody	Unido	Unido Consultant	Vicenna

ANNEX 3

ORGANISATIONS AND FACTORIES
CONCERNED WITH PROJECT

1. ŠIPAD KOMBINAT
2. ŠIPAD KOMERC
3. ŠIPAD I, R.C.
5. ŠIPAD, R.O. "MAJEVICA":
 - OOUR "BOSNA" - Brčko
 - OOUR "BRČKO" - Brčko
 - OOUR "SREBRENİK" - Srebrenik
 - OOUR "BUDUĆNOST" - Bos. Šamac
 - OOUR "NAMJEŠTAJ" - Gradačac
 - OOUR "STOLAR" - Bijeljina
 - OOUR "JADRINA" - Gračanica
 - OOUR "29. NOVEMBAR" - Orašje
 - OOUR "SRBOBRAN" - Srbobran
6. ŠIPAD, R.O. "KONJUH":
 - OOUR Table Factory - Živinice
 - OOUR Chair Factory - Živinice
 - OOUR Chair Factory - Lopare
 - OOUR Joinery production - Kladanj

Annex IV

PROPOSED PRODUCTION PROGRAMME FOR 1978

R/B	COOR-a	VRIJEDNOST REAL. 1976.	REALIZAC. I-IX 77.	OCJENA 77.	PRIJEDLOG OOUR-a	PRIJEDLOG RO-e
1.	"STIL"				65.648.000	65.723.000
2.	"BUDUĆNOST"	101.402.718	102.896.000	137.196.000	92.123.000	92.395.510
3.	"JADRINA"	68.874.630	63.601.000	84.804.000	101.731.700	101.757.600
4.	"NAMJFETAJ"	95.404.525	92.436.000	123.240.000	176.187.000	176.187.000
5.	"29 NOVEMBAR"	24.554.849	22.750.000	30.336.000	3.980.000	48.780.000
6.	"STOLAR"	16.789.712	20.616.000	27.480.000	92.303.000	92.303.000
7.	"SPROBRAN"	10.119.832	10.926.000	14.568.000	25.000.000	25.489.070
8.	"BOSNA"		77.057.000	102.756.000	113.800.000	114.132.000
9.	"BRČKO"	143.952.492	32.497.000	43.332.000	51.927.000	51.500.000
10.	"SREBRENİK"		21.805.000	29.076.000	54.871.000	54.489.500
U K U P N O :		461.098.760	441.942.000	592.788.000	777.570.700	822.756.680

"STIL" - BOŠNJSKI ŠTILAC

PRILJELOG PLEHA ZA 1978. GOD.

R/B	NAZIV PROIZVODA	POS. IZVR. fizič. pla- na za 77.	KOLIČINA	VAJZDROST
<u>I. GRUPA KUHINJSKI I DOPUNJAJ</u>				
1.	rustikalni regal "Antika"	-	1.000	12.000.000
2.	regal sa apl. "Antika"	-	1.100	9.757.000
<u>II. KUHINJSKI I DOPUNJAJ</u>				
3.	rustikalni stol "Antika"		1.100	968.000
4.	stolje za klasično kanče	12.984	18.000	8.100.000
<u>III. OSTALI PROIZVODI</u>				
<u>IV. IZVOR</u>				
5.	rustikalne komode			
	- komoda 502	294	2.000	4.114.000
	- " 507		2.500	2.637.500
	- " 508		2.500	2.400.500
	- tel.konzola 518		4.000	1.064.000
	- " stol 520		4.000	1.500.000
U K U P N O:				65.722.000

Generally checking plan acceptable except stl. komode reduced from 20.000 to 18.000 in favour of "29 November".
Wall units "Antique" have been increased by 100 pieces.

ODDEL "DOD. ČLOŠT" - DOKUMENTI Š. 10

PRILOGI K PLANU ZA 1978. LETA.

R/Š	NAZIV PROJEKTA	COJ. RAZV. fizič. šla- na za 77.	KOŠČINA	VAJETAČST
I SPISBI NAČELŠLAJ RAZV.				
1.	kačiči na razv. "Romantika"	4.357	4.500	23.991.930
2.	Dvosjed na razvlačenje	1.881	1.000	4.258.000
3.	Fotelje "Romantika"	7.388	8.180	15.869.200
II POPIS DOKUMENTI RAZV.				
4.	Trosjed na razv. "Luna"	2.800	2.100	8.540.700
5.	Ivosjed na razv. "Luna"	1.144	700	2.421.300
6.	Fotelja "Luna"	3.389	4.000	6.272.000
7.	šip kačiči "Lidija"	620	3.000	8.973.000
8.	Fotelja "Lidija"	645	3.000	4.410.000
9.	Tabureti	5.944		
	- "Romantika"		4.000	1.502.330
	- "Luna"		2.000	754.000
	- "Lidija"		1.500	573.000
10.	Kačiči standard uložak	14.534	18.000	14.760.000
U K U P N O:				92.395.510

Plan accepted except that 2.000 pieces of standard couch have been deducted and increased "Romantika" and "Luna" by 100 sets.

REMARKS:

1. Redesign new arm 3/seater, 2/seater/a chair, also new textile should be used.
2. New textile should be used for "Romantika".
3. All changes should take place before March 30 '78.

OOBR "JADRANA" - GRAČANICA

PRIJEDLOG PLANA ZA 1978. GOD.

R/B	NAZIV PROIZVODA	obj. izvr. fizič. pla- na za 77.	KOLIČINA	VRJEDNOST
<u>I GARNITURE</u>				
1.	Tapacirane garniture	3.102	4.300	36.744.000
2.	Kombinovane sobe	1.354	3.200	30.534.400
<u>II KUPNI I KUPNI NAMJ.</u>				
3.	Stolići	1.116	1.000	350.000
4.	Klasični kauči	24.689	21.500	28.143.500
<u>III PNESE</u>				
		8.100		1.828.000
<u>IV REZERVA GRADIVA</u>				
		9.142	900	1.424.700
U K U P N O:				101.757.600

The proposal is accepted with following changes:

Production of classical couches is reduced for 3000 pieces on behalf of OOB "29 November". Production of combined rooms is increased for adequate value, i.e. for 700 sets. In the plan of assortment we did not include wall units and china closets.

REDESIGN

1. Redesign combined rooms (2 types)
standardize classical couches,
2. Redesign club sets (2 sets)
3. Deadline 30 March 1978.

OOGR "KRAJŠTANJ" - GRADUŠČAC

PRIBODLOG PLAN ZA 1978. GOD.

N/B	NAZIV PR. IZVODA	COJ. IZVR. fizič. pla- na za 77.	KOMISIJA	VREDNOST
<u>I. PRIBODLOGI ZA 1978. GOD.</u>				
1.	Milica	180.354	170.000	67.507.000
2.	Mila		40.000	37.980.000
3.	Milozec	45.753	60.000	58.740.000
4.	Plakari 02	6.377	8.000	10.640.000
5.	Klasični arenci	509	680	1.258.000
U K U P N O:				176.187.000

COUČ "29. NOVEMBER" - ORNĚČI

PROJEKČNÍ PLÁN ZA 1978. GOD.

N/Č	NÁZEV PŘEDLOŽENÍ	obj. levl. fyzic. pla- na za 77.	KOLÍČKOVÁ	VRUBENOST
1.	Kauč T - 78 biber	9,158	20,000	31,000,000
2.	Kauč T - 78 estina	3,309	6,000	11,700,000
3.	Kauč T - 100 biber	1,339	2,000	3,500,000
4.	žarnička "sablina"	757	150	1,215,000
5.	žarnička "sava"	-	150	1,305,000
U K U P L O:				48,780,000

1. Accepted plan is to increase production of standard couches from 17,600 to 30,000 and to reduce club sets from 1,100 to 300 as well as other occasional furniture. Number of standard couches is increased and whole plan too, because during 1978 a part of the factory should be reconstructed.

2. Standardize classical couches and choose textile.

OUR "STONIA" - BELJICA

PROJEKAT PLAN ZA 1973. GOD.

A/D	NAZIV PROJEKTA	OCJ. LEVI. fizič. pla- na za 77.	KOLIČINA	VRIJED. OSF
1.	Spavaća soba "Aida"			
-	6/D	500	1.000	9.150.000
-	5/D	766	1.000	8.850.000
-	4/D	592	1.600	11.968.000
2.	Spavaća soba "Nava"	-	2.000	25.050.000
3.	Spavaća soba "Sanja"	773	300	6.400.000
4.	Spavaća soba "Elna"	-	2.000	24.130.000
5.	Spavaća soba "Apolo"	-	700	6.755.000
UKUPNO:				92.303.000

1. At OUR's demand the plan is accepted while technical service finds that the plan is unreal and not achievable, because of the fact that in assortment there are products for whose production the factory does not have proper technology. Also the assortment is wide (5 types of rooms), and it is necessary to limit it.

2. new design of bedrooms.

OSOB "SREBRAN" - SREBRAN

PRIBELLOV PLAN ZA 1978. GOD.

R/B	NAZIV PROIZVODA	Učj. izvr. fizič. pla- na za 77.	KOLIČINA	VAJSTANOST
<u>I UKUPNI KONTAKTNI MATERIJAL</u>				
1.	Regal "Srebran" sa stolom	645	1.390	11.815.000
2.	Regal "Demir" sa stolom	600	1.390	10.609.870
3.	Garnitura "Galeb"		600	1.924.200
	- vitrina	1.665		
	- ormar	400		
	- stolić	666		
4.	Ormarić za obuću	400	2.000	1.160.000
UKUPNO:				25.489.070

The plan is accepted without corrections.

In the second quarter of the year NO's technical service will make new re-design programme.

GOŠA "BOSNA" - BRČKO

PRILAZIŠĆI PLAN ZA 1978. GOD.

R/S	KLASIV PROJEKTA	COJ. LEVR. fizič. pla- na za 77.	KOLICINA	VEŠĆIŠĆI
1	1. STANJA ZA STANJE	2251	3.000	26.180.000
	<u>UŠĆIŠĆI</u>			
	2. KODIŠĆI	6006	5.400	47.031.000
	3. KODIŠĆI I	-	1.000	15.000.000
	4. KODIŠĆI II	-	1.000	10.000.000
	IZVŠĆI			15.000.000
	UKUPNO:			114.132.000

The plan accepted. It is necessary to standardize frame elements of wall units and bedrooms.

OOB "LORO" - ČRČE

FINANCIJNÍ PLÁN ZA 1978. GOD.

R/D	NÁZEV PROJEKTA	voj. izvr. fizič. pla- na za 77.	KOLIKOST	VALOROVOST
1.	Vložna "Lidija"	4.868	4.000	4.240.000
2.	Fotelja "Lidija"	5.436	4.000	2.040.000
3.	Club garniture	3.379	3.000	28.500.000
4.	Francuski kreveti	-	1.000	4.500.000
5.	Kauč "Jadran"	-	2.000	7.800.000
6.	Tačbre samac	1.475	1.000	170.000
	IZVOZ	-	-	4.000.000
UKUPNO :				51.500.000

The plan is accepted with following changes:

1. Financial plan wholly accepted with change of upholstered sets.
2. New design for two club sets and choose textile.
3. Standardize coaches and armchairs for combined sets.
4. Deadline March 30, '78.

ODR. "Slobodnik" - SREBENIK

PRISLEDIG FLERA ZA 1978. GOD.

R/B	NASIV PROJEKTA	Ocj. izvr. fizič. pla- na za 77.	KOLIČINA	VALJANOST
1.	Vitrina i ormar "Lidija"	106	2.000	2.880.000
2.	Kostur kupača "Lidija"	68	4.000	1.600.000
3.	Stolić "Lidija"	6.380	2.000	740.000
4.	Vitrina i ormar "Sava"	80	4.000	14.880.000
<u>TURISTIČKA OPREMA</u>				
5.	Ležaj BS - 10	8.656	4.000	2.240.000
6.	Ležaj BS - 20		1.500	810.000
7.	Ormar "Bety" - P	2.260	3.000	3.300.000
8.	Vitrina "Sofija"	-	2.000	3.000.000
9.	Stolić "Milano"	-	4.000	1.560.000
10.	Predšoblja	-	2.000	10.000.000
11.	Opećija soba "Dahir"	-	1.350	6.885.000
12.	IZVOZ	-		4.000.000
U K U P N O:				54.895.000

Plan of assortment wholly accepted.

REDESIGN

1. Redesign combined rooms "Lidija" and "Sava" (surface treatment) and unification of the frame.
2. Deadline: March 30, '78.

Annex 5

ASSESSMENT OF EXISTING PRODUCTION PLANNING AND CONTROL SYSTEMS,
AND RECOMMENDATIONS FOR THEIR IMPROVEMENT

Notes on lecture given by expert to RO Konjuh
on 16th November 1977

Introduction

Production management, both planning and implementation is broad in scope and essentially begins with market forecasting and assessing stock levels. From there top management determines what is to be produced in a given period and assigns production to the plant. From then on it becomes the problem of the production engineer. He must decide upon the combination of products for any given production cycle, and by so doing loads machinery to levels equal to their combined requirement.

1. Assess the strengths and weaknesses of the existing system:

Establishing delivery performance /"service" level/
maintaining controlled stock levels
control of work in progress
plant and labour utilization

2. Problems experienced in trying to achieve an efficient work plan

- i. One operation becomes overloaded and a queue of work for that operation is formed.
- ii. Work-in-progress builds up, impinges on space elsewhere and causes bottlenecks.

- iii. Queue causes waiting time at following operations and production rates drop.
- ix. Planned despatch dates not met.
- v. Priority given to shortages, thus reducing supervisors effectiveness
- vi Other operations throughout the factory begin to be overloaded intermittently.

3. Principles involved in designing production planning and control systems.

- i. Avoid permanent overload of production resources by relating forward sales plans to planned factory capacity.
/agreement and commitment of sales and production/
- ii. An accurate measure of factory capacity must be established so that any additional plant or production resources may be identified /important where variations in product mix considerably affect the loading in various sections of the factory/. Capacity must then be analysed within well defined control areas.
- iii. Establish the strategy for stocking and for programming. This is solved between the Sales and Production Departments.
- iv. Quantify a number of control areas within the factory, so that a balanced work flow can be planned. A control area is a group of operations /or possible a single operation which is likely to become seriously overloaded or underloaded with expected variations in the quantity and mix of work. It may consist of a department or where machine utilization is low. Within a department there may be critical operations which are made control areas.

In creating production schedules the proposed

work load for each of the control areas should be checked against the control area capacities.

v. Establish an accurate delivery date based on the forward load of orders. The following factors apply:

- a. Factory capacity
- b. Batch or series used
- c. Priority of certain deliveries.
- d. Van capacity and routing programme.
- e. Availability of materials and fittings.

vi. Develop procedures for continuous feedback of information so that variations from planned achievements are detected as soon as possible and remedial action taken. Whether written or oral, these must be formal.

4. Practical aspects of the early stages of development and installation of production planning and control system

/i/ Major requirement one of commitment

/ii/ Should be delegated to a trained specialist

Physical modifications

/iii/ Stores and intermediate storage points

/iv/ Revised stock levels / size of storage facilities

/v/ Minor changes to plant, layout, int. transport

/vi/ Planning and control - introduction of procedures and documentation to cover production, planning and control

/vii/ Capacity planning: Projected output to planned factory capacity

/viii/ Production planning: Establishing the work load with the factory some months ahead.

- /ix/ Production scheduling: Weekly or even daily statements of requirements for each section of the factory
- /x/ Operation sequencing: Hour by hour sequencing of work through operations on machines to meet certain objectives, e.g. reduction in through-put time or maintaining a steady work load on some critical machine or operation.

Organizational modifications

- /xi/ Determine responsibilities of various personnel responsible for carrying out production planning and control responsibilities, and define who they are accountable to.
- /xii/ Co-ordinate with purchasing department in re-ordering of materials, fittings and subcontracted items.

Phasing the changes

- /xiii/ These must be done to satisfy two requirements
 - a. To maintain a pace that can be coped with
 - b. To apply the new procedures to work areas which are not to any large extent dependent on a controlled flow of work from other areas where the new procedures have not yet been applied, e.g. the last department.

5. Procedures necessary to plan and control production so that a balanced mix of components is held.

- /xiv/ Variables which affect piece parts stocks are:
 - a. the variety of parts i.e. number which have to be made;
 - b. rate of production achieved, expressed in units;
 - c. frequency /per week/ that batches are started;
 - d. minimum stock planned for /safety stock/ to accommodate variations in call-off rate.

/xv/ So that physical restraints /e.g. piece parts store/ may not become a limiting factor the following actions should be taken:

- a. start batches as frequently as possible without compromising departmental performance;
- b. make use of setting aids to reduce setting time and to allow smaller batch quantities to be processed.
- c. keep production cycle to a minimum so as to minimize the waiting time between operations.
- d. Programme approximately the same number of batches of work comprising approximately the same TOTAL WORK CONTENT onto the mill each week and avoid accumulating mismatch /unmatched/ quantities in the piece parts store.

6. Linear Programming and Production Planning

/xvi/ Objective: Maximum machine utilization and therefore maximum product output.

/xvii/ Data required:

- a. standard times for individual parts.
- b. time required for component on individual machines
- c. total machine time per unit.
- d. time period /usually one week of five 8-hour days/
- e. total productive machine hours available.
- f. total number of items to be produced.

/xviii/ Analysis of above data by computer show:

- a. Tables showing comparison of machine use under actual and optimum conditions.
- b. Tables showing machine time required for each component of each unit to be manufactured.
- c. Table showing optimum and actual production scheduler under various restrictions of products and markets.

/xix/ Determination of the effects of tighter restriction on a particular programme choice and on its production. This is done by choosing a fewer number of items than those initially decided upon and making further computer analysis on that basis. A comparison of the results after three or four such analysis will indicate how effective the programme is in choosing a combination of products which are compatible with machinery.

ANNEX 6

Report on R.O. Konjuh

1. General

This factory has recently undergone a complete re-organisation and development programme with the assistance of Sumaprojekt, the Sipad industrial planning agency, and the Belgrade Technological Institute.

The sawmill has been re-planned and enlarged, the table factory has been completely re-built and at present a new chair factory is being laid out. This work is expected to be completed in about six months and consequently at the time of the visit the factory was producing only about 40% of its projected output of one million chairs and one million tables annually.

After a preliminary discussion with the Assistant Director, Mr. Markovitch, during which he outlined briefly the history of the factory, the expert visited each department in turn and had brief discussions with the engineers and other supervisory staff. Later he had a further meeting with the Director and the senior management personnel during which he gave his views on and reactions to what he had seen.

These may be summarised as follows:

1. Products

The product policy of the factory was determined on the basis of its long association with solid wood processing, particularly in relation to sawmilling, and table production. Both activities have been carried on extensively since about 1950 and to them was added the production of chairs in 1960. This was a logical development, since the factory is located in a major timber producing area for both hard and softwoods, and it naturally wished to retain as much added value as possible. Now it is a major producer of both chairs and tables, mainly dining-room and occasional variety, which are sold both on the Yugoslav market and for export. There is nothing particularly distinctive about these products, and there could be regarded as standard items of production similar to those produced all over Europe. Clearly then, price is a major factor in their sales, and this was acknowledged by the Director who also appreciates the dangers attached to doing business in this way. Once a competing manufacturer can produce a similar item more cheaply, the buyer can immediately change to him with possibly disastrous consequences for his former supplier.

The expert made the point that greater design input which should preferably be done on a professional basis, could provide the best answer to this problem. It would immediately provide distinctive and easily recognisable design characteristics which would be a positive advantage in marketing and selling and would at the same time be that much more difficult for a competitor to copy.

It would be just as easy to make a well designed chair as it is to make the current models, and very little additional attention to detail would bring the product up to the level of acceptable international standards. In this way the product could also claim a better price.

The total range of models produced appears to have few common elements or interchangeable components. Thus, from production and costing points of view there is much unnecessary duplication of effort, and wasteful activity. This can only be set right by re-assessing the range and possibly re-designing it on the basis of good design principles, value analysis and production engineering. It is a job therefore, for the professionally trained designer in collaboration with marketing and production management.

All models examined appeared to be structurally sound, and it is evident that the factory is very experienced and skilled in this kind of production. Apart from the specific considerations of ergonomics and anthropometrics, which are so important particularly in chair manufacture, greater attention should be paid to the quality of sanding and finishing. There also appeared to be dimensional errors in the dining-room tables where suitable heights and place widths did not conform to accepted standards. Some tables were not quite rigid, and in the case of extending tables, the width of the additional leaf could have been increased to great effect by a further 50 mm.

The surfaces of almost all tables are finished with a plastic laminated decorated with imitation wood-grain. In better quality dining-room furniture such a finish would not be acceptable. Furthermore, even from a production point of view it is considerably hazardous since even a tiny scratch on such a highly polished surface is difficult to eradicate and such tops always require extremely careful and expensive handling at all stages of production.

A factory such as this with its vast output potential should be extremely selective about the design expertise which it employs. It will not be sufficient to have its own resident designers, nor to collaborate fully with the Sipad Design Centre even though both are extremely important parts of its design policy. It should also seriously consider the employment of well-established and experienced foreign designers whose knowledge of local marketing requirements in respect of exports would be essential to doing successful business abroad.

The establishment of the other aspects of design such as prototyping and product development should be actively pursued so that new designs are evolved as speedily and efficiently as possible.

2. Production Facilities

2.1 Buildings.

All buildings have been completed and it is now a matter of making the best possible use of them in respect of layout, provision of storage and production space, internal transport and location of specific work stations.

The expert however would like in passing to comment on the decision to erect a single factory of 18,000 m² covering the total site available. It is normal practice in planning a factory of this size to do so on a piecemeal basis covering an expansion period of 20 years. In this way account can be taken of normal growth and inevitable changes in production technology, with the emphasis always on flexibility. Having said that, he has otherwise little fault to find with the overall planning which is at least as good as he has experienced elsewhere. Because of the limitations imposed in adapting the old building to be used to house the planned chair factory, it will be necessary to plan and supervise the workflow very efficiently in order to avoid congestion in what is a very narrow and confined area.

The areas which appear to have received least attention are in the assembly and finishing departments, and most particularly in the former. They each require to be subjected to the most intensive application of the principles of good layout, work station design and work study, and this should be done now as a matter of priority. Apart from designing and planning good individual work stations, the handling and transport of semi-finished and fully-finished products also require attention as well as the provision of assembling equipment, and location jigs. There is excessive handling of chair frames at present in the old chair factory and the plans made to deal with this problem in the newly laid-out building do not appear to be adequate.

Management therefore should seriously consider the introduction of an overhead conveyor system which would provide transport between assembly and finishing. The latter could possibly incorporate electrostatic type finishing and even if this is not found to be acceptable, should at least be automatic in principle, with drying tunnels and de-nibbing areas.

3. Productivity

Based upon the information provided by management the expert is of the opinion that productivity is low by generally accepted standards and certainly no more than half that of similar factories in Western Europe. For example, a chair factory in France, which is roughly similar in size, has the following profile:

- products	: Medium/High quality dining-room chairs
- material	: Beech
- annual output	: 800,000 chairs per annum or 3,200 daily
- stock held	: 40,000 at any time
- model variety	: 20 items with many interchangeable elements
- factory area	: 40,000 m ²
- executives	: 17
- foremen/supervisors	: 70
- workers (male)	: 175
- workers (female)	: 312
- sales	: 66 (administration and field)
- total workforce	: 640
- value of sales in 1976	: 330 million dinars
- exports	: 40%
- value of output per worker, per year	: 600,000 dinars

- annual consumption of timber : 20,000 m³
- ratio of man to machines : 1 to 1
- Finishing (by electrostatic spraying) : 4,000 chairs per day
- total number of finishing personnel ; 15, including de-nibbers

Some additional information

1. The factory employs assembly line techniques with diversified production, but each assembly-line is based on a specific model.
2. Standard elements are used as far as possible.
3. Only models which have a minimum production potential of 100 units per day are acceptable to production management.

This information which is by no means peculiar to the factory referred to should give the management of R.O. Konjuh some idea of how their organisation compares with that of the industry elsewhere

It should also be remembered that while there is a minimum in terms of investment below which it is unrealistic to be in the business of chair and table production, it does not follow that size alone is a major criterion for successful and profitable production. Konjuh has certainly the production facilities and raw materials in relative abundance, but it has not yet succeeded in putting them all together so that they add up to the right kind of productivity.

This is the responsibility of management, which must first be qualified technically in chair production and then should be fully conversant with, and able to exercise the techniques of management. Elsewhere in this report, attention has been drawn to the need to learn and develop these techniques, the absence of which the expert has no hesitation in stating are the cause of the low productivity presently being experienced in Konjuh, as in other factories within the Sipad organisation, a marked lack of knowledge of and experience in work study, the physical aspects of work planning and product development, and an overall absence of experience in chair production. These are essential elements in the building up of the special expertise and skills traditionally associated with this craft, and they must be learned and developed over a period of years.

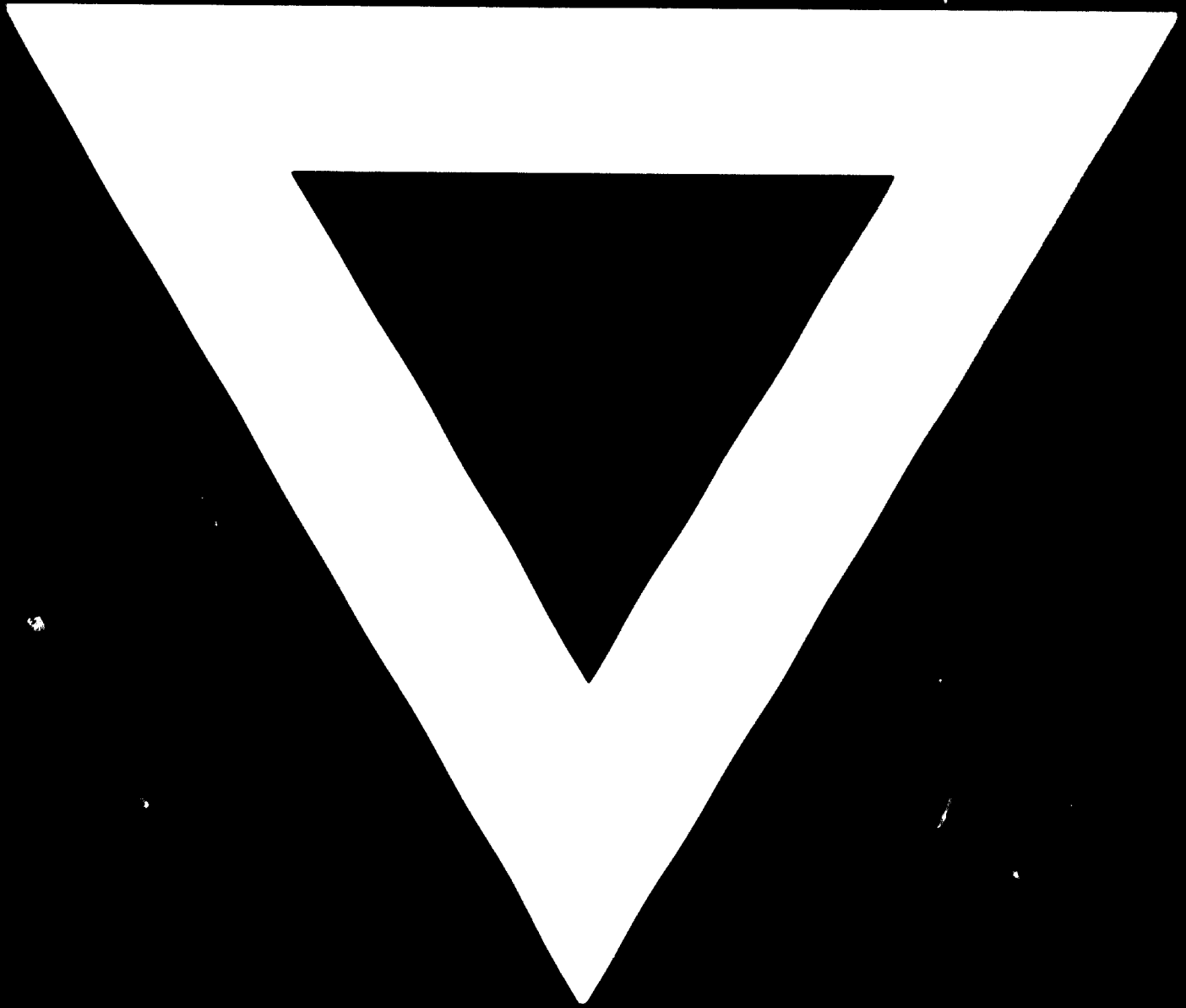
The recommendations made by the expert in this particular context apply in a special way to the management and workforce in Konjuh. There is no shortcut to their acquisition, although the process can be considerably speeded up by paying closer attention to design development, by using qualified and experienced chair and table designers and by ensuring that all relevant personnel are trained in their appropriate skills and techniques.

R.O. Konjuh contemplates the establishment of two new chair factories in the immediate future. The expert had an opportunity during his visit to examine and discuss the plans for these factories with those concerned. It is his view that these plans are somewhat stereotyped, do not reflect as they should, a particular product policy and are roughly similar to many other factories elsewhere which were also planned by the same planning agency. If they are proceeded with on this basis then it may be expected that they will produce furniture no different from that already being produced. This will obviously be to no one's advantage.

What is required initially is the establishment of a design and product policy which is distinctive and avoids unnecessary competition with existing ranges. In the case of Konjuh, and because of the superfluity of labour there, it should incorporate added value through the exercise of particular skills such as wood turning, bending, lamination, and possibly handcarving. It will naturally be influenced by precise marketing considerations and only when it is thus properly evolved should the detailed planning of the factory be begun. Not all the specialist equipment for this kind of factory may be bought "off the shelf" since it has to be designed and purpose built. It is the responsibility of the planning agency to do this work also, as well as to ensure that their plans are fully implemented to the stage when the first batch has been successfully produced.



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