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DEVELOPMENT OF THE FURNITURE AND JOINERY INDUSTRIES AND CREATION OF A CENTRE

DP/YUG/73/006

YUGOSLAVIA

Technical report: Assistance in computerized production planning and control

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 A. Puri, expert in computer applications in the furniture industry

United Nations Industrial Development Organization
Vienna

id. 77-6175

Explanatory notes

References to "dollars" ($) indicates United States dollars, unless otherwise stated.

The monetary unit in Yugoslavia is the dinar (Din). During the period covered by the report the value of the dinar in relation to the United States dollar was $US 1 = 18.3 Din.

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

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

The following abbreviations have been used in this report:

ERC Elektronski Račun Centar (Electronic Computer Centre)

IRC Istraživački Razvojni Centar (Research and Development Centre)

GEIMS General Electric Inventory Management System

OOUR Osnovna Organizacija Udruzestvenog Rada (Basic Associated Labour Organization)

RO Radna Organizacija (Working Organization - association of OOURs)

Annexes VI to IX have been reproduced without formal editing.

ABSTRACT

This report describes the work done during a four-month mission on the application of computers to production planning and inventory control in the furniture and joinery industry. The mission was part of a United Nations Development Programme (UNDP) programme of technical assistance to the Government of Yugoslavia to develop the furniture and joinery industries of Bosnia and Herzegovina and to create a centre. The United Nations Industrial Development Organization (UNIDO) and ŠIPAD were the executing and counterpart agencies respectively.

As a result of a quick survey in the field at the start of the mission the main problems faced on the shop floor were found to be:

(a) Stock holdings were out of balance: some materials were out of stock while others would not be used up for years;

(b) There were frequent hold-ups in production because materials were out of stock;

(c) Too much effort was required to determine the material and resource requirements for a production programme. A factory could thus find itself accepting orders that could not be met, or refusing orders that could.

It was decided to adapt and introduce GEIMS, an inventory control and production planning package consisting of thirty eight programs produced by the manufacturers of the computer available to ŠIPAD. The programs were compiled, corrected where necessary, and checked with test data. The Standard factory was chosen as the first site for trials. Coding schemes were devised and introduced for raw materials, finished products, intermediated, and resource centres. Master files were set up for the determination of resource loading and potential production bottlenecks for the new "Standard" range of wall units. Work was started on the creation of materials master files for inventory planning.

Two seminars were held to generate interest in and awareness of the work being done in production planning and inventory control. One seminar was attended only by members of the Standard factory and the ŠIPAD Computer Centre. The other was also attended by members of the other ŠIPAD units in ŠIPAD. Individual sessions were held with senior counterpart personnel and team members.

Visits were made to six factories (besides Standard) so that the expert could familiarize himself with ŠIPAD.

The main conclusions of the mission were:

(a) There is considerable untapped potential for the use of computers in ŠIPAD;

(b) Production planning and inventory control is a good starting point for computerization and is particularly worth while for factories producing a large product range (all furniture and joinery factories);

(c) The application of computers to annual planning will be worth while in some OOURs;

(d) The use of a computer for routine accounting work would be beneficial - primarily in new factories, then in OOURs facing staff shortages, and finally in other OOURs;

(e) The Computer Centre finds it extremely difficult to attract staff of the right calibre;

(f) There is a need for a high-level review of the future of computerization, and a long-term plan should be drawn up;

(g) There is a need for increasing awareness at all levels of how computers can help management;

(h) There is a need for standardization of codes and accounting procedures and documentation throughout the ŠIPAD group;

(i) A follow-up mission in autumn 1977 might help to maintain momentum and resolve problems.

The report contains a number of observations and suggestions to improve the general working of the Computer Centre.

CONTENTS

INTRODUCTION

Background

Timber and forest occupy an important position among Yugoslavia's natural resources. One third of the country's forest resources, or about 300 million cubic metres (1975 estimated), are in Bosnia and Herzegovina. The ratio of broad-leaved to coniferous timber is 2:1 but it is intended to reverse this ratio gradually in the coming years. The allowable annual cut for Bosnia and Herzegovina (5.6 million cubic metres) is also a third of Yugoslavia's total annual cut. Despite a five-fold increase in the ten years up to 1975, Bosnia and Herzegovina's share of the market for wood products does not match its timber resources. With this background an ambitious five-year development plan was conceived to modernize and expand the wood industry. An investment of Din 800 million was envisaged to double the production of the furniture industry and increase employment in it from 6,000 to 9,000. Joinery production was to be more than tripled (from Din 200 million to Din 650 million) through an investment of Din 950 million and a threefold increase in employment to 4,500.

To strengthen Bosnia and Herzegovina's furniture and joinery industry as both a domestic producer and an exporter, the Government of Yugoslavia requested the assistance of the United Nations Development Programme (UNDP) for a project to create a centre that would provide services, initially to Bosnia and Hersegovina and later to the other Yugoslav Republics, in the following fields:

- Market research and expansion of trade
- Improvement of design, including design and production of prototypes
- Improvement of production and quality testing of prototypes and products
- Increase of productivity by improved organization of production and management
- Dissemination of technical and statistical information, and other services

The United Nations Industrial Development Organization (UNIDO) was appointed as executing agency, and ŠIPAD acted as counterpart agency in Yugoslavia. Pending the legal constitution of the centre, the general management of ŠIPAD will be responsible for the project, through the national project director appointed by ŠIPAD.

ŠIPAD is a major co-operative integrated forest industry organization employing over 55,000 workers. Its activities include forestry, saw milling, pulp and paper production, the manufacture of wood-based panels, and the manufacture and sale of furniture and joinery products. ŠIPAD is responsible for 80% of Bosnia and Herzegovina's forests, 65% of its saw milling, 35% of its pulp and paper production, and 85% of its final wood-industry products. It is envisaged that the ŠIPAD wood technology unit, design centre, computer centre and market research organization will form the nucleus of the proposed centre and that each unit will develop into a self-financing OOUR.

UNDP's contribution to the project was just over $555,000; the Government of Yugoslavia's contribution was Din 15 million. The present report covers a four-month mission by a UNIDO expert in the application of computers in the furniture and joinery industries. The mission lasted from February to June 1977. The expert was assigned to introduce computerized production management and stock-keeping procedures in one of ŠIPAD's plants. His specific tasks were:

(a) To review the mechanized accounting methods used for stock-keeping, and for production planning and control;

(b) To recommend any changes necessary for the procedures to be computerized;

(c) To develop and test the programme to be used;

(d) To supervise the introduction of the programme;

(e) To recommend other assistance required for the development of computer systems in the plant selected and elsewhere.

I. FINDINGS

General background to the work programme

It was evident from initial discussions with ŠIPAD management that the mission should concentrate on the introduction of computerized inventory control and production planning. OOUR Tvornica Namještaja "STANDARD" (henceforth referred to as the Standard factory had been selected as the first site for the introduction of computerized production planning and inventory control. The experience gained at the Standard factory would be extended to other factories. From the point of view of management support and proximity to Sarajevo and the Computer Centre; the choice was a good one, although the absence of satisfactory coding schemes for raw materials, finished products and intermediates or for work and cost centres was a draw-back.

The problems that emerged in discussions with management at the Standard factory as relevant to production planning and inventory control were:

(a) Stock holdings were not in balance. There were some materials where stock in hand would not be exhausted for two years, while other materials were not available when needed;

(b) There were almost daily interruptions to production because some raw materials were not available;

(c) The breakdown of a production plan into raw materials, machine and manpower requirements took too long. This was particularly felt when tendering for a large order and could lead to the loss of an order that could be met or acceptance of one that could not.

The conditions described above were thought to be quite common in ŠIPAD.

It was also evident that resources in the Computer Centre were inadequate to develop a suite of programs from scratch. A quick survey of the manufacturers' software and of the manufacturing processes revealed that the General Electric Inventory Management System (GEIMS) package could be adapted to the needs of the furniture and joinery industry in general and of the Standard factory in particular.

Computerization and the Computer Centre

The potential for computerization in ŠIPAD is virtually untapped. Of the twenty Radne Organizacije (RO) within ŠIPAD, only ŠIPAD Komerc has introduced substantial computerization. The computer is used mainly for sales

and purchase accounts, tax accounting, statutory statistics, retail shop accounting, payroll work, forest inventory, and the annual cutting plan. (See also annex II.)

From visits to some of the factories (see annex V), it was evident that the traditional applications of computers for routine operations such as stock accounting, bookeeping, payroll, and the like would lead to economies in manpower. Their gradual introduction is recommended into those OOURs where the manpower made available by computerization can be used on more rewarding work, and also where it reduces the burden on highly skilled staff, who are scarce. It is thought that the computerization of production planning and inventory control will be benificial in all OOURs that produce a wide range of products, particularly the furniture and joinery factories.

Many new factories are being set up. These can benefit from computerized systems from the start. However, work on computerization should start at the planning stage of the factories. This could be avoided to some extent if administrative documentation and procedures could be standardized throughout SIPAD. Standardization would also reduce the development costs of computer systems substantially and, by using scarce computer personnel more effectively, would bring the benefits of computerization more rapidly. It is recommended that the standardization of administrative systems and documentation, and of codes for materials, intermediates, finished products, cost centres, customers, suppliers, and the like should be given priority.

The Computer Centre has difficulty in attracting good staff. Of the 24 posts approved in February 1977 for the systems and industrial engineering and applications maintenance departments, only eight were filled in June 1977. Only one of the eight had been recruited in the four months from mid-February to mid-June. Staff turnover has nevertheless fallen, partly as a result of increased salaries and partly because restrictions imposed on computer imports have reduced the growth rate of the market for computer personnel.

Two factors are thought to be responsible for the gaps in the Computer Centre's organization. The first and more important one is that, (in the opinion of the Computer Centre's management) despite salary increases in the past, the renumeration package offered by them does not compare with what other centres offer. The second is that the Centre has what would be considered

today a small and obsolete computer. Systems analysts and programers, who would prefer to work on machines that better their prospects for further advancement, might well avoid ŠIPAD's Computer Centre because they consider it a technological backwater. This disadvantage might be offset by a reputation for excellence, but the Computer Centre has still to acquire such a reputation.

The magnitude of the long-term investment in computer hardware and in the effort of the Computer Centre and its users is an argument for high level guidance and support. It is recommended that responsibility for the policy for the development of computerization within ŠIPAD should be formally placed under a committee. The composition of such a committee could be as follows:

Chairman: Deputy Director General of ŠIPAD

Members: President of the research and development RD
Two others drawn from the top level ŠIPAD management, one at least being the President of a manufacturing RO

Secretary: Director of the Computer Centre.

Some modifications to the organization of the Computer Centre might help.

There is a need for a small team - one person initially, but more if the computer is upgraded - whose responsibility it is to understand the operating system (driving software) and adapt it to the needs of the Centre. The team would also help in resolving the problems, generally encountered at the time of testing new programs, that arise as a result of the interaction between programs developed by the users and the driving software. This team should be attached to the Operations Department. It requires the highest level of technical competence in programming.

In keeping with the autonomous structure of the management system, the Computer Centre would need to sell its services to other OOURs. The Centre should therefore have systems salesmen. (At present the sales effort is largely the responsibility of the Director.) This will become particularly important when the Centre has specific packages it can sell.

The Centre has about 800 tapes, twenty five disk packs and a number of manuals. These are not well maintained, partly because of shortage of space and partly because the responsibility for maintenance is not specifically laid down. The investment in data is very substantial and its loss could lead to costs well in excess of investment. The post of a tape librarian for each

shift is thought desirable. It would be his responsibility to ensure the proper maintenance and issue of tapes, disks and computer literature.

One of the consequences of the lack of space is that magnetic tapes are left piled up on tables in the computer room. While it is understood that the general question of new premises for the Computer Centre is under consideration, immediate thought should be given to the housing and control of magnetic tapes and disks.

Some applications that were developed in the earlier stages of the Centre's life make excessive use of printer time. Minor modifications to the programs and documents could considerably ease the pressure on the computer at periods of peak loading. Savings of the order of 60-70% of computer time are thought to be possible in some programs. Time-consuming programs and the scheduling of the computer for production work during the day slow down development work. It is recommended that, as far as possible, long production runs should be scheduled during the second shift. There is no harm, however, in scheduling production runs of up to a maximum of half an hour during the morning shift, provided it is understood that development must have priority.

Any computer centre is analogous to a factory whose raw material is data and whose product is information. Data processing operations therefore require the same kind of administrative skills as factory management. It is felt that the management of the operations at the Computer Centre should be upgraded.

Staff in the Centre should be encouraged to gain proficiency in English, because much of the literature is available only in English, and English has become the language for international communication in this field. As far as could be ascertained, not one member of the staff of the Computer Centre was fluent in English.

Only a few manuals for manufacturers' software were available. The Centre should have a complete set of all manuals for all manufacturer's software, preferably in English, so that no time is wasted when a particular job has to be done. The lack of manuals made progress on the mission slower than it could have been.

The Standard factory

The factory has two main departments. The upholstery department produces armchairs and sofas (90% of output), and mattresses (10% of output). The case-goods department makes knock-down furniture, mainly wall units.

The factory exports some of its products to Africa and Eastern Europe, but the main sales are domestic. Ex-works value of sales was Din 163.4 million in 1976. Projected turnover for 1977 is Din 258 million, and materials purchased during the year are expected to amount to Din 137 million.

The factory employs 750-800 workers. It has so far made no use of computers, but the management felt that some of their production and inventory planning problems would be amenable to computer solution.

The existing system

The existing system of production planning and inventory control at the Standard factory starts with the annual plan. This is the result of interaction between SIPAD Komerc, RO Jahorina (of which the Standard factory is a part) and the Standard factory itself. The implications of the annual plan with regard to requirements of manpower, materials and machines are determined in the technical preparation section in the factory. This information is the basis for making the annual contracts for materials, most of which come from within the SIPAD group.

The annual plan does not distinguish between different veneer facings of the case goods or different colours for upholstery products. Nor does it take into account the projected stock levels at the end of the year to determine annual materials requirements.

Production planned one to two months ahead is broken down into material requirements by department. The document used for this shows the materials required for each product to be manufactured and the dates on which they are required on the shopfloor. It is supposed to be the authority for purchase. The following shortcomings were noted:

(a) The purchase quantity is related to the quantity to be manufactured and not to convenient or economic lot sizes;

(b) No account is taken of existing stocks; so over-stocking cannot be corrected;

(c) The time allowed in some cases is too short for buying through normal contractual channels. As a result, the advantage of SIPAD's collective buying strength is lost because materials must be purchased from wholesalers instead of manufacturers at prices which can be as much as 15% higher. Although the number of items involved is relatively small, a saving of 15% on even 5% of purchases is worth a million dinars in 1977.

In practice, the buyers do take some account of the stock position, orders placed, and future demand, but there is no regulation laid down as to how this should be done. GEIMS takes account of all the factors and should overcome many of the problems referred to.

On the basis of the purchases indent received from the technical preparation department, the buyers place orders with the sellers, sometimes using the supplier's order forms. This leads to the normal cycle of documentation: supplier's delivery note, the factory's material-received note, and the seller's invoice for payment.

For production, the plan is broken down into work orders (radni nalog) that form convenient batches. The size of the batches is not based on any specific calculations to minimize overall costs, but rather by feel and experience. This is another likely area for savings.

The technical preparation department also prepares the materials breakdown form for each work order and the requisitions to authorize production departments to withdraw the materials. The actual quantity drawn and the remaining balance are entered on the requisition by the storekeeper after which the requisition goes to bookkeeping for further processing. It is evident that there is much needless duplication of effort, most of which would be eliminated by computerization.

The bookkeeping section uses five Ascota ledger posting machines for financial accounts and costing. The costing system is based on planned prices for purchased materials (the difference between planned and actual prices being charged to a variance account) and points for work done. The work order is the basic control document for product costing and financial control, but the information is not available in time for corrective measures to be taken. Nevertheless, it is worth noting that most of the information required for costing is also required for production planning and inventory control by GEIMS. The additional cost of processing this information on the computer would be relatively small; so the exercise would be worth while after the successful

introduction of GEIMS if the resources released can be usefully redeployed.

No major reorganization is thought to be necessary as the result of the introduction of GEIMS. The existing planning staff on the team set up to introduce GEIMS would continue to have their original responsibilities, but would use GEIMS to carry them out. It is recommended that this section of two or three people should be the focal point of all communication with the Computer Centre and should be responsible for checking and correcting the data flowing to it. The Computer Centre should designate a single person to be the link with the Standard factory on all matters concerning GEIMS. In the longer term, as more jobs can be handled by the computer, organizational changes would become necessary in the factory as well.

One problem was that materials and resources centres were not coded. Coding schemes had therefore to be developed quickly. The coding schemes developed and applied for SIPAD's OOURs, for purchased materials, finished products and intermediates in the Standard factory are given in annex III. A major consideration in developing these schemes was the need to base them on something familiar so that decoding would be easy. In due course, when standardized codes are developed for SIPAD, the schemes will have to be replaced.

General observations

A common complaint was that storage space was lacking, and this was borne out by observation. It was felt that the problem could be alleviated in two ways. First, the space available could be better utilized through the use of suitable bins in the technical materials store and the use of racks or suitable handling equipment, or both, in the raw materials stores. (Raw materials in the Standard factory means wood, boards and the like. Technical materials includes all other purchased materials.) Second, a lot of space is used to store materials that will probably never be needed. If these materials can be disposed of or broken down for use, albeit inefficiently in the factory, much needed space would be made available.

Shortage of space combined with poor handling methods and equipment leads to repeated handling of materials. This not only wastes manpower but also increases losses in storage.

Materials are often stored in unsecured areas and are consequently frequently drawn without proper documentation. This leads to wasted effort in reconciliation and/or securing the necessary documents.

It is estimated that at any time 20% of stockable items are not in stock. The total number of stockable items is probably between four and five thousand.

The factory uses a system of stock-taking at the end of each year. This causes a considerable peak load and work is disrupted for a week or ten days. A continuous inventory system, where physical checking is staggered throughout the year, has many advantages and is recommended for consideration.

GEIMS

GEIMS is a suite of 38 programs listed in annex IV developed by the computer manufacturer for production planning and control. It was chosen as the vehicle to introduce production planning and control within SIPAD because it was found to cater for the production activities of a multi-stage batch-processing operation typical of the furniture and joinery industries. The system can be divided into four main phases:

(a) Inventory status. Inventory movements are recorded and current status obtained;

(b) Product definition. The product structure is recorded in a level-by-level breakdown of a finished product or intermediate into its requirements for resources of manpower, machines and materials - both purchased and manufactured;

(c) Order/demand. The status of orders to build up stock through purchases and manufacture is recorded along with the status of demands from customers and the factory that would run down stocks in the warehouse;

(d) Inventory and resource planning. The forward loading of resources and requirement of materials are reviewed day by day to indicate when stock replentishment orders should be placed and when and where resources will be in short supply.

For detailed information on GEIMS the reader should refer to the manufacturer's literature (GEIMS Application Review, GEIMS Application Reference Manual, GE-100 Resource Planning, and GEIMS program listings).

The introduction of the system at the Standard factory is well under way. Sufficient progress has been made on all four phases that resource planning for the "Standard" range of wall units is possible. The first runs have already

been made, but final checking of the product structure and correction of errors or omissions will be necessary before the data can be used for regular planning. Data collection for the inventory planning phase is about 60% complete. Work has yet to start for the upholstered range of products.

In order to maintain the momentum generated during the mission covered by this report, it might be useful to follow up with a further mission in autumn 1977, timed to coincide with the first medium-term planning excercise.

Training and familiarization

As a part of the familiarization phase of the mission, the expert visited six of SIPAD's factories. Brief reports of these visits are given in annex V. The general picture that emerged from the visits was that it would be useful to computerize inventory control in most cases. Computerized production planning would be worth while only in multi-product (e.g. furniture and joinery factories) but was not likely to be so beneficial where the range of products was small (in the particle-board factories, for instance).

Two seminars were held to familiarize people in SIPAD with the work being done at the Standard factory and to give an idea of further possible computer applications to production planning and inventory control. The first seminar was held at the Standard factory on 29 April 1977 and was attended by some 36 people from Standard and ERC. Its purpose was to explain how the system would operate and what results it would give. The second seminar was held on 9 June 1977 and was attended by 22 people from other parts of SIPAD besides Standard and ERC. Its purpose was to discuss the application of computers to production planning and inventory control. In addition to these seminars individual sessions were held with all the senior counterparts to explain the GEIMS reports and how they could be used.

A question that was very frequently raised in discussions was the desirability of independent computer facilities at factories, either through terminals or through independent in-house computers. The answer would depend on such factors as the relative cost of data transmission and computer power, and the speed of response. In general, however, it would be more economical to start by sharing computer facilities with other users through a service bureau or a central computer.

In discussions with SIPAD management the view was voiced that there is insufficient appreciation of what the computer can do for management at all levels. Spreading a greater awareness of the possibilities of computers is seen as one of the major tasks of ERC and should be taken up by them as soon as resources permit. ERC should also try to draw suitable candidates for their vacancies from within SIPAD and should accept the additional training burden. This may be a viable alternative to recruiting from outside, which is proving difficult.

Administrative arrangements

The permanent project administration should be strengthened. It would also help if each expert was assigned an interpreter and was given priority in the use of the interpreter's time. The interpreters could continue their work in the SIPAD pool when not required.

Further work

There are three areas for further work:

(a) Routine accounting applications. These are within the competance and experience of existing staff at ERC, possibly supplemented by further recruitment. The order of priority suggested is: first, in new factories; second, in OOURs facing staff shortages; and third, in other OOURs;

(b) Medium-term planning. This involves the use of linear programming to make optimum use of projected resources in the forthcoming year. The excercise is likely to prove beneficial in multi-product factories, particularly if demand exceeds supply. Interest has been expressed in this excercise in the joinery factory at Sokolac and the furniture factory at Višegrad For best results, medium-term planning should be synchronized with the annual planning cycle. In other words, it should start in September/October;

(c) Forest simulation. In view of the need to plan forest management and development 80 years ahead, the ability to try out a number of alternative policies and strategies could affect future activities significantly. The work could perhaps best be done in collaboration with a university as a research project.

II. RECOMMENDATIONS

Recommendations are given below in the order in which they appear in the text.

1. Computerized production planning and inventory control should be extended to all furniture and joinery factories.

2. Routine accounting (bookkeeping, payroll etc.) should be computerized in existing COURs so as to alleviate manpower shortages.

3. New factories should have computerized systems from the start.

4. Administrative documentation, procedures and coding should be standardized throughout SIPAD.

5. Common coding schemes for materials - purchased and manufactured, including intermediates - should be adopted throughout SIPAD.

6. A high-level committee should be formed to determine computerization policy and priorities and to monitor progress.

7. A systems programming team should be created as a part of the computer operations section. The team should consist initially of one very competent programmer, to enable the best use to be made of the driving software and to resolve problems arising from its interaction with programs under development.

8. Specific attention should be given to sales of the services of the computer centre.

9. A tape librarian should be provided during each shift, whose responsibility it is to maintain and control magnetic data files and computer literature.

10. Immediate attention should be given to providing adequate space for computer tapes and disks to improve the security of these data stores.

11. The first shift in the Computer Centre should be reserved as far as possible for development work.

12. The operations of the Computer Centre should be brought together under a manager with considerable ability and of a sufficiently high calibre.

13. Computer Centre staff should be given incentives to learn English.

14. The Computer Centre should try to get all manuals for all software produced by the manufacturer and related to the SIPAD computer.

15. All communications concerning the introduction of GEIMS should be routed through a special team in the Standard factory to a designated person in the Computer Centre.

16. The team mentioned in 15 would also be responsible for checking and correcting the data flowing to the Computer Centre.

17. Consideration should be given to replacing the present system of annual stocktaking by one of continuous inventory checking.

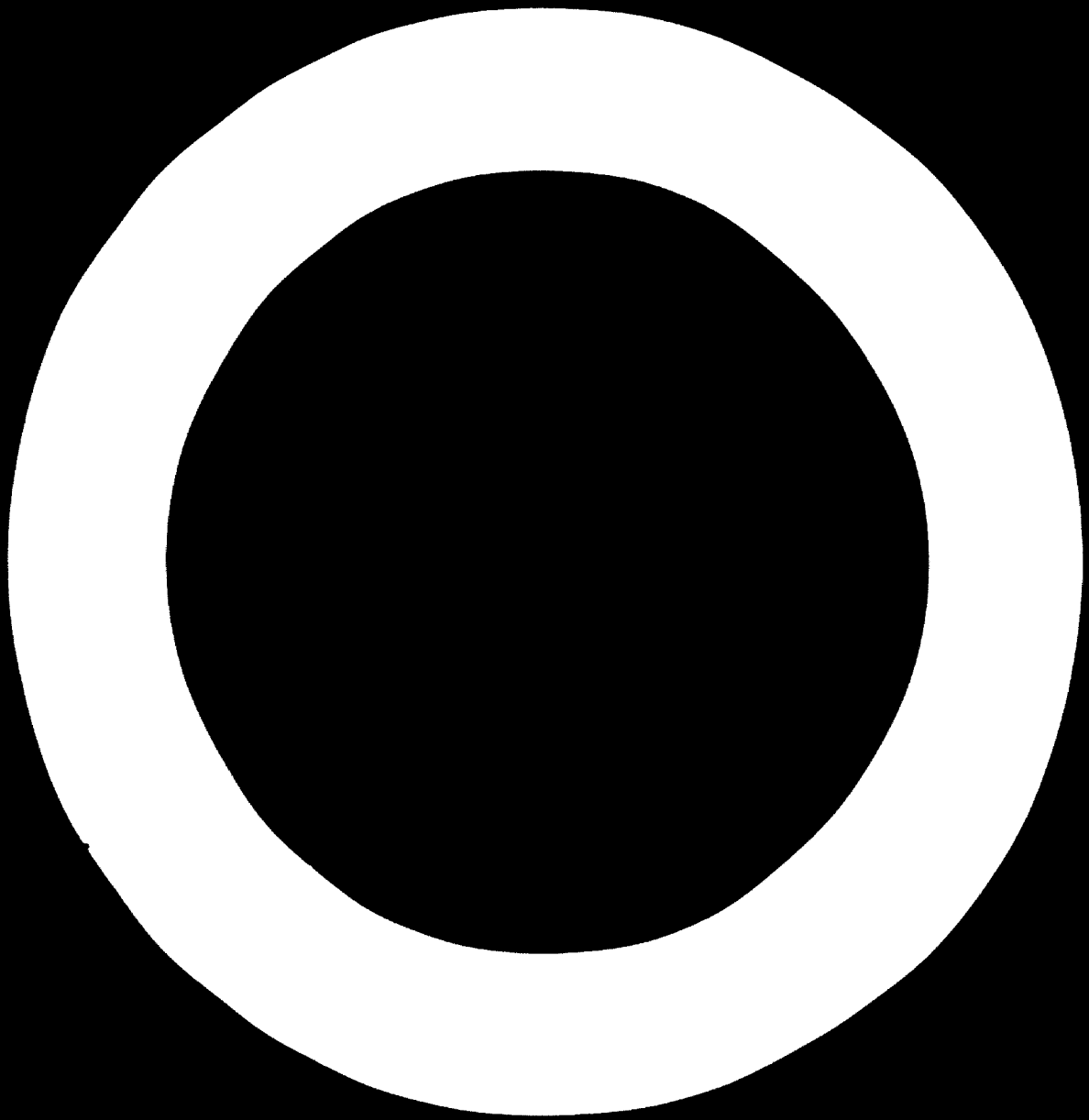
18. A follow-up mission should be arranged to maintain the momentum generated so far, resolve any problems that have arisen, and complete the implementation of GEIMS. It is estimated that four to six months will be needed for this work.

19. ERC should regard making management at all levels more aware of the possibilities of computers as an important part of its work.

20. ERC should tap resources within SIPAD to fill vacancies and should accept the additional training burden.

21. Annual planning using linear programming should be introduced on a trial basis in the Sokolac joinery factory and in COUR "Varda" in Visegrad.

22. The possibility should be considered of starting a research programme for forest simulation on the computer to evaluate different management strategies.



Annex I

EXPERT'S JOB DESCRIPTION

Post title: Expert in applications of computers to production management and stock-keeping in the furniture and joinery industries

Duration: Four months

Date required: As soon as possible

Duty station: Sarajevo and the site of a furniture or joinery plant in Bosnia-Herzegovina

Purpose of project: To assist in the development of the furniture and joinery industries of Bosnia-Herzegovina and the creation of a centre

Duties: The expert will be attached to the SIPAD Computer Centre (which will eventually be incorporated in the centre to be created). The expert will be responsible to the national project director and will, in collaboration with the director of the Computer Centre and his national staff, introduce computerized production management and stock-keeping procedures in one of Bosnia-Herzegovina's furniture or joinery plants. Specifically, the expert will be expected to:

1. Review the present mechanized methods used for stock-keeping (including purchases and sales) and production planning and control.
2. Recommend any changes that have to be introduced so that the procedures may be computerized.
3. Develop and test the programme for these procedures which must also be applicable to other similar plants.
4. Supervise the gradual introduction of the computerized system in the plant.
5. Recommend any other assistance needed to assure the development of computerized systems in the plant, and in the furniture and joinery industry of Bosnia-Herzegovina in general.

The expert will also be expected to prepare a report, setting out the findings of his mission and his recommendations to the Government on further action that might be taken.

Qualifications: Computer science specialist with considerable experience in developing and introducing programmes for stock-keeping and production management.

Language: English; French acceptable.

Background information: The furniture and joinery industries of Bosnia and Herzegovina contribute about 8 per cent to the Republic's gross national product, and represent over 4 per cent of its exports. An ambitious five-year development plan is being implemented to double the production of furniture to attain Din 2,000 million and 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 200 million to Din 650 million and the work force will treble to attain 4,500 persons. Investment of Din 950 million is foreseen for joinery plants. SIPAD, a co-operative integrated forest industry organization consisting of 126 factories and employing 55,000 persons, accounts for 65 per cent of saw-milling and 85 per cent of the final products of the wood industries of Bosnia and Herzegovina. The Government of Bosnia-Herzegovina and the SIPAD organization have decided to create a "Centre for the Development of the Furniture and Joinery Industry" to cater for the 38 existing furniture and joinery plants within the organization, and have requested UNDP/UNIDO assistance in the development of this industrial sector and the establishment of this Centre. It is to have the following departments: technology, quality control and documentation, design, marketing and engineering, and organization services.

The SIPAD Design Centre is to be incorporated in the above Centre once it has been established. It has a HONEYWELL series 100, model 120 computer with a 32 k capacity, 3 disk units, 4 tape units and the necessary ancillary hardware, and employs about 30 persons. It is planned to use part of the computer's unutilized capacity for production, management and control, and stock-keeping in some of the larger furniture and joinery factories of Bosnia and Herzegovina.

Annex II

THE SIPAD COMPUTER CENTRE

A. Main items of equipment

Computer

Honeywell G120 CPU with 32 k byte memory (k = 1024)	one
Disc unit with control (DSC-161) - 7.68 m byte storage, 256 k byte/sec transfer rate	one
Disc units (DCU-160) - 7.68 m byte storage, 256 k byte/sec transfer rate	two
Tape unit (MTM-163) - dual density 1,600/800 bpi, transfer rate 30/15 k byte/sec	one
Tape units (MTS-163) - 1,600 bpi, transfer rate 30 k byte/sec	three
Printer (PRT-14T) - 1,100 lpm, 136 print positions, dual carriage transport	one
Card reader (CRZ 111) - 400 cpm	one

Data preparation

Key-tape units (901-500 B)	four
IBM 029 non-printing punches	three
IBM 059 verifiers	two
Honeywell P 100 programmer's printing punch	one

Auxiliary

Forms burster	one
Decollator	one

Storage

Tapes	about 800
Disc packs	about 25

B. Organization

Serial number	Designation	Establi-shment	Actual	Educational qualification [a/]	Experience	
					Total	Job related
General management						
1.	Director	1	1	VSS	8	5
2.	Assistant director	1	1	VSS	5	5
3.	Secretary	1	1	SSS	3	3
Project and industrial engineering department						
4.	Departmental head	1	-	III stephen	6	4
				VSS	6	5
5.	Project leader	2	-	III stephen	5	3
				VSS	6	4
6.	Senior project engineer	2	2	VSS	4	2
				VS	6	4
7.	Project programmer	2	1	VSS	3	2
				VS	5	3
8.	Programmer	2	2	VSS	2	1
				VS	3	2
9.	Junior programmer	4	-	VSS	1	1
				VS	2	1
				SSS	3	2
Project implementation and maintenance						
10.	Departmental head	1	1	III stephen	6	4
				VSS	6	5
11.	Leading systems analysts	3	1	VSS	5	4
				VS	8	5
12.	Senior systems analysts	3	1	VSS	4	3
				VS	6	4

Serial number	Designation	Establi-shment	Actual	Educational qualification [a]	Experience	
					Total	Job related
13.	Systems analyst	3	1	VSS	3	2
				VS	5	3
14.	Programmer	1	-	VSS	3	3
				VS	5	3
Hardware maintenance department						
15.	Head of department	1	1	VSS	8	5
				VS	10	7
16.	Maintenance engineer	1	1	VSS	5	3
				VS	7	5
17.	Maintenance technician	1	-	SSS	3	1
				VKV		
Data preparation and control section						
18.	Head of department	1	1	VS	5	3
				SSS	7	5
19.	Coding leader	1	1	VS	3	1
				SSS	5	3
20.	Input-ouput control leader	1	1	VS	3	1
				SSS	5	3
21.	Senior input-ouput controller	1	-	SSS	4	2
22.	Input-output controller	1	-	SSS	2	1
23.	Shift leader	2	2	SSS	7	5
24.	Senior operator	6	4	SSS	4	4
25.	Operator	8	7	SSS	3	3
26.	Junior operator	12	8	SSS	1	1
Computer operations section						
27.	Chief operator	1	-	VS	5	3
				SSS	7	5
28.	Operations leader	2	1	SSS	5	5

Serial number	Designation	Establi-shment	Actual	Educational qualifications a/	Experience Total	Experience Job related
29.	Senior operator	2	2	SSS	4	4
30.	Operator	2	2	SSS	2	2
OOUR - Administration department						
31.	Head of department	1	1	VSS	3	3
				VŠ	5	5
32.	Head bookkeeper	1	-	VŠ	5	5
				SSS	7	7
33.	Leader - administration and self-management	1	1	VŠ	3	3
				SSS	5	5
34.	Liquidity control	1	b/	SSS	3	3
35.	Typist	1	1	I B klasa	1	1
36.	Storekeeper - messenger	1	1	KV	1	1

a/ Abbreviations used for educational qualifications:

III stepen	Master's degree	-	(6 years university)
II stepen or VSS	- Graduate	-	(4 years university)
I stepen or VŠ	- Intermediate	-	(2 years university)
SSS	- Secondary school	-	(12 years schooling)
VKV	- Senior craftsman	-	(KV + experience + examination)
KV	- Technical school (vocational)		(12 years schooling)
I B klasa	- Typist with class 1B certificate		

b/ Now done through R.O.IRC.

C. Applications

The Computer Centre works two shifts, five days a week. About 80% of its work is devoted to ŠIPAD Komero. The main applications are:

(a) Sales and purchase accounts;

(b) Accounting of taxes on sales and purchases payable to the State, the republic and the communes;

(c) Provision of statutory statistics for social monitoring. These include assets, funds, personal income (lični dohodak), and various financial ratios. Essentially this means the preparation of detailed quarterly balance sheets that are provided at three levels: ŠIPAD Kombinat, RO and OOUR. The basic information is submitted by OOURs and consolidated by the Computer Centre;

(d) Accounting for retail shops. There are over 200 shops and about 60,000 accounts. Basic inputs are bills and cheques and four kinds of adjustments or corrections. Twenty-five reports are produced in the following four categories:

(i) Control of input - two reports;

(ii) Sales by shops - five reports;

(iii) Buyer's status (payment of instalments, warnings sent, legal action taken, etc.) - 15 reports;

(iv) Communications with buyers - three reports;

(e) Payroll and personnel information. Thirty-six reports cover 2-3,000 people working in two ROs (ŠIPAD Komero and ŠIPAD IRC). Extensions are being negotiated.

The remaining 20% of computer time is divided between development work and the following regular jobs:

(a) Forest Inventory. This is based on a 5% sample, a circle of 25 m diameter being sampled in a 100 m square grid. Each year, 100,000 hectares are sampled. The information gathered covers not only timber but all forms of forestry information. An accuracy of ± 2% is claimed with 95% confidence. The information is used in planning forest activities;

(b) The annual cutting plan.

From time to time the computer has been used for critical-path analyses for the construction of factories (at Sokolac, Bosanska Krupa and Ključ) and roads. It has also been used for some statistical work.

Annex III

CODING SCHEMES

Codes developed for SIPAD's OOUR's

This is a four digit code of which the first two digits represent the RO and the next two the OOUR with the RO. OOURs are numbered consecutively; the order has no speoial signifioance. The proposed codes for all SIPAD ROs and for all OOURs of "Jahorina" are as follows:

First digit pair

SIPAD top management (00-09)

00	SIPAD Kombinat Sarajevo	

"Servioe" ROs (10-39)

10	Inženjering	Zvornik
11	IRC	Sarajevo
12	SIPAD Komerc	Sarajevo

"Production" RO's (40-99)

40	"Jahorina"	Sarajevo
41	"Romanija"	Sokolac
42	"Maglić"	Foča
43	"Velež"	Mostar
44	"Konjuh"	Živinioe
45	"Biraš"	Vlasenioa
46	"Majevioa"	Brčke
47	"Kozara"	Bosanska Gradiška
48	"Sebešić"	Travnik
49	"Janj"	Donji Vakuf
50	"Sator"	Glamoč
51	"Grmeč"	Drvar
52	"Ključ"	Ključ
53	"Una"	Bosanska Krupa
54	"Oštrelj"	Bosanski Petrovac
55	"Celpak"	Prijedor
56	"Sana"	Sanski Most

Second digit pair

"Jahorina" OOURs (RO 40)

01	Forestry	Pale
02	Proocssing	Pale
03	Initial prooessing	Srednje
04	Initial prooessing	Ilijaš
05	Boards and veneer	Ilijaš
06	Assembly	Ilijaš
07	"Igman" forestry	Hadžići
08	Wood processing	Hadžiof
09	"Treskavica" forestry	Trnovo
10	Processing	Trnovo
11	Plywood	Blažuj
12	Hardboard	Blažuj
13	Veneer	Blažuj
14	Forestry	Kalinovik
15	Wood prooessing	Kalinovik
16	"Standard" furniture factory	Sarajevo
17	Initial processing	Vareš
18	Forestry	Vareš
19	Final prooessing	Vareš
20	Transport	Vareš
21	Forestry	Fojuica
22	Initial processing	Fojnica
23	Final prooessing	Fojnica

Material oodes for the Standard factory

For the material oodes two factors were of partioular importanoe: speed of development, and the need to make use of existing oodes wherever possible. The oode is restrioted to the 15 plaoes that GEIMS permits.

Purohased materials

In aooordanoe with ourrent praotioe at the Standard factory, purohased materials are divided into three oategories:

(a) Subcontracted materials - generally subcontracted to the other COURs within SIPAD;

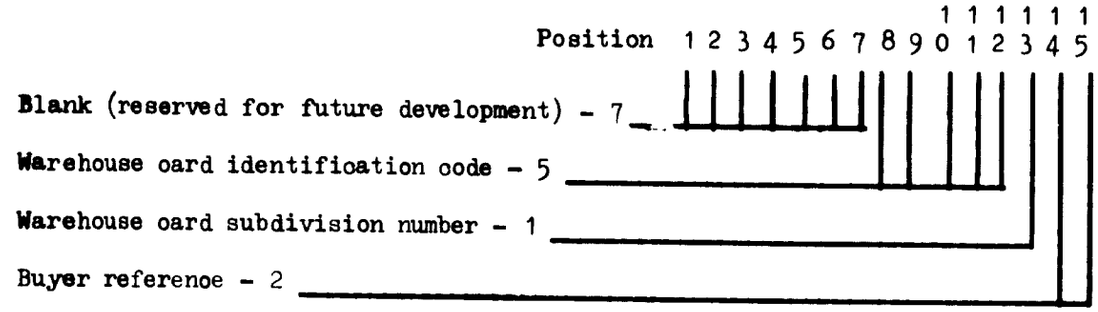
(b) Basic raw materials - wood, particle board and plywood;

(c) Technical materials - all other materials, including screws, glues, fasteners, fittings, spares, and general stores.

For all these materials an eight digit code has been adopted, based on the item codes currently used in the warehouses. A card is maintained for each item in the technical store, with a five digit numeric code, approximately as follows:

..0 -	999	Fuels and lubricants
1000 -	1999	Coloured metals
2000 -	2999	Glass
3000 -	3999	Hardware (screws, nuts, bolts etc.)
4000 -	4999	Tools
5000 -	5999	Electrical materials
6000 -	6499	Bearings
6500 -	6999	Varnishes
7000 -	7999	Chemicals and plastics
8000 -	8999	Wooden items (brushes etc.)
9000 -	9499	Paper
9500 -	9999	Textiles
10000-	10999	Rubber items
11000-		Automobile spares

Occasionally it is found that a code number has to be subdivided to maintain continuity - to distinguish between screws of the same type made of different alloys, for example. Cards numbered 3055/1, 3055/2 and 3055/3 could therefore exist. The proposed scheme allows for five digits to take the card code, one digit to allow for any suboods and two further digits as a reference (to be used in this case to identify the buyer). The following coding scheme is proposed for technical materials:



Essentially the same code structure has been proposed for basic raw materials and subcontraoted items, exoept that the letter "S" (sirovine - raw materials) is the first oharaoter of the code. This is followed by four digits to allow for the oard number, one digit to allow for subdivision of a given code and two digits for the buyer. The oodes are right-justified.

Manufactured produots

Manufactured products are divided into:

(a) Finished produots (items that are ultimately sold);

(b) Elements (items that remain unchanged in the finished produot - the door of a wardrobe in a wall unit, for instance);

(c) Intermediates (items that are further changed in the process of manufacture).

Codes for all manufaotured products are left-justified. A mixed alphabetio and numeric soheme has been adopted for ease of applioation.

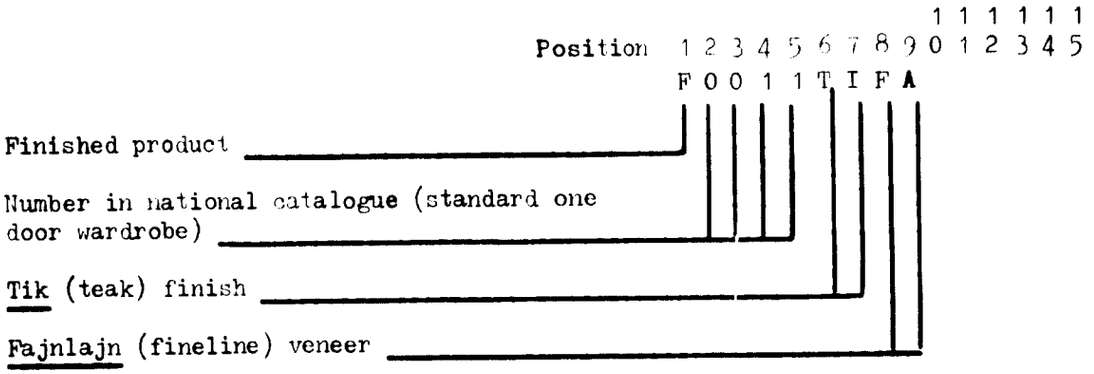
Finished produots

It is understood that this is a national oatalogue in whioh eaoh finished produot of the Standard faotory has a unique number. The proposed ooding soheme for finished produots is based on this number. However, the oataloque number does not differentiate between different finishes of the same style of produot. A one-door wardrobe of the style "Standard", for example, would have the same oode regardless of whether the finish is teak, nut or oak. The ooding soheme proposed allows for these distinotions (whioh are vital both to the oustomer and for produotion planning).

The soheme is as follows:

The first oharaoter is "F" for finished produot. This is followed by the numerioal oode of the produot in the national oatalogue. Two alphabetio oharaoters then follow for eaoh of various features of the finish. The feature

could be type of wood and type of veneer for wall units, or type of textile and colour for upholstered furniture. A typical code would be:



Elements

The proposed coding scheme for elements identifies the elements by their physical characteristics and without reference to the finished products into which they go. This could be of value to designers. The scheme is outlined below.

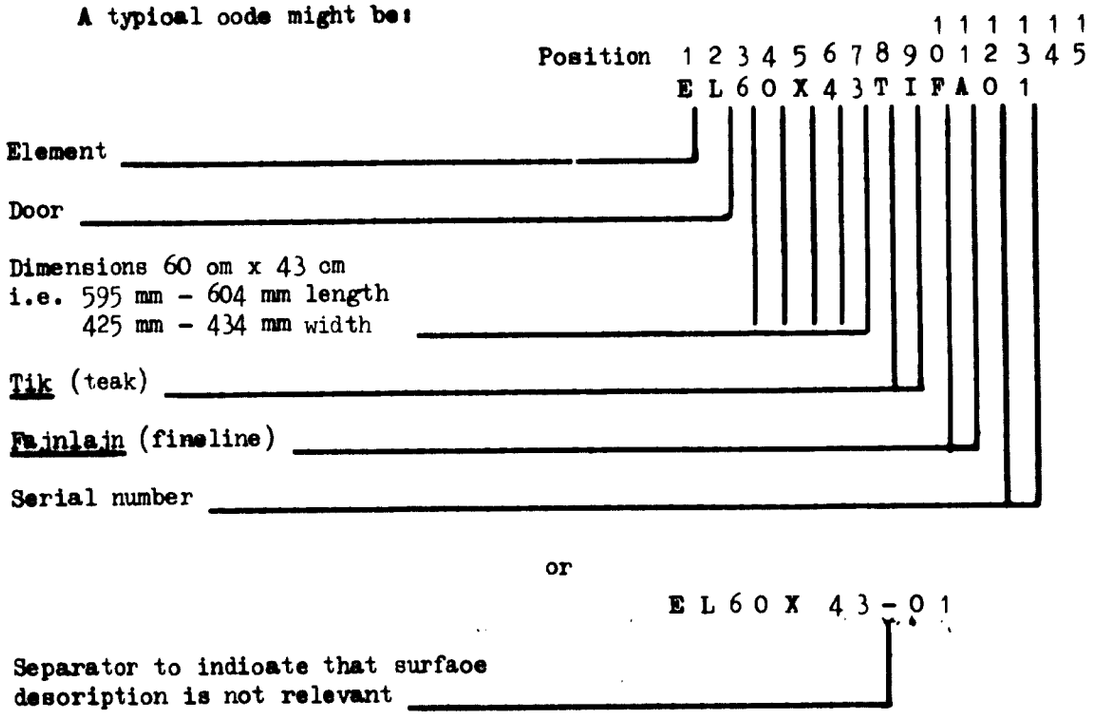
The first character - the letter "E" for elements - is followed by an alphabetic code for the element of one or more characters. For wall units, the Standard factory had already devised the following codes, which will be used:

L for doors
S for stranica (side)
H for horizontal (top or bottom)
P for polica (shelf)
etc.

The element code is followed by the main dimensions (in centimetres to the nearest centimetre) separated by "X". The dimensions are followed by an alphabetic code for the surface finish. This coding is on the same basis as that for finished products.

The final code is a serial number to distinguish between items that are different but would otherwise have the same code (e.g. a left and a right element, or elements whose dimensions differ in such a way as not to be reflected in the coded dimensions). A hyphen "-" is used as a separator when a code is omitted because it is not relevant.

A typical code might be:



or

E L 6 0 X 4 3 - 0 1

Separator to indicate that surface description is not relevant

Intermediates

The coding scheme for intermediates is based on the same principles as are used for elements. It is as follows:

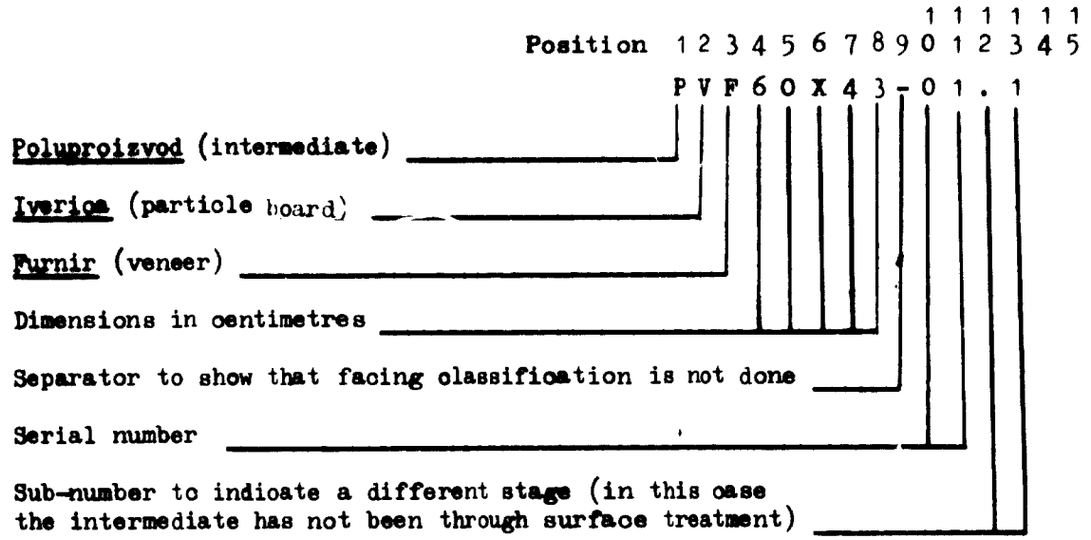
The first letter is P for poluproizvod (semi-finished or intermediate). This is followed by an alphabetic code of one or more letters indicating the main materials used. The following codes are used:

B for bridna (edge)
D for dekoracija lajsne (decoration)
F for furnir (veneer)
L for lesonit (hardboard)
M for masivno drvo (solid wood)
P for plastika (plastic)
S for šperploča (plywood)
V for iverica (partiole board)

V would stand for partiole board on its own, VF for veneered partiole board etc.

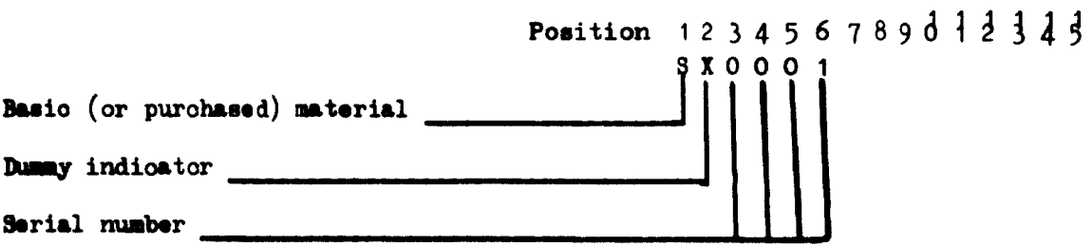
The material code is followd by the significant dimensions. The dimensions are followed by an alphabetic code to describe the surface or finish of the intermediate. This is followed by a serial number to differentiate between items which would otherwise have the same code. In the case of intermediates it may also be necessary to distinguish between two different stages where none of the coded characteristics change, this is done by adding a further serial - a sub-number after "a". This would be necessary, for example, to distinguish between a lacquered and unlacquered part.

An example of coding of an intermediate is:



Dummy or shorthand codes

Dummy codes are used to save writing for often repeated combinations of items in a product structure. The letter X is used to indicate a dummy item. The first letter indicates the kind of materials being combined and corresponds to the first letter of the material code, except that for purchased materials it is "S". This is followed by a four digit serial.



Codes for resources

For resource planning, it is necessary to code resources of machinery and manpower. GEIMS allows for a fifteen character code made up as follows:

(a) Department - four digits;

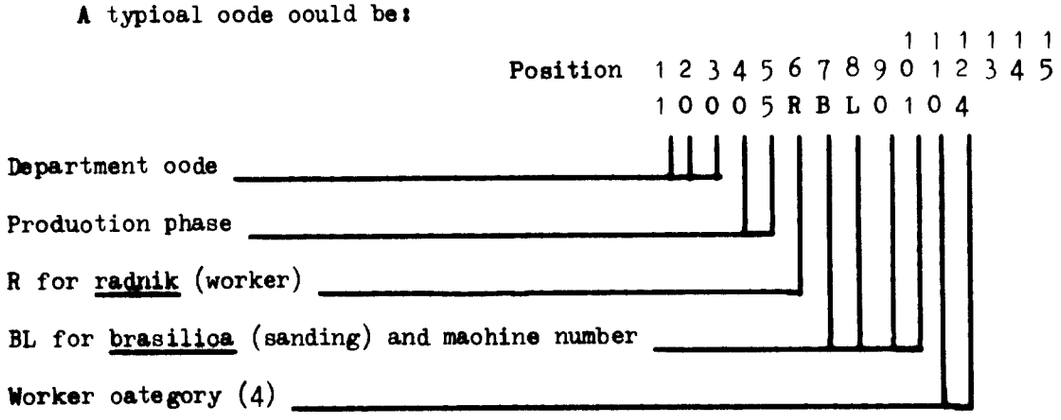
(b) Section - four digits;

(c) Resource identifier - seven digits

The Standard factory's existing coding scheme is used as far as possible for departmental coding. It is a three-digit numeral and is right justified.

Since there were no further subdivisions in the Standard coding scheme, it was decided to use the "section" code to identify the phase of production (packing, assembly, board processing, surface finishing, and so on). This is a two-digit right-justified numeral. The resource itself is left-justified; its first character is R (for radnik) if the resource is a worker, or M if it is a machine. The next two characters are two letters that identify the machine type and the next two characters are numerals to distinguish between different varieties of a given machine type. The last two digits denote the worker category and are not used for machines. Worker categories are linked with the hourly payment rates and provide links for costing in the future.

A typical code could be:



Annex IV

GEIMS PROGRAMS

Program name	Purpose
	INITIAL MASTER FILE CREATION
PXINTIR	Initial loading of material and resource master information
PXINTS	Sort
PXINT2R	Elimination of duplicate records
	MAINTENANCE OF MASTER AND PRODUCT STRUCTURE FILES
PXFM1R	Recording and preliminary editing of file update data
PXFM1M	Macro manipulation
PXFMS	Sort
PXFM2R	Updating master files
	UPDATING INVENTORY INFORMATION
PXMUR	Recording stock changes - receipts, dispatches, withdrawals and adjustments
	MAINTENANCE OF ORDER AND DEMAND FILES
PXOD1R) PXOD2R)	Recording orders and demands and producing bills of materials for released orders
	REPORTS PRODUCED
PXILR	Inventory list
PXPLR	Parts list
PXIPLR	Indented parts list
PXIS	Item status
PXRL	Resource list
PXRRL	Resources required list
PXWULR	Where-used list
PXOCD1) PXOODS) PXOOD2)	Open order and demand lists
PXCOD1) PXCODS) PXCOD2)	Closed order and demand lists

Program name	Purpose
PXIPIR) PXIPS) PXIP2R)	Inventory planning
PXRP1) PXRPS) PXRP2)	Resource planning
PXIM1) PXIMS) PXIM2) PXIM3)	Product costing and Cost implosion
	DISK FILE HOUSEKEEPING
PXCOMP1) PXCOMP2) PXCOMP3) PXCOMP4) PXCOD3)	File compression programs to eliminate unwanted records for efficient processing

Annex V

VISITS TO FACTORIES

A number of factory visits were arranged as a part of the programme of familiarization with SIPAD's activities. The opportunity was taken during the visits to make a quick assessment of the desirability of computerizing production planning and inventory control.

OOUR "Neretva", Konjić

OOUR "Neretva" has its own forestry, transport and sawmilling departments. A furniture factory is being built that is intended to continue the local tradition of wood carving. The sawmilling and related activities were seen, as were some designs typical of the proposed production in the new factory.

The sawmill handles 20,000 m^3 per year of round wood. The OOUR also sells 80,000 m^3 of unsawn logs.

The following views were formed regarding computerization:

(a) Computerized inventory control is likely to be worthwhile for maintenance and general stores items;

(b) Computerized production planning is not likely to be worthwhile at this stage of sawmilling;

(c) Computerization of both production planning and inventory control would be worthwhile in the new factory and should, if possible, be introduced from the start.

RO "Velež", Mostar

The sawmill, plywood factory and the main warehouse were seen. "Velež" is one of 20 ROs within SIPAD and has 10 factories. Two more are due to start operations during 1977: a factory to make 200,000 pieces a year of solid wood chairs in Nevesinje and one to make furniture based on traditional styles in Konjić. The RO employs 2,800 workers. Annual turnover is Din 360 million exports - mainly of sawn beech and fir-account for 25% of this figure. Two new export-oriented factories are planned. These will export 50% of their production. The OOURs of the RO produce sawnwood (coniferous and hardwoods), joinery products and boards. Mostar has two factories: a sawmill handling 18,000 m^3 of logs (65% fir), and a plywood factory producing 6,000 m^3 of plywood of classical quality and dimensions. Approximately 100 final products are produced.

Because the emphasis in the past had been on primary conversion and the raw materials were under the OR's own control, problems of planning were not significant. With the move towards end products for sale to the ultimate user, however, planning is likely to need more attention. Inventory control of spares and other maintenance materials was mentioned as a possible problem area.

The warehouse was well laid out and well maintained. Capacity could be increased by using metal bins of varying sizes to stock items that require little space.

The following views were formed regarding computerization:

(a) Computerization of production planning and inventory control is likely to be beneficial in both new factories and should be introduced from the start, if possible;

(b) Computerization of inventory control for maintenance and general stores items is likely to be worthwhile;

(c) Computerization of production planning in the sawmills and plywood factories is not likely to be worthwhile at this stage.

OOUR "Varda", Višegrad (Two visits)

The "Varda" factory was commissioned in its present form in July 1976 to produce solid-wood furniture for export and for the domestic market. An older factory is being converted for the manufacture of toys and will use off-cuts from the furniture factory as a major raw material. At present, 70% of the factory's production is being exported - mainly to Sweden and West Germany - but the plan for the year is to export 50% of production. There is considerable flexibility in the mix of woods (coniferous and hardwoods) that the factory can use. At present the mix is 50% of each. Production is divided into three lines:

(a) A board line, occupied 70%, working a single shift;

(b) A sawing line, occupied 85%, working two shifts;

(c) A carving line, occupied 60%, working a single shift.

Furniture sales are seasonal. The holiday months from mid-June to the end of August are relatively slack. The period from September to January is marked by a high level of sales to householders. The months from February to mid-June are average, with the tourist season making up to some extent for reduced sales to householders.

"Varda's" documentation and control system for production and inventory is very well conceived and integrated. "Varda" is well placed to computerize and should benefit from doing so.

One key problem was the time and effort required to translate market requirements into production requirements, and production requirements into resource requirements of manpower, machines and materials. Consequently, this area should be the starting point for computerization in "Varda", and further development should stem from it. The development priorities should be approximately as follows:

(a) Material and resource breakdown;
(b) Resource planning for production control;
(c) Inventory planning for production control;
(d) Stock accounting;
(e) Purchasing and purchase account;
(f) Salary payments and manpower accounts;
(g) Labour efficiency and control;
(h) Machine utilization.

Items (a) and (d) could be introduced gradually during 1977 (subject to resources being available with the Computer Centre). Item (f) could be developed during 1978. The response time for these activities is such that the SIPAD Computer Centre at Sarajevo can undertake the work without the need for any terminals at the plant in Višegrad.

It was thought that "Varda" might need terminals in 1977 and intelligent terminals in 1981. This assessment is based on the time required for an organization to refine progressively its use of a system until it can benefit from fast response times. The assessment is tentative and a member of imponderables could affect the timings suggested.

Another area where benefit from computer usage was thought to be possible is annual planning. Here it was found that estimated market demands exceeded the capacity of the factory because of a shortage of resources. The application of linear programming techniques would not only provide the optimum product mix for the factory, but would also indicate areas for management action. This activity should be synchronized with the next planning cycle; work would need to start early in August in order to provide the first plan by the end of September.

It is recommended that "Varda" and ERC should work along the lines indicated above.

It is evident that a standardization of systems and codes for similar activities throughout SIPAD is well worth pursuing. This is partioularly so because manpower resources in systems development will always be in short supply, and effort saved there should yield benefits far beyond the savings in direct costs.

RO "Romanija", Sokolac

RO "Romanija" has 18 OOURs made up as follows:

Forestry	4
Sawmills	4
Joinery	4
Particle board	1
Transport	3
Building construction	1
Workers welfare	1

The management of seven of these OOURs is in Sokolac, whioh is also the headquarters of the RO. The RO employs 5,500 workers and has an annual turnover of Din 1,000 million. It has its own forestry, sawmilling and finishing plants. "Romanija" makes no furniture. Sokolac has a 30 year tradition in joinery, but "Romanija's" joinery faotory was built only three years ago. The partiole-board factory was started in 1960 and renovated in 1976.

The particle-board factory is highly automated and manufactures boards in eight thicknesses, one width and two lengths. The factory works three shifts, 330 days in the year. It has a daily capacity of 200 m^3 of partiole board (66,000 m^3 a year).

The joinery factory produoes 60,000 doors and windows a year of whioh one third are for contract and two thirds for direot sales on the market. There are 80-100 different products (without allowing for differenoes in oolour or fitting) - an intensive range. It was evident that considerable study has gone into the handling of materials and work in both factories.

The following views were formed regarding oomputerization:

(a) Considerable benefit might be derived from applying linear programming teohniques to medium-term (about one year) planning for the joinery faotory, beoause of the variety of produotion and beouuse demand exoeeds supply;

(b) The computerization of short-term production planning and inventory control is likely to be worthwhile in the joinery factory;

(c) The computerization of inventory control for maintenance materials and general stores is likely to be worthwhile in the particle board-factory.

Annex VI

STANDARD FACTORY - ORGANIZATION

Director of the OOUR

A. Commercial sector: Director

Sales services: Chief, responsible for:

- External sales
- Export
- Retail
- Advertising
- Invoice typing service
- Finished products on stock

Purchasing services: Chief, responsible for:

- Purchasing in Yugoslavia
- Import
- Typing services
- Stock of raw material
- Stock of other materials

Transportation services: Chief, responsible for:

- Dispatcher
- Cashier
- Services
- Transportation means (vehicles)

B. Development sector: Director, responeible for:

- Market research
- Designing
- Technology
- Investments
- Construction development
- Calculations
- Technical and economical analyses
- Prototypes production

C. Production sector: Director

Technical preparation: Chief, responsible for:

- Technical working out
- Working out of conetructione
- Material norms
- Time norms
- Operative planning
- Timings
- Calculatione
- Release

Technical control: Chief, responsible for:

- Analyses
- Finished products control
- External control

Maintenance: Chief, responsible for:

Foremen
Dispatcher
Planning records
Machine maintenance
Installation maintenance
Building maintenance

Furniture production: Chief, responsible for:

Dispatcher
Keeping records in plants
Transportation

Primary conversion: Chief, responsible for:

Foremen
Timber drying
Grading
Tool shop
Internal transport
Panel processing I
Solid wood processing
Panel processing II

Finishing: Chief, responsible for:

Foremen
Internal transport
Surface finish
Assembly
Packing

Upholstery: Chief, responsible for:

Dispatcher
Foremen
Mill records
Prototype production
Cutting of synthetic foam
Transportation
Textile cutting and sewing
"Bonel" line
"Molt" line
"Sanel" line
Compound club set line
Common club set line
Polyureathane production

D. Financial sector: Director

Accounting department: Chief, responsible for:

Head bookkeeper
Financial bookkeeper
Purchase bookkeeper
Fixed assets bookkeeper
Bookkeeping for workshops
Canteen bookkeeping

Salaries calculation
Suspensions
Mecanography
Typing
Cashier
Liquidator's office: Chief, responsible for:
Financial coding
Instalment loans
Mecanography

Planning and analyses: Chief, responsible for:

Economic analyses
Planning

E. Sector for management services: Director, responsible for:

Self-management and legal services
Work protection
Staff services
Common services
Security
Canteen services

Annex VII

SEMINAR FOR "STANDARD" FACTORY

A Seminar was given at "STANDARD" factory on 29 April 1977 to familiarize the management and workers at all levels concerned with the system being developed, how it would operate and what results it would provide. The seminar was held under the chairmanship of Mr. Tihomir Drakulić, Director of OOUR TN "STANDARD". About forty people attended.

The seminar was based on a number of transparencies prepared by the expert for use with an overhead projector. The contents of these slides is reproduced on the following pages.

1.	PLANIRANJE PROIZVODNJE I KONTROLA ZALIHA	PRODUCTION PLANNING & INVENTORY CONTROL
2.	CILJ	OBJECTS
	- Objašnjenje sistema	- To explain the system
	- Predvidjanje poteškoća	- To foresee difficulties
	- Procjena budućih zahtjeva	- To assess future needs
3.	Šta se može očekivati od planiranja proizvodnje i kontrole saliha ?	What should a production planning & control system achieve ?

4. PROBLEMI

1. Vreme i napor za odredjivanje materijala, radne snage, mašina potrebnih za jedan nalog ili je taj plan proizvodnje vrlo visok.

2. Nije moguće proveriti raspoloživost resursa (materijala i drugog) prema zahtevima.

PROBLEMS

1. Time and effort to determine material, manpower & machine requirements of an order or a production plan is very high.

2. It is not possible to check availability of resources (material and others) against requirements.

REZULTATI

1. Prekidi proizvodnje

2. Odlaganje izvršenja naloga

3. Mogućnost prihvatanja naloga koji se ne mogu izvršiti

4. Mogućnost odbijanja naloga koji se mogu izvršiti

RESULTING IN

1. Interruptions to production

2. Delays in meeting orders

3. Possibility of accepting orders that cannot be met

4. Possibility of refusing orders that can be met.

5. OBEZBEDITI	PROVIDE
INFORMACIJE O TOME	INFORMATION ON
KOJI	WHAT
RESURSI:	RESOURCES
	of
radna snaga	manpower
mašine	machines
materijali	materials
su potrebni	are needed
KADA	WHEN
su potrebni	they are needed
KADA	WHEN
je potrebno preduzeti	action is needed
korake da se oni obezbede	to get them
TAKO DA	SO THAT
SE ZADOVOLJI ZAHTEV	MARKET DEMAND
SA TRŽIŠTA	IS SATISFIED
6. ZAPISIVANJE	RECORD
Donošenje	Decisions
odluka	taken
REVIZIJA	REVIEW
Implikacije	Implications
donetih	of
odluka	decisions
	taken

7. PREDLOŽENI SISTEM

THE PROPOSED SYSTEM

POSMATRANO SA STANOVIŠTA ZALIHA

SEEN FROM THE POINT OF VIEW OF STOCKS

PROIZVODNJA I NARUDŽBE POVEĆAVAJU ZALIHE

PRODUCTION AND PURCHASES INCREASE STOCKS

PRODAJA I IZDAVANJE TVORNICI SMANJUJU ZALIHE

SALES AND ISSUES TO FACTORY REDUCE STOCK

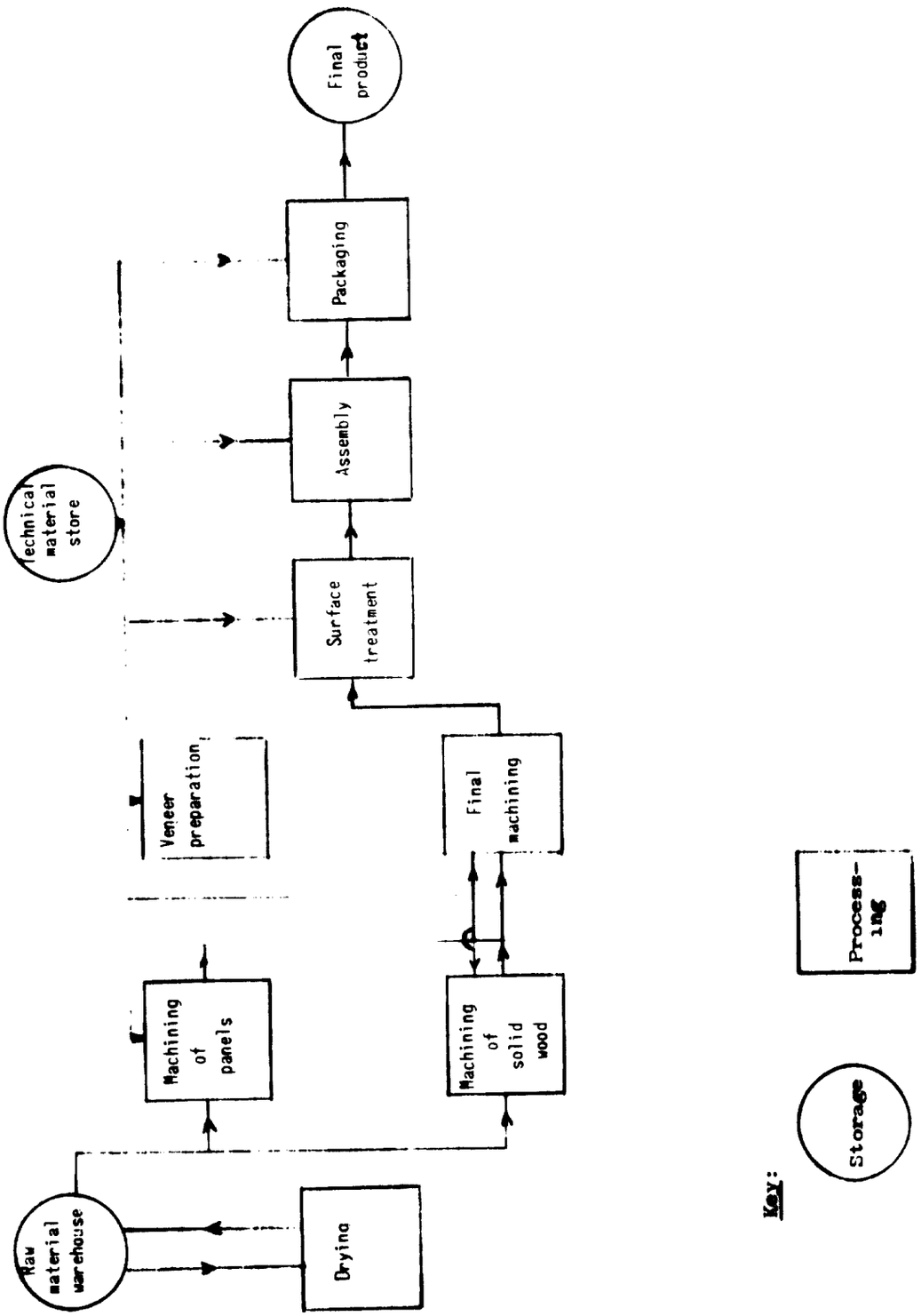
8. MI DAJEMO JEDAN MODEL SISTEMA U KOMPJUTERU. OVAJ MODEL DAJE SLIKU OSNOVNIH KARAKTERISTIKA SISTEMA.

WE SET UP A MODEL OF THE SYSTEM IN THE COMPUTER. THIS MODEL DEPICTS THE ESSENTIAL FEATURES OF THE SYSTEM.

9. KOMPJUTER RADI UNAZAD OD VREMENA KAD ZAHTEV TREBA ZAVRŠITI, DA BI ODREDIO KOJE MATERIJALE I DRUGE RESURSE TREBA OBEZBEDITI U RAZLIČITO VREME. ONI SE POREDE SA RASPOLOŽIVIM MATERIJALIMA I RESURSIMA I MOGUĆIM PODRUČJIMA SA PROBLEMIMA.

THE COMPUTER WORKS BACKWARD FROM THE TIME THAT A DEMAND HAS TO BE COMPLETED. IT DETERMINES WHAT MATERIAL AND OTHER RESOURCES ARE TO BE PROVIDED AT DIFFERENT TIMES. THESE ARE COMPARED WITH WHAT MATERIALS AND RESOURCES ARE AVAILABLE TO DETERMING WHAT THE PROBLEM AREAS ARE LIKELY TO BE.

Phases identified for production planning and control of wall units in Standard factory



10.	NAPRAVLJENI IZVEŠTAJI	REPORTS PRODUCED
	PLANIRALJE ZALIHA	INVENTORY PLANNING
	PLANIRANJE RESURSA	RESOURCE PLANNING
	LISTA DELOVA	PARTS LIST
	INDENT LISTA DELOVA	INDENTED PARTS LIST
	LISTA POTREBNIH RESURSA	RESOURCES REQUIRED LIST
	LISTA GDE SE MATERIJALI KORISTE	WHERE USED LIST
	LISTA ZALIHA	INVENTORY LIST
	LISTA RESURSA	RESOURCES LIST
	LISTA OTVORENIH NALOGA	OPEN ORDERS LIST
	LISTA OTVORENIH ZAHTEVA	OPEN DEMANDS LIST
	LISTA ZATVORENIH NALOGA	CLOSED ORDERS LIST
	LISTA ZATVORENIH ZAHTEVA	CLOSED DEMANDS LIST
	IZVRŠTAJ O STATUSU ARTIKLA	ITEM STATUS REPORT
	LISTA MATERIJALA ZA NALOG	ORDER BILL OF MATERIALS

11. IZVRŠTAJ O PLANIRANJU ZALIHA	INVENTORY PLANNING REPORT
GLEDA RASPOLOŽIVOST I ZAHTEVE SVAKOG MATERIJALA IZ DANA U DAN I PREDLAŽE KOJE SU DALJNE NARUDŽBE POTREBNE I KADA.	LOOKS AT THE AVAILABILITY AND REQUIREMENTS OF EACH MATERIAL DAY BY DAY AND SUGGESTS WHAT FURTHER ORDERING IS NEEDED AND WHEN.
12. IZVEŠTAJ O PLANIRANJU RESURSA	RESOURCE PLANNING REPORT
GLEDA NA ZAHTEVE I RASPOLOŽIVOST RESURSA (RADNE SNAGE I MAŠINA) IZ DANA U DAN I SIGNALIZIRA AKO JE POTREBNA AKCIJA RUKOVODSTVA NEGDE.	LOOKS AT REQUIREMENT AND AVAILABILITY OF RESOURCES (MANPOWER AND MACHINES) DAY BY DAY AND POINTS OUT IF MANAGEMENT ACTION IS NEEDED ANYWHERE.

77-073 INVENTORY PLANNING REPORT

REF. / DATE	DESCR. / REF.	UNIT OF MEASURE / CODE	INV. LOCATION / BAL-FWD	REORDER / ORDERS	LOTSIZE / DEMANDS	LEADTIME / AVAILABLE	SHRINKAGE / SUGGEST	COMMENTS
F1	TABLE	EA		50	100	002	00	
77-171	F0730	P	139	1,000		1,139		
77-260	F0730	D	1,139		17,246	16,107-	16,200	
P1	TABLE TOP	EA		100	100	002	05	
77-169	F0730	P	130		1,001	871-	1,000	
77-258	F1	S	124		16,217	16,073-	16,300	
P2	LEGS	EA		200	400	002	1.0	
77-169	F0730	P	462		4,004	3,542-	4,000	
77-258	F1	S	418		64,865	64,447-	65,600	
P3	LONG APRON	EA		200	400	002	1.0	
77-169	F0730	P	562		4,004	3,442-	4,000	
77-258	F1	S	518		64,865	64,347-	65,200	
P4	SHORT APRON	EA		200	400	002	1.0	
77-169	F0730	P	498		4,004	3,506-	4,000	
77-258	F1	S	454		64,865	64,411-	65,600	
B1	SCREW	EA		6,000	1,000	070	2.0	
77-169	F0730	P	6,938		26,400	19,462-	26,000	
77-258	F1	S	6,018		427,600	421,652-	428,000	
B2	WOOD LEG/APRON	CM		80,000	40,000	030	10.0	
77-167	P2	S	119,480		164,000	44,520-		
	P4	S	44,520-		84,000	128,520-		
	P3	S	128,520-		164,000	292,520-	440,000	
77-256	P2	S	102,480		2,688,600	2,586,120-		
	P4	S	2,586,120-		1,377,600	3,963,720-		
	P3	S	3,963,720-		2,673,200	6,636,920-	7,480,000	
B3	WOOD TOP	C2		100,000	400,000	030	10.0	
77-167	P1	S	199,326		4,200,000	4,000,674-	4,800,000	
77-256	P1	S	319,326		8,460,000	8,121,674-	9,200,000	

77-L73 RESOURCE PLANNING REPORT

RESOURCE IDENTIFICATION AND DATE	REF.	(WORK) CENTRE CODE	DESCRIPTION BAL-FWD	UNIT OF MEASUREMENT REQTS.	CAPACITY AVAILABLE	EXTRA-FACTOR % USAGE %	EFFICIENCY COMMENTS
M1		**ASSY. PRESS**		**HR**	**4.00**	**0**	**90.0%**
77-073							
77-168	F1	S	380.00	216	164	56.84	
77-171	F0730	P	176.00	38	138	64.79	
77-260	F1	S	494.00	600	106-	114.17	OVER
W1		**ASSY. PRESS**		**HR**	**4.00**	**0**	**100.0%**
77-073							
77-168	F1	S	380.00	195	185	51.31	
77-171	F0730	P	197.00	34	163	58.41	
77-260	F1	S	519.00	540	21-	102.80	OVER
W2		**ASSY. SCREW**		**HR**	**4.00**	**0**	**87.5%**
77-073							
77-168	F1	S	380.00	330	50	86.84	
77-171	F0730	P	62.00	57	5	98.72	
77-620	F1	S	361.00	926	565-	175.53	OVER

13. LISTA DELOVA
INDENT LISTA DELOVA
LISTA POTREBNIH RESURSA
LISTA GDE SE MATERIJALI KORISTE

PARTS LIST
INDENTED PARTS LIST
RESOURCES REQUIRED LIST
WHERE-USED LIST .

OVI IZVEŠTAJI SAČINJAVAJU TEHNIČKE SPECIFIKACIJE MATERIJALA

THESE REPORTS CONSTITUTE THE TECHNICAL SPECIFICATIONS OF THE MATERIAL

PROMENE JE MNOGO LAKŠE DOKUMENTOVATI UZ POMOĆ KOMPJUTERA.

CHANGES ARE MUCH MORE EASILY DOCUMENTED USING THE COMPUTER.

14. MOGUĆE DRUGE KORISTI

- AUTOMATSKO IZDAVANJE ZAHTEVA
- AUTOMATSKO DAVANJE CENA ZA ZAHTEVE
- ODRŽAVANJE I VODJENJE KARTICA ZA ZALIHE
- TROŠKOVI PROIZVODA
- TROŠKOVI NALOGA
- DRUGE AKTIVNOSTI KNJIGOVODSTVA

POSSIBLE OTHER BENEFITS

- AUTOMATIC PRODUCTION OF REQUISITIONS
- AUTOMATIC PRICING OF REQUISITIONS
- MAINTENANCE OF STOCK RECORDS
- PRODUCT COSTING
- ORDER COSTING
- OTHER BOOKKEEPING ACTIVITIES.

15. BUDUĆE POTREBE

FUTURE NEEDS

16. PLANIRANJE ZA OPTIMALNE REZULTATE

PLANNING FOR OPTIMUM RESULTS

DUGOROČNO
PROCENA:

1. OPTIMUM PROIZVODA
2. KRITIČNI RESURSI
3. EKONOMIČNI PRAVCI ŠTA MENJATI

LONG TERM:
TO ASSESS

1. OPTIMUM PRODUCT MIX
2. CRITICAL RESOURCES
3. PROFITABLE DIRECTIONS FOR CHANGE

KORISTITI DUGOROČNI PLAN ZA ODREDJIVANJE

1. POLITIKE VODJENJA ZALIHA
2. POLITIKE PROIZVODNJE

USE LONG TERM PLAN TO DETERMINE

1. STOCKING POLICIES
2. PRODUCTION POLICIES

KRATKOROČNO
ODREDITI STVARNU PROIZVODNJU U SVETLU OGRANIČENJA I POLITIKU KOJA IZ OVOGA PROIZLAZI.

SHORT TERM:
TO DETERMINE ACTUAL PRODUCTION IN THE LIGHT OF CONSTRAINTS AND POLICIES EMERGING ABOVE.

17. MOGUĆE POTEŠKOĆE

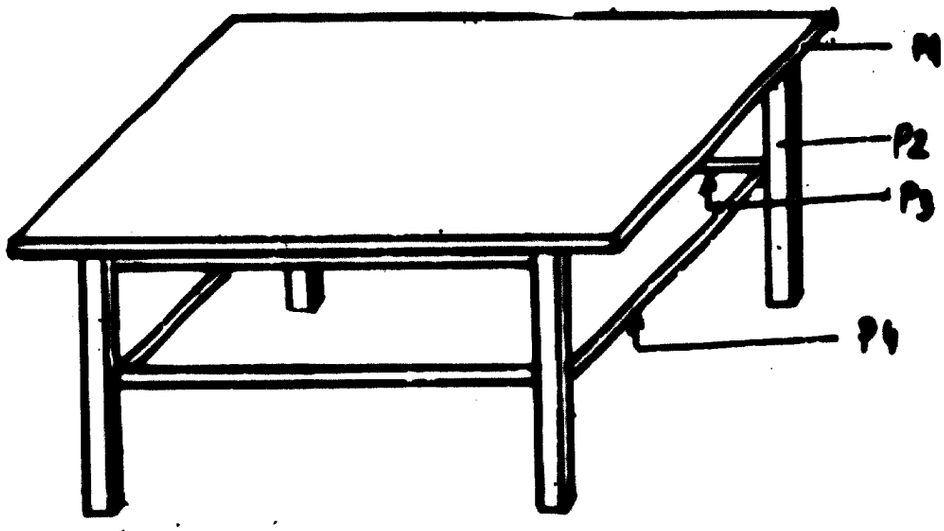
LIKELY DIFFICULTIES

18. ZAPAMTITI	POINTS TO REMEMBER
1. OUTPUT NE MOŽE BITI BOLJI OD INPUTA -GIGO-	1. OUTPUT CANNOT BE BETTER THAN INPUT -GIGO-
2. PAŽNJU POSVETITI DETALJIMA	2. ATTENTION TO DETAIL IS IMPORTANT
3. KOMPJUTER NE MOŽE DA MISLI	3. THE COMPUTER CANNOT THINK
4. KOMPJUTER NEĆE NIŠTA URADITI, ON ĆE SAMO OBRADITI PODATKE. AKCIJA JE ZA RUKOVODSTVO I RADNIKE	4. THE COMPUTER WILL NOT DO ANYTHING IT WILL ONLY PROCESS INFORMATION ACTION IS FOR MANAGEMENT AND WORKERS.
19. KOJE OSNOVNE INFORMACIJE SU POTREBNE ZA SISTEM ?	WHAT BASIC INFORMATION DOES THE SYSTEM NEED ?
20. PODACI O	INFORMATION ON
MATERIJALU	MATERIALS
RESURSIMA	RESOURCES
STRUKTURI PROIZVODA	PRODUCT STRUCTURE
NALOZIMA ZAHTEVIMA	ORDERS DEMANDS

21.	TERMINOLOGIJA	TERMINOLOGY
	NARUDŽBA SE IZDAJE DA SE DOPUNE ZALIHE U SKLADIŠTU: - PRODAVCU - TVORNICI - KOOPERACIJI	ORDER IS PLACED TO REPLENISH STOCKS IN THE WAREHOUSE - ON VENDORS - ON FACTORY - ON SUBCONTRACTORS
	ZAHTEV SE IZDAJE SKLADIŠTU DA SNABDE MATERIJALOM - POTROŠAČA - TVORNICU	DEMAND IS PLACED ON THE WAREHOUSE TO SUPPLY MATERIALS - BY CUSTOMERS - BY FACTORY
22.	PODACI O MATERIJALU	MATERIAL INFORMATION
	- IDENTIFIKATOR MATERIJALA - OPIS - KOLIČINA NA ZALIHI - LOKACIJA MATERIJALA - TROŠKOVI PO JEDINICI - VELIČINA JEDINICA ZA NARUDŽBU - TAČKA PONOVNE NARUDŽBE - ŠKART - KOD IZDATNICE	- MATERIAL IDENTIFIER - MATERIAL DESCRIPTION - QUANTITY ON HAND - INVENTORY LOCATION - UNIT COST - LOT SIZE - REORDER POINT - SHRINKAGE - WITHDRAWAL CODE

23. PODACI O RESURSIMA	RESOURCE INFORMATION
ODELJENJE	DEPARTMENT
RADNI CENTAR IDENTIFIKACIJA	WORK CENTRE IDENTIFICATION
RESURS	RESOURCE
RADNI CENTAR OPIS	WORK CENTRE DESCRIPTION
ODELJENJE OPIS	DEPARTMENT DESCRIPTION
KAPACITET	CAPACITY
EKSTRA KAPACITET	EXTRA CAPACITY
JEDINICA MERE	UNIT OF MEASURE
TROŠKOVI PO JEDINICI	UNIT COST
PROCENAT EFIKASNOSTI	EFFICIENCY PERCENT
24. PODACI O NALOGU I ZAHTEVU	ORDER DEMAND INFORMATION
IDENTIFIKATOR MATERIJALA	MATERIAL IDENTIFIER
IDENTIFIKATOR NALOGA/ /ZAHTEVA	ORDER/DEMAND IDENTIFIER
KOLIČINA	QUANTITY
TERMIN	DUE DATE
25. STRUKTURA PROIZVODA	PRODUCT STRUCTURE
IDENTIFIKATOR MATERIJALA	MATERIAL IDENTIFIER
IDENTIFIKATOR KOMPONENATA ILI RESURSA	COMPONENT OR RESOURCE IDENTIFIER
KOLIČINA KOMPONENATA (ILI RESURSA) POTREBNIH PO JEDINICI MATERIJALA	QUANTITY OF COMPONENT (OR RESOURCE) USED PER UNIT OF MATERIAL.

F1 Table



P1 Table top
one per table
waste 0.1 %

P2 Leg
four per table
waste 0.1 %

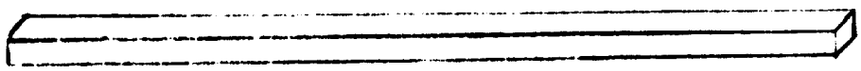
P3 Long apron
four per table
waste 0.1 %

P4 Short apron
four per table
waste 0.1 %

Note: The percentages given for waste are hypothetical.

B1 Screws 24 per table waste 10 %

B2 Wood for legs and aprons

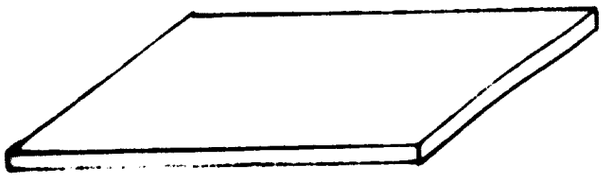


40 cm per leg waste 2.5 %

20 cm short support
waste 5 %

40 cm per long support
waste 2.5 %

B3 Wood for table tops



4000 cm^2 per table top
waste 5 %

Note: The percentages given for waste are hypothetical.

26. RESOURCES REQUIRED

ASSEMBLY UNIT.

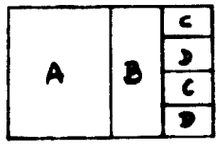
Res	Description	Time required per table	Availability (hrs/day)
W1	Assembler	2'	4
M1	Assembly press	2'	4
W2	Screwdriver	3'	4

WOODWORKING

	Sawing	Sanding	Material preparation
P1 Table top	60"	150"	-
P2 Legs	5"	20"	10'
P3 Long apron	5"	20"	5'
P4 Short Apron	3"	15"	5'
Available hours per day	4	12	136

PRODUCT STRUCTURE

Key:



A = Description of resource/material
B: R for resource; M for material
C = Code for resource/material) always
D = Quantity of resource/material) in pairs
used per unit

27. 77073 INDENTED PARTS LIST

F1 TABLE U/M: EA

PRODUCT STRUCTURE POSITION	MATERIAL IDENTIFICATION	DESCRIPTION	QUANTITY PER ASSY	U/M
1	P3	Long apron	4.004	EA
2	B2	Wood LA	41.0	CM
1	P4	Short apron	4.004	EA
2	B2	Wood LA	21	CM
1	B1	Screws	26.4	EA
1	P2	Legs	4.004	EA
2	B2	Wood LA	41.0	CM
1	P1	Table top	1.001	EA
2	B3	Wood top	4200.0	C2

28. 77073 PARTS LIST

F1 TABLE U/M: EA INV.LOC:

MATERIAL IDENT.ND	DESCRIPTION	QUANTITY PER ASSY	U/M	INV. LOC.
P3	Long apron	4.004	EA	
P4	Short apron	4.004	EA	
B1	Screws	26.4	EA	
P2	Legs	4.004	EA	
P1	Table top	1.001	EA	

29. 77073 REQUIRED RESOURCES LIST

P1 TABLE TOP U/M: EA INV.LOC.

RESOURCE IDENT NO	WORK CENTRE	TIME PER ASSY	U/M	DEPARTMENT
M3	Sanding	-04167	HR	Woodwork
M2	Sawing	-01667	HR	Woodwork
W4	Sanding	-04167	HR	Woodwork
W3	Sawing	-01669	HR	Woodwork

30. 77073 WHERE USED LIST (RESOURCE)

M3 SANDING U/M: MR DEPT. WOODWORK

MATERIAL IDENT NO	DESCRIPTION	QUANTITY PER ASSY	U/M	IN LOC
P1	TABLE TOP	.04167	EA	
P2	LEGS	.00556	EA	
P3	LONG SUPPORT	.00556	EA	
P4	SHORT "	.00417	EA	

31. 77073 WHERE USED LIST (MATERIAL)

B2 WOOD LSS U/M: CM INV.LOC.

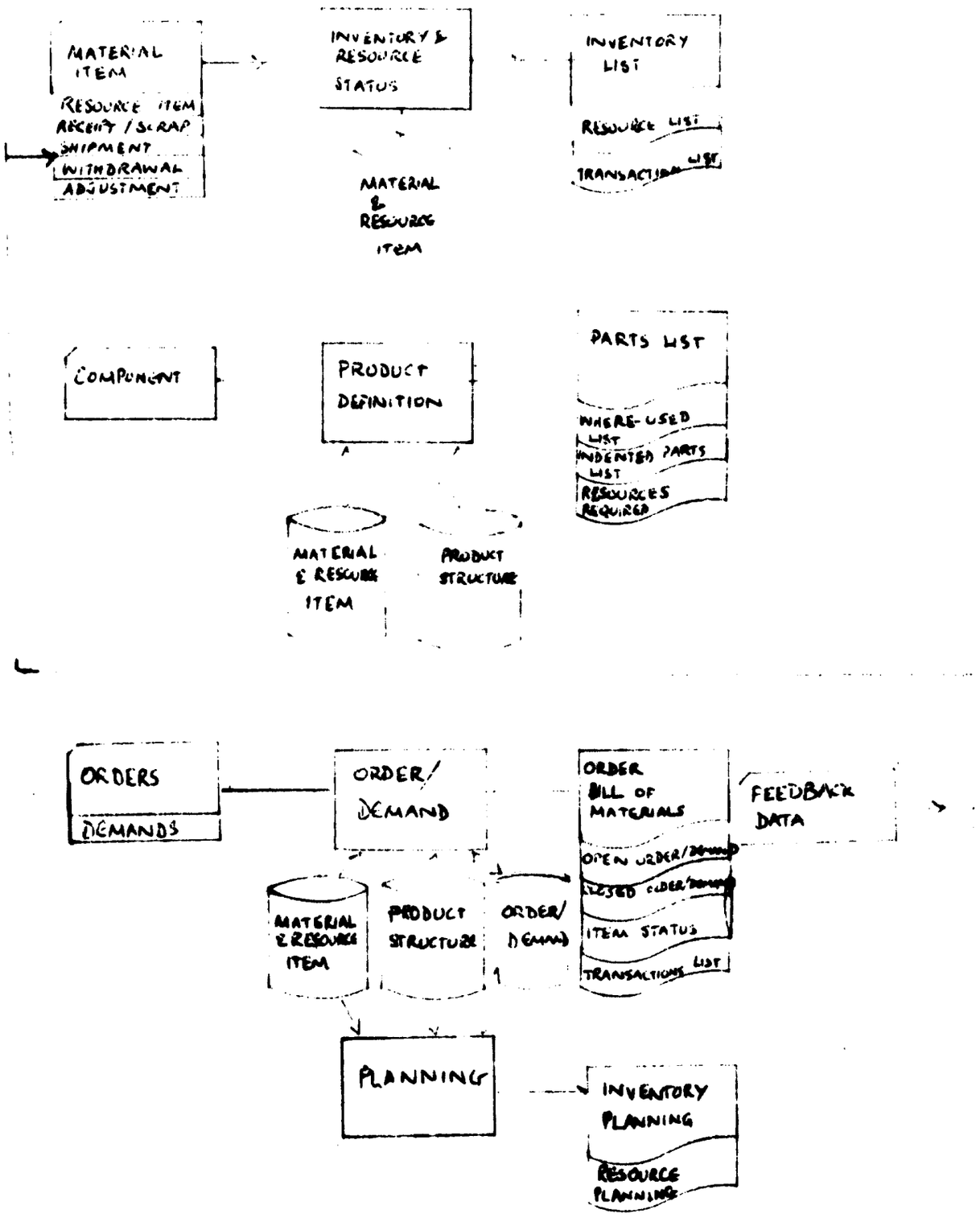
MATERIAL IDENT NO	DESCRIPTION	QUANTITY PER ASSY	U/M	INV. LOC.
P2	Legs	41.0	EA	
P3	Long apron	41.0	EA	
P4	Short apron	21	EA	

32. 77028 ORDER BILL OF MATERIALS

ORDER NO	MATERIAL NO	DESCRN. TABLE	ORDER QTY	START DATE	DUE DATE	INV. LOC.
F4	F1		4,000	77-130	77-132	

MATL IDENT	DESCRPN	QUANTITY PER ASSY	U/M	QUANTITY REQUIRED	INVENTORY LOCATION
B1	Screws	26.4	EA	105.600	
P1	Table top	1.001	EA	4,004	
P2	Legs	4.004	EA	16,016	
P3	Long apron	4.004	EA	16,016	
P4	Short apron	4.004	EA	16,016	

PHASES IN PRODUCTION PLANNING AND INVENTORY CONTROL



Annex VIII

SEMINAR FOR ŠIPAD

A Seminar was held for ŠIPAD executives on 9 June 1977, unter the chairmanship of Morie Papo, Director of RO IRC, to discuss the application of computers to production planning and inventory control Advantage was taken of the presence in Sarajevo of the UNIDO expert on Industrial Engineering, Desmond P. Cody, to enable the participants to benefit also of his experience.

The Seminar consisted of three parts:

Part 1: Applications to medium-term planning. The contents of this part appears later in this annex.

Part 2: Applications to shorter term planning and inventory control with special reference to the work being done at STANDARD factory. This part was based on the earlier seminar at STANDARD factory, details of which appear in annex VII.

Part 3: Applications with special reference to the furniture industry.

Parts 1 and 2 were presented by the expert in computer applications. Part 3 was presented by the expert in industrial engineering.

The Seminar was attended by 22 people, drawn from the following organisations:

RO IRC (Research and Development)
RO "BIRAC"
RTV - Sarajevo (Computer Centre)
OOUR ERC (Computer Centre)
OOUR "ŠUMAPROJEKT"
OOUR Zavod za tehnologiju drveta
RO "JAHORINA"
OOUR "STANDARD"
RO "ROMANIJA"
OOUR "JOINERY"
ŠIPAD - Kombinat
Mrs. Stanišić, Secretary of the Project, Interpreter

Text on which part 1 of the Seminar was based

It is a privilege for Mr. Cody and myself to be participating in a discussion with this distinguished group. I deliberately used the word "discussion" because I hope this will be an opportunity to share experiences all round. That

so many have taken the time and trouble to come here is a most encouraging sign for the success of the project.

It would, perhaps, not be out of place to say a few words about the project, and I hope you will forgive me if I repeat what is common knowledge.

This project was set up as a result of an agreement between the Government of Yugoslavia and the United Nations Development Programme to develop the furniture and joinery industry in Bosnia and Herzegovina. UNIDO was appointed the executing agency for the project and ŠIPAD the counterpart agency. Responsibility for the project has been vested in the National Project Director, Mr. Pjaca. The other permanent member of the project here is Mrs. Stanišić, who is Secretary of the Project and interpreter. Some of the areas, where it was thought that the injection of experience from outside would have a catalytic effect in the development of the industry were:

- Marketing and market research
- Design of wooden and upholstered furniture and prefabricated housing
- The application of industrial engineering techniques to production and finally
- The application of computers to production planning and inventory control

Seven or eight missions have already been completed, which covered the first three aspects mentioned above, namely marketing, design and documentation, and staff from your organizations would, no doubt, have participated in them. Mr. Cody's and my mission concern the last two areas I mentioned earlier, namely the application of industrial engineering and computers. Ours are the first missions in these areas in this project. Incidentally, in addition to the experts' missions, there is also a provision for study tours and fellowships to enable groups or individuals to get an insight into methods of working abroad.

I think it is very significant that the need for development along several fronts simultaneously is recognized. It is true, I think, that for best effect, there needs to be a balance between these activities. It is rather like furniture - a chair which has one leg very much longer than the others is not likely to be very comfortable to sit on. In fact it is desirable that these various arms of management should work closely together. There is little use in producing something that will not sell, nor in designing something that the buying public does not want. Similarly designs that enable one component to be put to several uses help saleability by keeping overheads down - I believe that people who went on the recent study tour to Scandinavia had an opportunity to see examples of this. Similarly the application of industrial engineering techniques

improves the economics of production and finally the computer's ability to process information fast can be harnessed, first to help decide what action to take, and second to show up potential trouble spots in time for corrective action to be taken.

I should like to spend some time now talking about this last aspect. Specifically I would like to talk about a particular facet of medium-term planning on the one hand, and on the other hand about production planning and inventory control in the shorter term as we are attempting to introduce in "STANDARD" factory; about the problems we have faced and what we hope to achieve. Please, do not hesitate to stop me if I say something that is either incorrect or unclear, or if you would like to add something to what I have said - by way of confirmation or otherwise.

Let me first talk about the medium term. By this I mean a period of around a year. I think every factory in SIPAD starts with an annual plan. At one factory that I visited the prodedure was somewhat as follows - and I would guess that this pattern is repeated elsewhere with perhaps some variations. The annual plan covers the calendar year. The planning cycle beings in July of the previous year. From July to Se tember market information is collected. This information on what the market can accept is made available early in September to the Technical Department. The Technical Department breaks down the market requirement into resource requirements of manpower, machines and materials. If the resources are adequate, there is no further problem. In fact, however, even in factories where there is overcapacity, it is found that some imbalances in resources exist which prevent the whole of the market requirement from being met. The Technical Department then prepares a plan of the products which can be made from the available resources. This first draft is ready around the end of September, and discussion on the plan and its implications covers the month of October. Here again, the plan may be acceptable, but generally fresh guidelines may be laid down for the preparation of the final plan. These guidelines incorporate fresh market information, enhancements of the product range, modification of total working time (e.g. extra shifts or more working on Saturadys) and manpower availability. On the basis of these guidelines the Technical Department prepares a final plan in the first half of November, which would generally be accepted by end of November, possibly with minor modifications. In the factory I visited the breakdown of an annual plan into resource requirements etc. takes 10-15 days for a team of ten people. There are 35-45 different finished products in the plan. And when the first breakdown is made 10-15 resources are found to be critical - i.e. required a modification of the plan.

The application of the computer using linear programming to the selection of the best product mix can be very beneficial - benefits of the order of 2-3% of turnover being quite common. The approach is particularly valuable where single resources have to be shared between several products.

Essentially what we do in the process is to create a model of the real life situation as we think it will be, incorporating the maximum amount of each product that the market will accept, the minimum we must make for policy reasons, the availability of resources of material and machinery and manpower, the extent to which they are used in each product, the extent to which sales of one product are dependent on another etc.

The data are then fed into the computer, which processes the information fed to it (incidentally it could be done manually too, but it takes a very long time for even relatively simple models), and in effect tells you the optimum plan in the light of the information you have fed. However it does something else also that is very valuable. It tells you which are the best directions for you to go and what are the effects of changes in the model.

This approach is particularly valuable when there is a large selection of finished products being manufactured, which use common resources and if demand exceeds supply. Typically, joinery factories and furniture factories with a wide product range would benefit from its applications.

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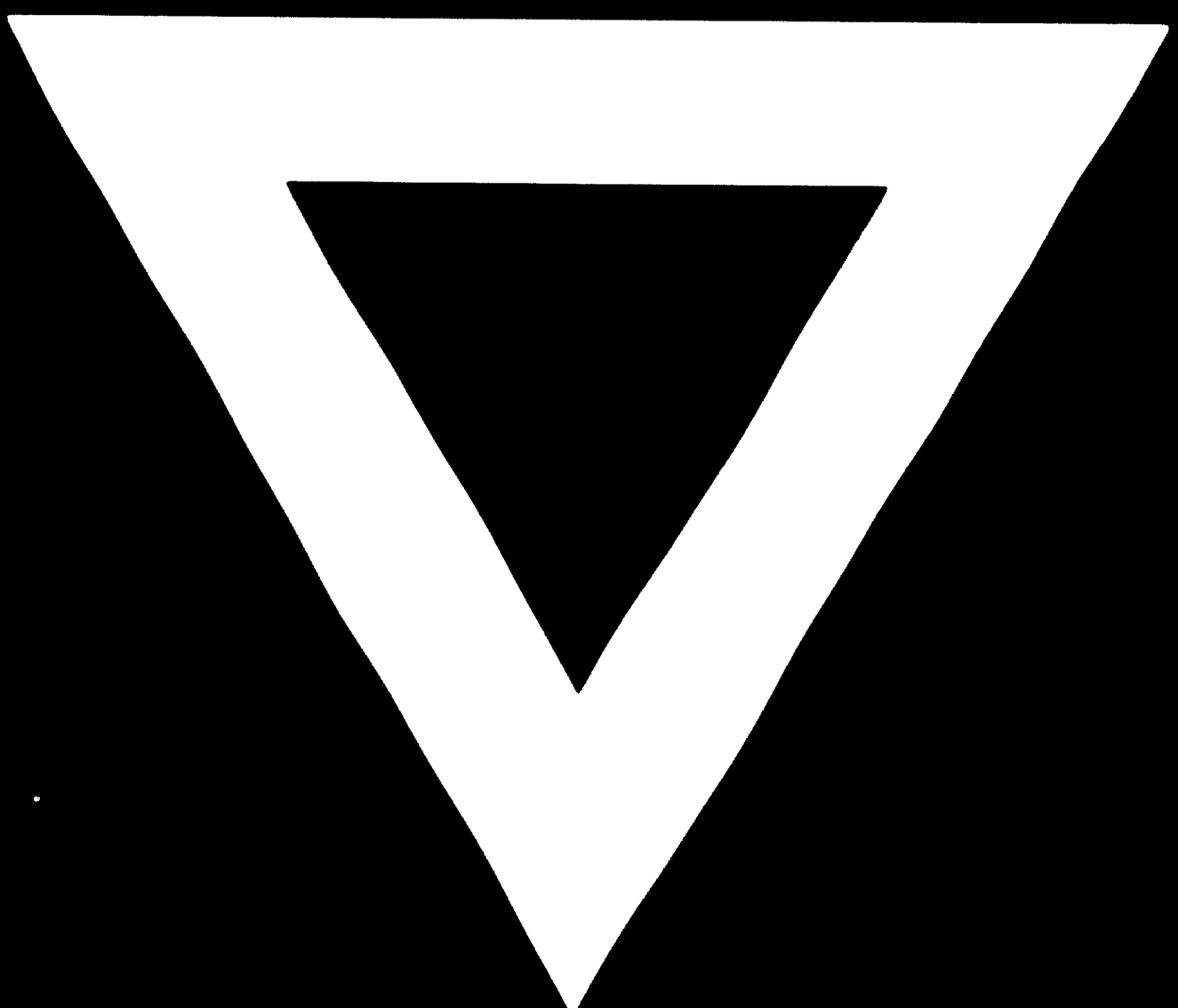

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