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INTERNAL TRANSPORTATION AND TECHNOLOGY

IS/YUG/74/017

YUGOSLAVIA

TERMINAL REPORT

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

United Nations Industrial Development Organization

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United Nations Development Programme

INTERNAL TRANSPORTATION AND TECHNOLOGY

IS/YUG/74/017

YUGOSLAVIA

Project findings and recommendations

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 Wolfram M. Erdlen, industrial engineering expert

United Nations Industrial Development Organization
Vienna, 1976

Explanatory notes

The following abbreviations are used in this report:

IPM	Industrija Precizne Mehanike
OOUR	Osnovna Organizacija Udruženog Rada (A self-managed unit of an enterprise)
ZOOUR	Zajednioa Osnovnih Organizacija Udruženog Rada (A co-operative of self-managed units)

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ABSTRACT

By request of the Government of the Socialist Federal Republic of Yugoslavia, an expert from the United Nations Industrial Development Organization (UNIDO) was sent on mission to the Industrija Preoizne Mehanike (IPM), a leading company in Yugoslavia in the field of automative equipment (diesel injection pumps and carburators). The project was "Internal transportation and technology" (IS/YUG/74/017) of the United Nations Development Programme (UNDP); it lasted six weeks, commencing on 12 May 1976. UNDP contributed $9,000 towards the project; UNIDO was the executing agency.

On the arrival of the expert at Belgrade, it was immediately clear to him that the job description did not cover the tasks that needed to be done. They were therefore redefined by the expert, with the agreement of the management of IPM and of UNIDO. The mission was divided, by request of the expert, into two official phases:

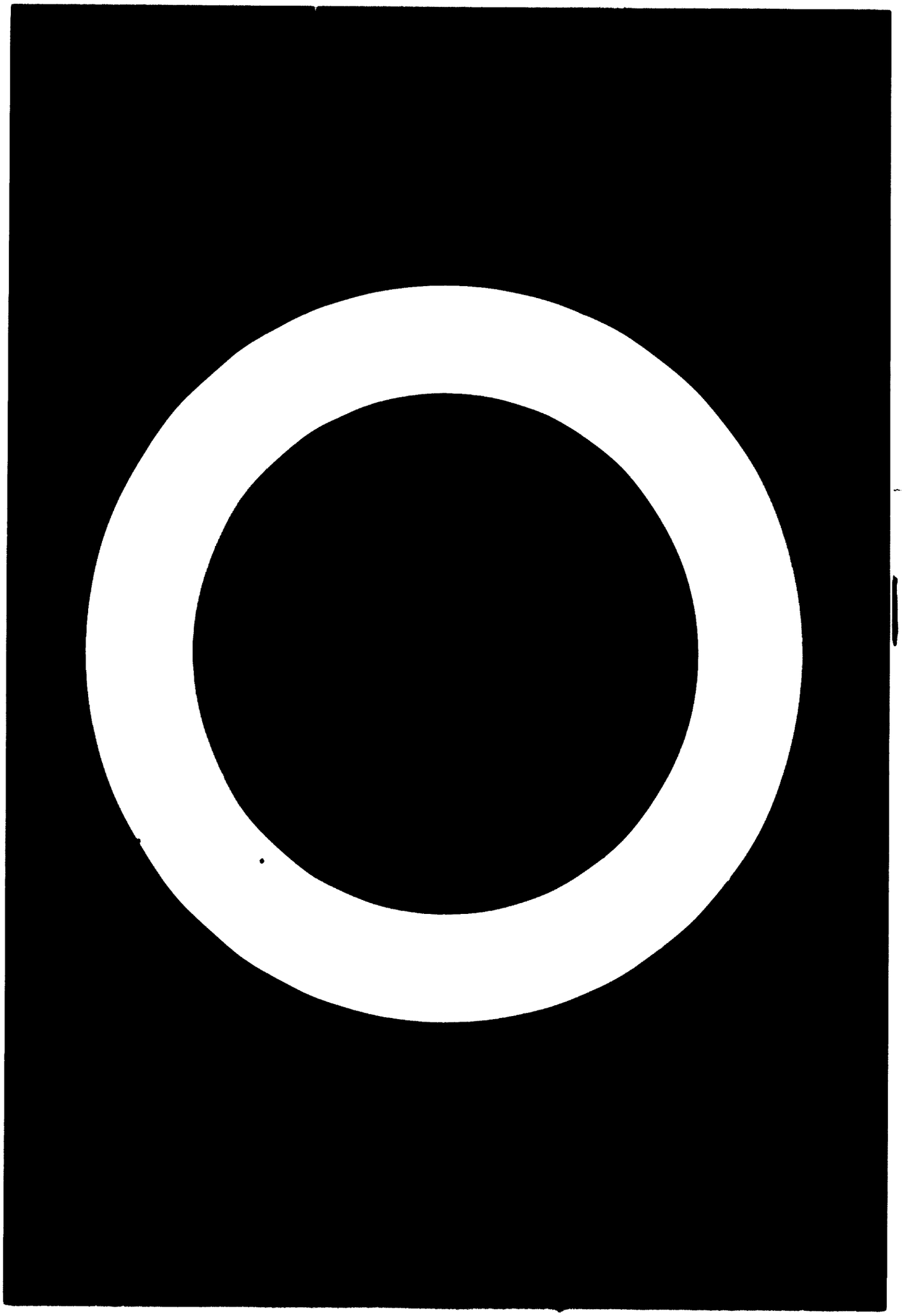
1. Analysis of the situation with collection of data.

2. A study of possible improvements and preparation of an unofficial extended report for IPM, and the preparation of this terminal report.

The expert's main recommendations were:

1. The installation of a material management system. He suggested detailed improvements of materials handling whose effect would be far-reaching.

2. The establishment of a store for semi-finished goods.



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INTRODUCTION

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I. FINDINGS

Plan of organization

IPM comprises, under a co-ordinating general manager, eight OOURs and two ZOOURs. The OOURs are quite different in significance, staff, output etc.; the biggest one is the Division of Diesel Equipment Manufacturing (OOUR Dizel) with nearly half the total output and with associated departments, e.g., for surface or heat treatment.

Production and trades programmes

There is no difference between the programme of production and that of trades as there are no commodities. The former has as its guidelines the statistical data of registered motor vehicles, but this programme is not equal to the evolution in motorization in Yugoslavia. The reason is not the lack of export markets, but the limited factory space for production.

The different fields of production are given in annex I. The only new field for the next few years will be rotation-diesel-pumps. Also given in annex I is the output for 1975. By 1980 the output will have increased more than 250% (1975 = 100%).

The factory structure

The following subjects were considered in regard to the factory set-up:

(a) Branch factories and subsidiaries;

(b) Supply of raw materials;

(c) Area of factory, site and space;

(d) Energy supply;

(e) Traffic;

(f) Machinery.

(a) Branch factories and subsidiaries. There are no branch factories and there is no plan to set any up in the near future. Neither are there existing subsidiaries as Yugoslavia has a system of self-government of united workers.

(b) Supply of raw material. The supply of raw materials creates difficulties. The reason are that there are limited supplies available in Yugoslavia and, more important, it is necessary for IPM to process special materials in very small quantities. These difficulties will increase rather than decrease.

(c) Area of factory, site and space. The area of the factory is too small for present needs and will, therefore, clearly be much too small for future production. A new production building is being designed to improve the situation concerning production space.

(d) Energy supply. The energy supply poses no difficulties as IPM is situated in an urban area of Belgrade. However, there must be a clear conception of future needs, so that the suppliers of energy are prepared to meet these.

(e) Traffic. IPM has quite good connexions with public transport but there will be problems in the future with parking space.

(f) Machinery. The shortage of convertible currency has resulted in a lack of modern machinery, even when the products require a high level of technology in processing to reach the necessary quality. However, in the spring of 1976 it was decreed that all future exports be effected with convertible currency. This means, that the situation, especially for IPM, will improve and the necessary machinery can be bought wherever it is available.

Marketing and sales

Marketing

Market demands, domestic and international, exceed the production of IPM. This can be seen from the quite small store of finished goods.

Customers

Potential customers are factories for engines, cars and lorries. The small production of spare parts is distributed via these factories. In this connexion, nozzles are not seen as spare parts; these are sold to the same factories as additional parts for diesel motors.

There are certain restrictions in exports, as the conditions of licenses do not allow certain markets to be supplied. On the other hand, exports are necessary in order to obtain raw materials from abroad.

The expert believes that there will be a change in market commodities and IPM should be prepared for a buyers market in Yugoslavia, which means that at IPM, for instance, a special organization for the distribution of spare parts has to be set up.

Sales

Sales are forecast to increase as shown below, taking 1975 as the base year:

Year	Percentage
1973	45
1974	75
1975	100
1976	149
1977	176
1978	197
1979	230
1980	276

Distribution

IPM has only a small basic organization for distribution as there are only a few big domestic customers and few steady connexions abroad. If, as forecast, business increases, IPM will have to enlarge its distribution organization with, for instance, a central store for finished goods and stores for regional distribution.

Constancy of products

It is important for the return of investment to have a clear view of the constancy of products and their lifetime. In comparison with Western countries, the situation in Yugoslavia is, and will be for the next few years, marked by a high constancy of products.

If IPM would distribute its own spare parts, this constancy would increase as then IPM, and not its customers, could decide how long spare parts would be available. This statement may not apply to components for cars but it is accurate as far as parts and components for diesel motors are concerned.

Research, development and design

Research

IPM has no research department but one should be set up by 1980.

Development

The development of new products at IPM is quite good considering the circumstances. More than 50% of the line-diesel-pumps are developed at IPM, 100% of the door-closers and more than 70% of car components such as carburetors. Only the carburetor for the Zastava 101 (FIAT 128) is produced by licence from Weber/Italy.

Design

The design department is well equipped and staffed. This enables IPM to avoid gaps in technology, which could otherwise be critical. This department also covers auxiliary means of production, such as mouldings etc.

Standardization

IPM has a good standard of technology. The standards used are Deutsche Industrie Norm (DIN) and Yugoslavian Standards (JUS). However, there must be

great improvements in internal standardization of materials to avoid problems in the supply of minimal quantities of raw materials.

Production

Production planning

The most recent methods of production planning are in use at IPM but their efficiency is low. The reason is that capacity is based on scheduled output but the real output of workers, who are paid by the piece, is nearly double that planned.

Lot sizes

Lot sizes are calculated by old methods of production scheduling not by the improved methods which include lot sizes as well as the costs of purchasing, storage and internal handling of materials. This means that the lot sizes are smaller.

Production methods engineering

It is not the task of this mission to find better methods in production engineering but as the main task, to improve the handling of materials, is closely concerned with production engineering, it has to be considered.

The expert evaluated flow-sheets for materials and discovered that seldom has the quickest route been chosen.

Production lines

Production lines were not evaluated as simple multi-purpose machinery determines the main quantity of equipment today.

Production schedule control

The methods of production schedule control are based on manual notations which leave an information gap. So this department acts more as a book-keeping group than as an aid for timely performance of all orders. However, if it were better organized, this department could improve the flow of materials.

Run-through times

The run-through times, given by production schedule control, are not observed by the production department so nearly all orders take longer than they should.

Planned deadlines are exceeded by from 3 to 179 days. One goal must be to shorten these times which would considerably improve efficiency.

Waste and refuse treatment and re-use

The treatment of waste and refuse is one of the biggest problems at IPM, although not realized as such because most of the costs are hidden ones.

The real problem is not the system of transport from the holes in the ceiling to the storage-boxes, which is a good one, but the expensive collection from the single machines to these holes in the ceiling.

Materials for production and internal services

Purchasing

Purchasing is a difficult task at IPM as there is an increasing need for special materials in very small quantities. This point has to be considered in the statements about the raw-materials store.

The co-operation between the technology and the purchasing departments is quite good, but difficulties arise because purchasing decisions are made by the design department. This is the usual procedure in all industrialized countries.

One additional difficulty for purchasing at IPM is that there is no information system on consumption. This can be solved by intensified use of Electronic Data Processing (EDP) at IPM as will be explained.

Stock-keeping

Stock-keeping is not organized at IPM. There is a raw materials store with too high a stock and too low a turnover. However, the creation of a new building for stores indicates that this attitude is now changing.

Stocks of semi-finished goods are only held for the toolroom. In this case, they are of the necessary high quality as the keeping of these stores is combined with internal quality control.

Such items as pre-assembly components and parts are not real stores but cushions in the flow of materials and do not create a problem.

The finished goods store is presently of little importance as IPM is unable to meet market demand. However, it will be important in the total materials flow to help balance the possibilities of production and the necessities of meeting market demands.

There are some stores for auxiliary materials; these are the responsibility of different departments which means that they cannot be properly controlled.

Internal materials transport and handling

Internal materials storage, transport and handling has recently been decentralized, which is an inefficient method of organization and causes hidden costs. It has been shown by tachograph records that transport equipment is under-occupied; there would be no such problem if this situation were better organized. No further investments in transport equipment should be made except for pallets and boxes, of which there is an insufficient number.

A third problem is the transport of salvers for nozzles; these nozzles amount to a not unimportant quota of materials movements at IPM.

Packing and dispatching

The last step in production, packing, is done in close connexion with the last assembly operation. Space in the upper level of the production building, which is of high value, is used for stocking empty packaging materials as, for instance, European pool-box pallets.

Decentralized packing is only a partial improvement. More important would be the decentralized dispatching of finished goods as there is no effective control of goods leaving the factory.

External materials transport

The external transport of materials is mostly done by IPM's own lorries. These are under-occupied and their proper use would lower costs considerably. There was not enough time to make a comparison between the costs of transport done by the company's own lorries and by the forwarders but it could be profitable for IPM to investigate this.

Personnel

The costs of personnel are important for detailed calculations of different methods of performance, for instance in materials handling. It can happen that

a speoial automatic method is uneconomical at present but will not be so in a few years. Wages are relatively low in comparison with other oountries but they are increasing rapidly.

Value analysis

A value analysis of materials would be effective if the real cost of materials flow were known, which presently it is not. As the main emphasis at IPM is on technology rather than technology and economics combined, a value analysis has not been made.

II. EVALUATION

Market coverage and possibilities

Meeting market demand in Yugoslavia depends not on the price of the automotive components produced by IPM, but on long-term contracts with the customers. A more economic production would give additional profit and a higher income for the staff.

The market possibilities in Western countries depend mainly on price. In a buyers market this price is not a result of costs but is more dependent on the readiness of customers to pay for goods, so costs have to be lowered and this can best be done by improvements in materials handling, which is the least developed field at IPM.

Management and organization

The main problem of improving methods in materials handling and materials flow is in the recent decentralized organization of IPM which does not permit big improvements. The different areas of materials flow are as follows:

Internal and external transport
Purchasing
Stores
Dispatching
Production schedule control

There can be a general circulation of transportation aids in the whole factory and a special circulation in smaller spheres, as in the case of the castor-supports for nozzles. This smaller circulation should be chosen from existing transportation aids.

Floor carts

Floor carts, hand pallet trucks, electric pallet trucks and normal fork trucks, will be the base of the system of materials flow.

IPM already has a production building with two levels and intends to widen the space by a building of the same type and it is important to choose the right type of floor cart . The different types of floor carts demand different carrying capacities of the floors and this factor should be considered as the authorization procedure for the new building is now taking place.

The floor carts being used are not the most economical as there is too small a quantity of hand pallet trucks which are the cheapest transport equipment for pallets.

Continuous conveyors

IPM has few tasks for continuous conveyors as the type of production arrangement is of workshops and is not linked except for three production or assembly lines.

Continuous conveyors have two effects: first, they cause higher fixed costs and second, they lower labour costs. These are single purpose conveyors which should be chosen only if there are permanent transportation tasks but the final decision will still depend upon costs.

Planning of stores

The stores at IPM are seen in the same way as in Western countries some years ago, as necessary evils.

Raw materials store

Certain materials are over-stocked.

The raw materials store should be moved from its present site to the new building annex for which a layout has been made. However, this is unsatisfactory as the engineer responsible has no experience in planning stores with a 4-way-reach fork truck and no possibility of discussing his plan with other consultants. Three more layouts were prepared and the best one of these has to be modified.

Store for semi-finished goods

A store for semi-finished goods in connexion with the installation of material management will be necessary.

Normally, such a store should be situated at the centre of internal traffic connexions, but as this is not possible another solution has to be found. If

IPM agrees this would be as follows: there is a free space between the main production building and the new building. If part of this free space were roofed, a store for semi-finished goods could be installed.

Finished goods store

There is no real finished goods store and one will not be necessary until 1980. A distribution organization for spare parts should be installed at IPM but if the advice of the expert is not taken into consideration when planning for the Masino project, there will be no space to install or erect a store for finished goods.

Transport of machines

The transport of machines is still a problem at IPM.

German suppliers offer two different types of equipment: one is combined equipment and the other, which is better, consists of two different parts, one for lifting and one for carrying. The second type is the cheaper one.

Improvement of materials handling

The effects of the improvement of materials handling on material management are quite enormous; they are summarized here:

- Increased possibilities of covering present and future markets
- Direct and indirect savings of investments for materials handling and better efficiency and rising profits
- The possibility for all workers to earn more money and a corresponding lower turn-over of staff
- Better planning of production installations
- Better use of EDP with lower costs, by briefer and better information
- Standardization of transportation aids, floor carts, continuous conveyors and lorries for improved production and distribution
- Better utilization of the capacity of machinery and of the space used for the same output
- The meeting of planned deadlines for orders
- Avoidance of delay and therefore the use of less material in production which in turn would mean using less capital
- Smaller stocks in the stores by better planning of purchasing and use of material considering all costs so that calculations can be based on real data

- More efficient quality control
- Better utilization of the capacity of floor carts, continuous conveyors and lorries by one person having overall responsibility
- Fairer wages for the workers in stores and transport

This list is not complete for material management affects all fields in the company and the effects are enormous.

Economic effects

The economic effects will be as follows (reduced costs +, increased costs -; a + i = amortisation and interest) in Din per annum:

Better market coverage	+	1
Transport equipment (a + i)	+	95,000
Transport aids (a + i)	-	190,000
Lorries (a + i)	+	160,000
Running costs for transport equipment, transport aids and lorries	+	100,000
Other hidden costs of materials handling	+	1
Less fluctuation of staff by better materials handling	+	1
Changed use of EDP	+	1
Costs towards EDP	+	1
Better utilization of machinery (10% of a + i)	+	3,400,000
Lost output of machinery	+	1
Delay in meeting deadlines	+	600,000
Indirect costs of purchasing	+	1
Less qualities and quantities in the raw materials store (total costs of store, 3% of the direct material costs)	+	3,120,000
Store of semi-finished goods (a + i)	-	45,000
Personnel costs	-	1,045,000
Hidden costs of personnel	+	12,305,000
Value analysis	+	1
Lower capital required	+	1
Total	+	18,500,009

Notes: The nine items with 1 Din per annum are important but the effects cannot be shown.

Increased costs result from too few transport aids, investments for the store of semi-finished goods and installation of a material management system.

Reduced costs involve many items and can only be shown by detailed investigations.

In the unofficial report given to IPM, the total real costs of materials handling in 1976 were estimated at Din 31,650,000. The expert assumes that these can be reduced by nearly half, if the main proposals are followed, i.e., the installation of a material management system and the establishment of a store for semi-finished goods.

The organization of some departments of the diesel division, such as surface treatment, heat treatment, and roto-finish is not favourable. These departments service the whole factory as all divisions have need of these treatments.

Materials handling

Materials handling in production and in storage is one activity and not, as now practised by IPM, two. This practice is the cause of some of the problems which have arisen. Another cause is the machinery layout. Machines are too close together and prevent a normal materials flow. Also similar types of machines placed together extend the materials flow.

The number of types and the quantity of transportation aids, such as pallets, boxes etc. show the lack of an overall responsibility for these matters as does the fact that transport equipment is not fully used.

Management of materials

Management of materials (MM) is based on the field of materials flow. Materials flow can be defined as follows:

> "Materials flow is the concatenation of all processes in the fields of extraction, treatment and processing, as well as of storage and distribution of goods in certain spheres."

Information

There are wide information gaps at IPM. This seems to be the case in general for Yugoslavia but, in a production of high quality, information must be available.

One such gap is the lack of opportunity of the technological administration to read periodicals from abroad in the field of materials handling. First, these are not available and secondly, the engineer responsible has only a basic knowledge of French. Therefore, the only information sources are periodicals or training courses in Serbo-Croatian and these are too few to effect a real improvement.

Report on the Masino project

The engineering office of the Masino project has been ordered by IPM to prepare a report on the complete planning for a new product, the DPA-pump. The expert has been requested by IPM to consider this report with regard to materials handling and storage.

This report, in general, is of a high quality except when it deals with materials handling and storage which is seen as one field in planning.

In the view of the expert, a project which does not consider the materials flow is not a complete project. A detailed analysis cannot be made in this report but is part of the unofficial report made for the internal purposes of IPM. The main points are:

1. The site of the future raw materials store is not mentioned, so presumably this will remain in the same place in the Annex. By the time it is built traffic connexions to what will be the main entrance will be bad.

2. The finished goods store will have no exit and it is unclear where it will be situated.

3. There is no free space in the grounds of IPM for any buildings that may be necessary in the future.

4. The quantities and qualities of materials are calculated but which materials are in stock and which materials will be additional has not been ascertained.

5. The machinery in the new production hall is too close, so there will be no room for even the smallest transportation aid, such as pallets or boxes.

6. The space for traffic purposes in the production hall amounts to 48.4% of the total.

7. Production should be concentrated as much as possible but there are no continuous conveyors in the layout and no list of machinery.

8. The quantity of transport equipment is given without details.

9. The only transportation aids mentioned are 20 pallets and 230 transport boxes which is grossly inadequate.

It is the expert's opinion that the layout must be replanned for normal materials handling.

III. CONCLUSIONS

1. It will be neoessary to install a system of materials management as soon as possible.

2. A store should be established for semi-finished goods in order to avoid delays in time soheduling.

3. Transportation aids should have one standardized height for pallets, box-pallets, boxes, and salvers for nozzles.

4. The utilization of transport equipment should be improved.

IV. RECOMMENDATIONS

Management and organization

Materials management is responsible for the development and co-ordination of better techniques and systems in quantity fixing, flow and control of material from the purchase through production to the distribution of finished goods.

Intensified use of EDP

EDP is used at IPM only for general planning processes and not for continuous schedule control, as is necessary. Therefore, the use of EDP should be intensified as it is in production scheduling and control where a realistic picture of the situation and activities is available daily. The installation of materials management at IPM depends on the intensified use of EDP.

Planning of materials flow in production

Size of pallets and boxes

One basic detail for an efficient system for materials flow is the right size of transportation aids, such as pallets and boxes. Presently, sizes are not standardized.

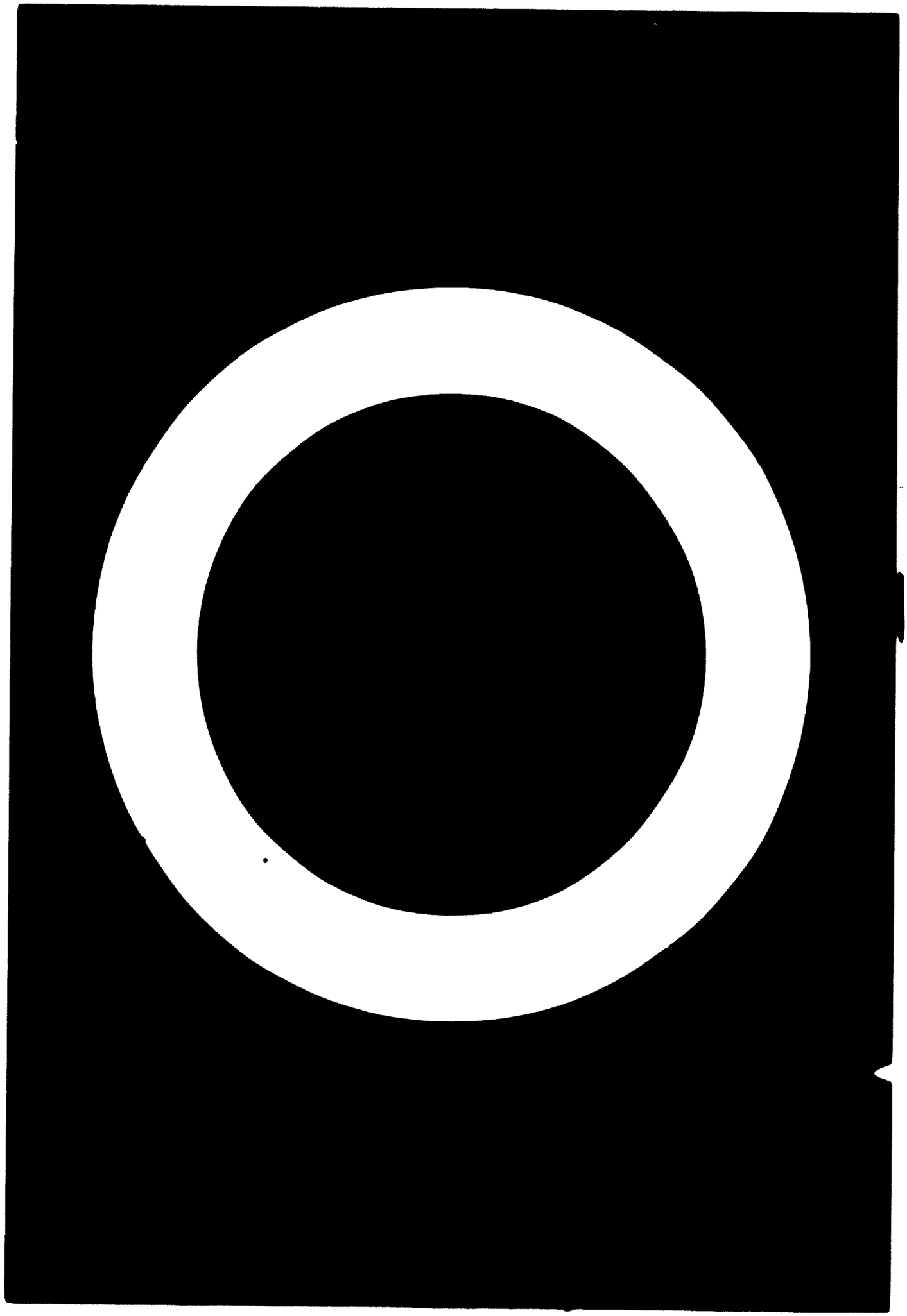
The European pool pallet is 800 x 1,200 mm, but there is insufficient production space at IPM for these. The pallets at IPM should be half the size, i.e., 600 x 800 mm.

Neither is the under-run height standardized. This is important and, according to international standards, should be 100 mm.

Besides these two sizes, special transportation aids will be used in the future. These are the two types of pallets, for normal racks and bar-material, for the new raw-materials store. Additionally, transportation aids for the salvers for nozzles should be found and the expert proposed castor-supports for these parts with a dimension of 440 x 1,070 mm.

Other transportation aids

Other transportation aids are the existing pallets, boxes etc., which have to be used until they are amortized. This will take some years, so that there has to be a plan on how these transportation aids will be employed in the future.



Annex

JOB DESCRIPTION

Title:	Expert in internal transportation and technology
Required time:	Three months
Purpose:	To help IPM, Belgrade, to solve internal transportation problems within the framework of existing technological possibilities and the production plan which consists of: 1. High pressure pumps for diesel engines 2. Petrol engine equipment/carboretors, water pumps
Duties:	The expert is expected to: Study the existing situation Analyse the situation; propose a solution for internal transportation with eventual layout alteration of existing technological equipment; propose supplies for transportation; and train staff (two men) for this work.
Qualifications:	Graduate mechanical engineer with experience in technological processes and internal transportations
Languages:	English, French and German

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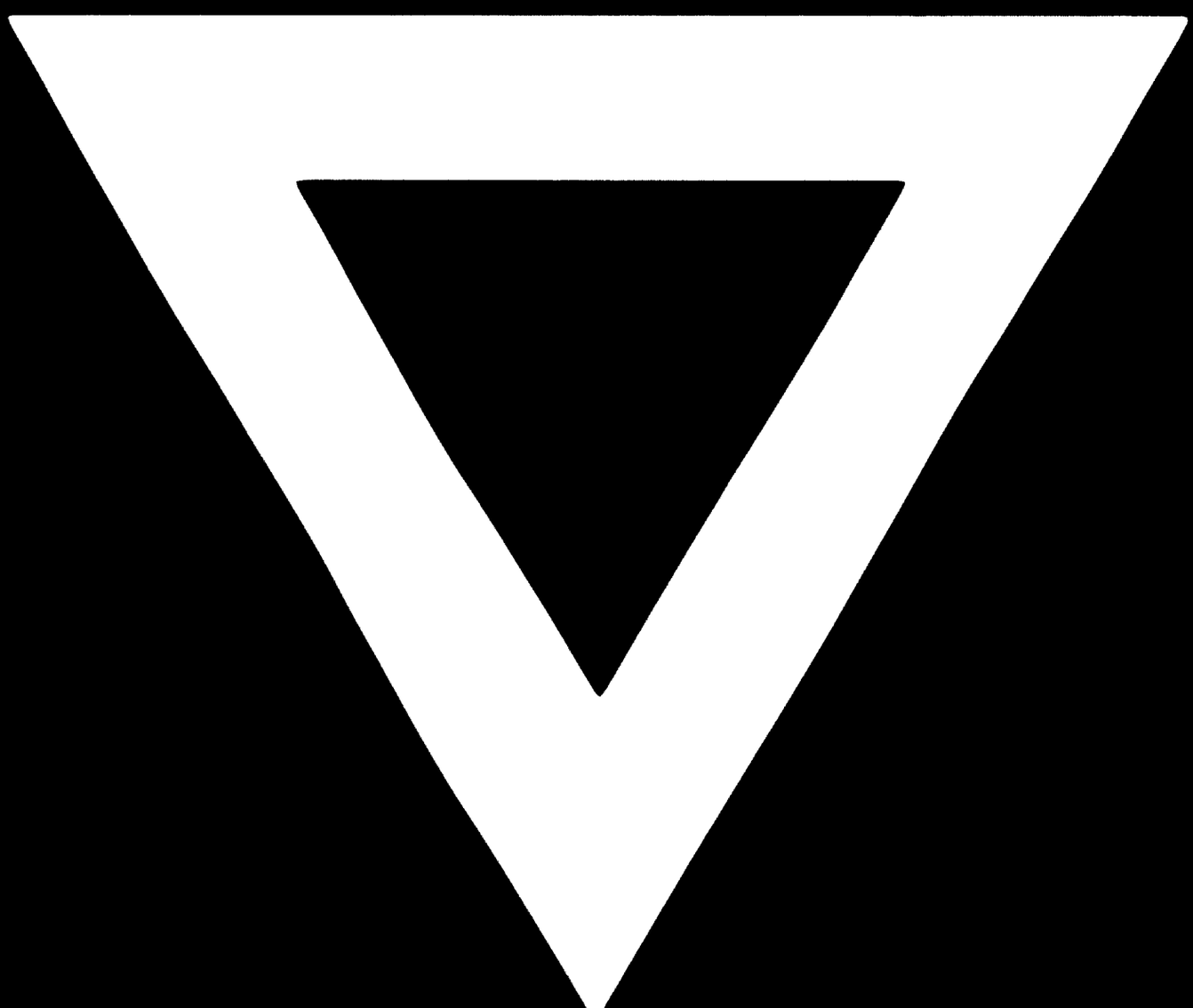

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