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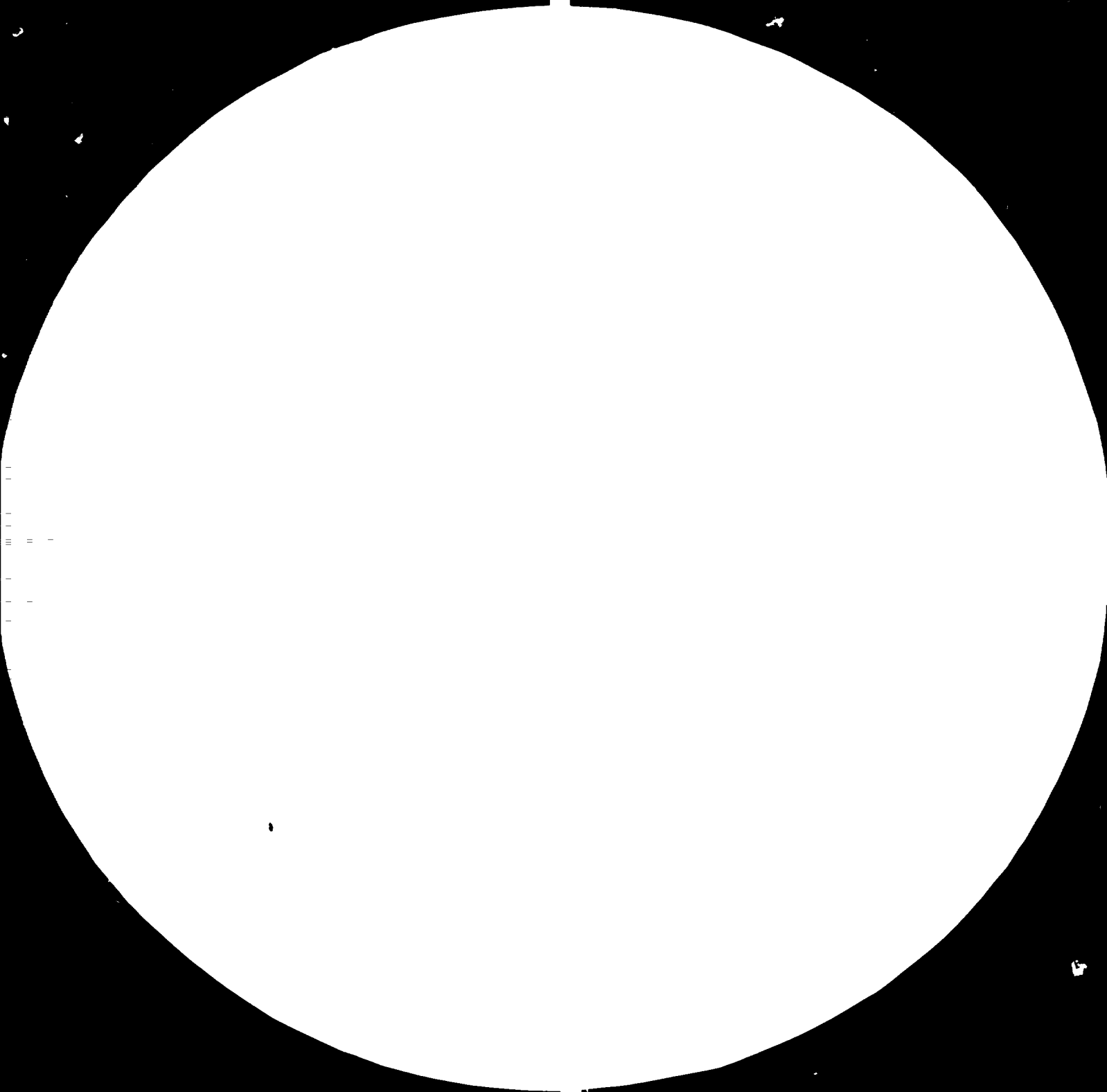
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**REPAIR AND MAINTENANCE CENTRE  
FOR SUGAR AND RICE MILLS**

**VIETNAM**

**POLYTECHNA**

**INPRO**

**PRAGUE**

2616

**CZECHOSLOVAKIA**

CONTRACT NO. T S I 72

11993

Vietnam.

FINAL REPORT

REPAIR AND MAINTENANCE CENTRE AND SPARE PARTS

PRODUCTION FOR SUGAR AND RICE MILLS,

V I E T N A M

PROJECT NO. DP/VIE/80/037

POLYTECHNA

I N P R O

PRAGUE - CZECHOSLOVAKIA

August, 1982

A B S T R A C T

The present Report concerns the work of the mission of Czechoslovak experts J. Semsch M.Sc. and A. Straževský M.Sc. in the Socialist Republic of Vietnam from December 1st, 1981 till January 12th, 1982 submitted by POLYTECHNA/INPRO. The mission was effected within the framework of the UNIDO Project No. P 81/26-26 DP/VIE/80/037 "The Establishment of a Permanent Repair and Maintenance Centre and Spare Parts Production Facilities for Sugar and Rice Mills in Vietnam" on the basis of Contract No. T 81/72 concluded between the UNIDO Vienna and the foreign trade corporation POLYTECHNA Prague.

The stay of the mission in Vietnam and the working programme were secured, from the organizational point of view, by the Ministry of Food Industry and the Ministry of Food in Hanoi, whose representatives were the main partners for the mission during its activities, as well as during negotiations on the conclusions.

The mission was also in regular contact with the UNDP representative in Hanoi, with whom the mission delegates consulted all important matters continuously.

The Report states the items of information of the mission of Czechoslovak experts in Socialist Republic of Vietnam, where the mission investigated the possibility of the establishment of Permanent Repair and Maintenance Centre and Spare Parts Production Facilities for Sugar and Rice Mills. The mission also looked for the most advantageous ways of utilizing the financial

contribution of the UNDP amounting to US Dollars 3 000 000. This amount is intended for the establishment, equipment and realization of the activities of the said Repair and Maintenance Centre and Spare Parts Production Facilities.

The project was formulated at a time when there was only one Ministry of Food. After the reorganization in 1981 the Ministry was divided into two parts: the Ministry of Food, having rice mills in its jurisdiction and the Ministry of Food Industry administering sugar mills.

The two ministries agreed to divide the financial contribution of the UNDP into two halves and to build two separate Repair and Maintenance Centres:

The Ministry of Food Industry - UNDP financial contribution of US \$ 1 500 000 - new Central Repair Plant in Bien Hoa. ✓

The Ministry of Food - UNDP financial contribution of US \$ 1 500 000 - the restoration of existing Repair Plant and Production of Machinery and Equipment for Rice Mills - Hoang Liet Factory in Hanoi.

At the last meeting on 9th January 1982 in Hanoi in the presence of the representative of the State Planning Committee and UNDP representatives, both ministries requested the mission to elaborate two separate Final Reports, one for the Ministry of Food - rice mills and the other for the Ministry of Food Industry - sugar mills.

At the briefing held in the UNIDO office in Vienna

on the 2nd and 3rd March it was decided that there will be only one final report, but with two separate parts - one for rice mills, the other for sugar mills.

The Government of the Socialist Republic of Vietnam have already entrusted the General Management of Sugar Factories in Ho Chi Minh City to build a Central Repair Plant for maintenance and repairs of sugar machinery and equipment in Bien Hoa; buildings have been designed and steel structures ordered. Also the Ministry of food have decided to restore the existing Hoang Liet Plant to a Central Repair Plant for rice mills. Due to these facts the team of experts was obliged to change the conception of one Central Repair Plant to two separate repair plants - one for rice mills, one for sugar mills.

#### Rice Mills

The mission has come to the conclusion that it will be necessary to support the solution of the problem of improvement of maintenance, repairs, production of spare parts and of new machinery and equipment for rice mills by the financial aid of the UNDP:

1. Purchasing of rice milling equipment - paddy grader, paddy separator and stoner, testing in rice mill and utilization of the experience in the design of modern machines, to be produced in Hoang Liet Plant.
2. The assignment of one chief technical adviser for the overall operation of the project.
3. The assignment of 2 experts on designing modern rice milling machinery and equipment, to be produced in Hoang Liet Plant.



4. Purchasing machinery, equipment, measuring instruments and tools for Repair Plant and Production of Machinery and Equipment for Rice Mills - Hoang Liet Factory in Hanoi.
5. The assignment of experts on erection of machinery and equipment in Hoang Liet Plant.
6. The improvement of machining technology and maintenance by assigning 2 experts on machining technology and maintenance.
7. The assignment of one expert on the improvement of the quality of rubber rollers for husking machines.
8. Purchasing Shore hardness tester for the testing of the quality of rubber rollers for husking machines.
9. Six international fellowships of 20 man/months for technical on-the-job training of local technical staff in different activities.

#### Sugar Mills

The mission has come to the conclusion that for the improvement of maintenance, repairs, production of spare parts and of new machinery and equipment for sugar mills the UNDP financial contribution should be used in this way:

1. Purchasing of machinery, equipment, measuring instruments and tools for the Central Repair Plant for Maintenance and Repairs of Sugar Machinery and Equipment in Bien Hoa.

2. The assignment of one chief technical adviser for overall operation of the project.
3. Preparation of engineering and electrical part of the project documentation by assigning two consultants.
4. The assignment of experts for the erection of machinery and equipment in the Central Repair Plant in Bien Hoa.
5. The assignment of
  - one expert on repair of rolls and machining of sheaths for sugar cane mills
  - one expert on electric repairs
  - one expert on technological process studies
  - one expert on designing machinery and equipment for sugar factories
6. Six international fellowships of 21 man/months for technical on-the-job training of local technical staff in different activities.

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RICE MILLS

## 1. GENERAL

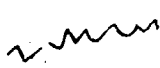
The Socialist Republik of Vietnam has a population of approx. 55 600 000 in 1981 51 673 700 according to the census in 1978, and covers an area of 329 566 square km. The population is not distributed evenly over the country. For exemple, the provinces of Ha-Noi, Ho-Chi-Minh, Thai Binh have the density of population over 1000 inhabitants per square km whereas the provinces of Lai Chan, Gia Lai-Kon Tum and Lam Dong have the density below 30 inhabitants per square km. The population growth is estimated to be 2,5 - 2,6% yearly. It is estimated that about 65% of the population are directly dependant on agriculture for their income.

Rice forms an important part of the staple diet in Vietnam. In accordance with UN criteria, the basic requirements are 17 kg rice or equivalent per adult per month. This total includes 11,3 million tons of paddy produced yearly.

## 2. PADDY PRODUCTION

Paddy is produced mainly in two areas: the Red River Delta in the North with approximately 1,5 million ha (19,4 - 24,4% of total production) and the Mekong River Delta in the South with about 1,8 million ha. Provinces in the Mekong Delta with considerable surplus production are Min Hai, Han Giang, Kien Giang, Cun Long and Dong Thap.

There is a serious shortage of transport facilities from the South to the deficit areas in the midland



and in the mountainous areas in the North, therefore the Government has planned the increase of paddy production in the Red River Delta in order to meet the need of rice on the spot.

Harvest of paddy rice

<u>Year</u>	<u>Vietnam</u>	<u>from this, Red River Basin</u>
1976	11 866 000 tons/year	2 890 000 tons/year
1977	10 885 000 - " -	2 300 000 - " -
1978	10 040 000 - " -	2 370 000 - " -
1979	10 758 000 - " -	2 460 000 - " -
1980	11 678 000 - " -	2 180 000 - " -

There are two and in the South three paddy harvests in the country.

The main harvest in the South is in December/January producing 54% of the total production, the April/May harvest with 34% and the July/August harvest with 12%.

3. PADDY GRAIN COMPOSITION

Paddy grain is composed of:

- the husk - formed by the palea and lemma - it can be either beardless or bearded
- the cuticle or inner skin - it has five microscopic layers; the total or partial removal of these layers determines the milling degree
- the starchy kernel (endosperm) - it forms the edible part of the seed
- the germ - the germ cavity is clearly visible at one end of the whole grain

According to the Vietnamese National Standard, the quality of white rice should be within the following limits but, due to obsolete, worn out machines these limits are not achieved. The yield obtained in medium size and big rice mills is as follows:

	Vietnamese National Standard %	Quality achieved in medium and big mills %
Paddy grains	100	100
from these: impurities	1	2,5 - 3
husks	20 - 22	20,5
bran	5 - 6	6,5
small broken rice	-	5
losses during milling	n.a.	0,2
white rice	71 - 74	65

The quality of white rice, average data from big mills:

White rice	75	50
Half rice grains	25	20
Broken rice	-	30
Paddy in rice (grains/kg)	15	60 - 100
Pebbles, stones	0,002	0,05
Bran remnants in rice	0,015	0,2
Change of colour of grains - grains/kg	none	20 - 30

The yield obtained in small rice mills is even lower - less than 60%. It is estimated that the average yield ratio in Vietnam is 61%. Compared with Vietnamese National Standard, this low ratio represents the losses of 1 168 000 tons up to 1 518 000 tons per year of white rice in the year 1980 or 21,0 kg up to 27,3 kg of white rice per capita per year.



It is necessary to improve the yield of rice from paddy as soon as possible to the ratio given in the Vietnamese National Standard.

Husks are used only as fuel in rice mills or in private houses.

Bran is cattle or other animals' fodder. Raw bran generally contains 18-22 per cent of oil, or approximately the same percentage as soybeans. Oil is edible after extraction and refining; it is excellent for cooking, salads etc. The residue of rice bran after oil extraction is rich in proteins, vitamins and minerals. Compared with raw bran, it contains a small quantity of free fat, which is not desirable for fodder; further, it never decomposes even if stored for a long time. Therefore it is better than raw bran.

All big rice mills and some medium-size rice mills in Vietnam have rice bran oil extracting plants, i.e. only approx. 3 per cent of bran are crushed and extracted. The installed machinery and equipment is mostly old, obsolete, with hand-operated filter presses (for example, the rice mill in Nam Dinh), therefore the extracted quantity of rice bran oil is small (sometimes even less than 8%). There are big reserves in this field. Modern smallest rice bran oil extraction plants have the capacity of 15-30 tons of extracted bran per 24 hours, i.e. bran from 250 - 500 ton of paddy. Now, when the small rice mills will be replaced by the medium-size ones it will be possible to organize the transport of raw bran from more medium-size rice mills to one small rice bran oil extraction plant. Extraction of 25 per cent of bran in Vietnam will give approx. 35 000 ton of edible oil per year (more than 0,6 l per capita per year).

Impurities - dust, straw, stones, pebbles, sand, metal etc. Due to bad sifting of paddy after the harvest by farmers and cooperatives, impurities are 2,5 times above the limit given by the Vietnamese National Standard.

Losses during milling - small particles of paddy, dust and rice not filtered, coming to the air or lost in another way.

Small broken rice - is used as animal fodder. It is the biggest loss of the final product - white rice. Small broken rice as well as broken rice (30% in the final product - white rice) is caused by obsolete machinery and equipment not functioning properly, mainly:

- 1) paddy husking machines with locally made rubber rollers - they increase the ratio of small broken rice (fodder) and broken rice in white rice three times in comparison with imported ones,
- 2) paddy husking machines with two flat sheller discs with emery and/or corundum surfaces,
- 3) old design of whitening machines - horizontal whitening cone coated with emery and corundum grains etc.

Change of colour of grains - 20 - 30 grains in one kg of white rice are black. This black colour is caused by locally made rubber rollers, used in paddy husking machines.

Bran remnants in white rice - After polishing on old type polishers the rice grain remains rough and bran sticks on the rice. Fermentation, mould and fungi of

bran remnants leads to deterioration in quality of white rice (higher sourness of white rice).

#### 4. PADDY HANDLING

Harvest: As already mentioned there are two to three harvests in the country yearly. After the manual harvest the paddy is threshed by hand or by mechanical threshers.

Sifting of paddy - After threshing the paddy is sifted mostly manually or on simple sifting machines driven by hand. Impurities (dust, straw, stones, pebbles etc.) are 2,5 times above the limit given by Vietnamese National Standards. This should be improved in the future.

Transport to rice mills - Paddy is transported to small rice mills by carts, to medium and big rice mills by carts, lorries; losses by transportation are relatively small.

Drying - sundrying is the traditional way of drying paddy in Vietnam. It is the most practical method for paddy harvested in the dry season. Sundrying is difficult in the wet season. The lack of drying facilities is the main cause of loss of quality of paddy and the final product, i.e. white rice. A safe moisture content is 14 - 15%, moisture content of more than 20% leads to deterioration in quality due to fermentation, mould and fungi. The rice may be seriously affected by toxic materials produced by fermentation and the growth of mould and fungi.

This problem was partly solved as the Plant in Hoat Liet started the production of drying plants of its own design, capacity of 2,5 tons per hour, drying

rate per pass (reduction of moisture) of 2 - 2,5%.  
Planned production in the year 1982: 10 pieces. Also  
a factory in South Vietnam is producing drying plants.

#### 5. RICE MILLS

There are thousands of small, medium-size and big rice mills in Vietnam.

<u>In the North Vietnam</u>	Total	from this, Red River Delta
Rice mills with capacity of 180 tons/day	4	4
Rice mills with capacity of 90 tons/day	8	5
Rice mills with capacity of 45 tons/day	20	8
Rice mills with capacity of 0,8 - 2,5 tons/day	3715	n.a.

The capacity of the rice mills is given in the final product of the rice mills, i.e. white rice. It is presumed capacity. The efficiency of all units is down to 60 - 80% and the output quality is low.

The total milling capacity of the big and medium rice mills in North Vietnam is 680 000 tons of rice or 1 040 000 tons of paddy/year, in the small rice mills it is about 2 500 000 tons of paddy/year.

<u>In South Vietnam</u>	Total
Rice mill with capacity of 500 tons/day	1
Rice mill with capacity of 300 tons/day	1
Rice mill with capacity of 200 tons/day	1
Rice mills with capacity of 0,8 - 1,2 tons/day	unknown

Medium and big rice mills are concentrated in cities and district centres; small rice mills are scattered in villages and agricultural cooperatives.

In the future, small rice mills with the capacity of 0,8 - 2,5 tons/day will be gradually replaced by medium-scale rice mills having the capacity of 45-90 tons/day.

Rice mills in Vietnam were built 20 - 30 or more years ago, therefore their machinery and equipment is old and worn out. Presently all medium-size and big rice mills are operating at reduced capacity (60 - 65% of planned capacity). Most of the machines are obsolete, not performing well their function, some are even not available in the production process. Some examples:

Stoners are machines that separate stones from paddy or brown rice. Conventional sieving stoners, which are used in existing rice mills, cannot achieve perfect separation. New stoners separate stones from paddy or brown rice by utilizing the difference between the specific gravity of rice and the stone.

Paddy graders - the number of new varieties of paddy grains grown in Vietnam at the present time (more than 20) has resulted in the mixture of varieties at farm level, at the procurement centres and rice mills. Most existing rice mills are without graders or have obsolete ones.

Paddy separators separate brown rice from paddy. The existing separators use the principle of flow-stream; they are not efficient. Modern paddy separators are of gravity type utilizing the difference in weight and surface roughness of paddy and brown rice.

Thickness/width graders are used for separating immature grains from brown rice and broken parts from white rice. Graders are produced in Vietnam. They are of an old design, heavy, not performing their function. In the modern revolving hexagonal screen, immature grains and broken parts are discharged through slits (or round holes) in the screen and carried away by a screw conveyor.

Rice graders separate one or two kinds of broken rice from whole rice according to the length or immaturity degree of paddy and the extent of dehusking. Broken rice which is more than half of whole rice in length cannot be separated from whole rice by a sieve or a thickness/width grader. This type of machine is essential for rice mills if they wish to obtain high quality rice. Modern rice graders are of cylinder type.

Rotary sifters sift milled rice into 3 classes; head rice, large broken rice and fine broken rice. Modern models have 2-4 sieves of the same mesh and one sieve of a different mesh. The combination of sieves may be freely changed, using some 40 - 50 kinds of sieves, to meet any specific sifting requirements.

Whitening machines are of an old design (horizontal whitening cone coated by emery and corundum grains). Modern whitening machines are of abrasion (grinding) type and friction type. The abrasive roller acts as a knife cutting the bran layer of the kernel whereas the friction process peels the layer off, leaving the kernel of rice intact and ready for further whitening.

Husking machines - Paddy husking machines with rubber

rollers are mostly used. Rollers revolves at different speeds and in opposite directions. The paddy is fed into the gap between the rubber rollers from above and is husked by the abrasive action between the rollers. This system is better than paddy huskers with two flat sheller discs with emery and/or corundum surfaces, which are installed horizontally.

Rubber rollers produced in Vietnam are of low quality. Their service life is 25 - 30% of that of imported ones.

Rice polishers - Existing polishers are of an old design, rice grains remain rough after polishing, bran sticks on the grain, the percentage of bran remnants in rice is high.

Bag sewing machine - Most of rice mills are not equipped with this machine, therefore sewing is done manually. Most of the above-mentioned machines produced in the country should be modernized and the production of those not yet manufactured should start in Vietnam as soon as possible.

#### 6. REPAIR PLANT AND PRODUCTION OF MACHINERY AND EQUIPMENT FOR RICE MILLS - HOANG LIET FACTORY IN HANOI

This plant was selected by the Ministry of Food as a Central repair and maintenance plant for rice mills in North Vietnam. The plant was built and put into operation in 1963; during the war it was bombed (bomb-destroyed) four times. In 1973/1974 it was restored and the production started again.

This plant does not carry out only repairs and maintenance of machinery and equipment for rice mills, but it also produces machinery and equipment for complete rice mills of the following capacities:

- machinery and equipment of small rice mills with the capacity of 2,5 tons and 5 tons per day,
- machinery and equipment of medium-size and big rice mills with the capacity of 45 tons and 90 tons per day,
- paddy grains driers with the capacity of 2,5 tons per hour,
- noodle processing machines,
- ventilator for paddy grain stores,
- spare parts for rice mills - for example sieves made of wires or of steel sheets, buckets etc.

This plant provides approx. 30% of spare parts for rice mills. The remaining spare parts are secured by the big rice mills themselves (wooden parts etc.) or they are imported. The total production of new machinery, equipment and spare parts is 1500 tons/year. The plant covers only partly the demand for new machinery and equipment for rice mills and paddy grain stores and driers.

The machinery and equipment is old, partly bomb-destroyed, worn out, not maintained well (shortage of lubricants) etc.

The factory is big with 570 workers in two-shift operation plus managerial staff. They are skilled but the production is performed in an old way method - piece production of components and parts, which are fitted to counterparts without the possibility of counterchange.



Machines and equipment produced in this plant for rice mills are of very old design. Even when new, they are not performing well their function and are causing the low ratio of white rice yield from paddy grains.

The plant needs:

- 1) To modernize the installed machinery, equipment, measuring instruments and tools.
- 2) To design new machines and equipment for rice mills not yet produced in the plant and to redesign and modernize the types of machines produced in the plant.
- 3) To train workers and staff in modern production methods.
- 4) To increase the production of modern machines and equipment for rice mills and production of spare parts to 2400 tons/year to meet the requirements of rice mills in North Vietnam.

#### Grey Iron Foundry

The grey iron foundry is situated in a building 60 x 18 m with two bays. The 6 m wide bay stores raw materials, manual handling, weighing and charging and 2 melting cupola furnaces of inner dia 600 mm, with fixed, unheated forehearth, with skip charging equipment.

The 12 m wide bay is equipped with a 3 ton overhead travelling crane, a moulding sand mixing machine with the capacity of 1000 kg and a smaller mixer for the production of cores with the capacity of 300 kg. Free

area is used for manual production of moulds and cores. There is no drier in this foundry, therefore all castings are made in natural green sand moulds. Casting is done twice a week.

Also cleaning of castings is done by hand without blasting. Outside the foundry in the open area there is a small, very simple melting furnace for non-ferrous metals, mainly aluminium alloys, heated by wood.

The foundry casts gray iron castings up to the piece weight of 500 kg.

Anthracite is used for melting in cupola furnaces instead of coke - this causes a high percentage of sulphur in the molten iron. A high percentage of grey iron and steel scrap is used. As the grey iron foundry does not have its own metallurgical laboratory and cannot control the content of carbon, sulphur and silicon, the quality of grey iron castings is very low.

To improve the quality of castings, it is advisable:

- 1) To replace the anthracite used in cupola furnaces for melting purposes by quality coke - at least for complicated castings.
- 2) To perform at least simple metallurgical tests of sulphure, carbon and silicium content. To build a chemical laboratory with simple equipment for classical wet-method tests and with the simplest equipment of a sand laboratory.
- 3) To add ferrosilicium to the molten metal to improve the quality of grey cast iron.

- 4) To test hardness by a hardness tester.
- 5) To replace the simple melting furnace for non-ferrous metals by a low-frequency melting furnace.
- 6) To improve casting technology and the quality of forming materials, to make laboratory tests of sands and to use the most advantageous charge of moulding and core materials.

#### Machining shop

The machining shop is equipped with many machines:

- 1 horizontal boring machine, spindle dia 100 mm
- 1 vertical boring and turning mill dia 1000 - 1200 mm
- 1 planing machine, table size 1000 x 2500 mm
- 1 vertical milling machine
- 3 horizontal milling machine
- 3 shapers of different sizes
- 1 slotting machine
- 1 gear milling machine dia 500 mm, module 6
- 2 cylindrical grinding machines
- 1 surface grinding machine, table size 250 x 1000 mm
- 20 centre lathes of different sizes, max. dia 500x2500 mm
- 1 capstan lathe, boring of spindle approx. 36 mm
- 1 radial drilling machine, max. boring dia 50 mm
- 2 special presses for the production of sieves made of steel sheets
- 2 special machines for the production of sieves made of wires
- 2 presses for the production of bicycle chains

Tool room and production of buckets

1 centre lathe  
1 shaping machine  
1 column drilling machine  
1 bench-type drilling machine  
1 universal tool grinding machine

Assembly of machines

The assembly of machinery and equipment is housed in a building 150 x 24 m with 2 bays (each 12 m wide).

Machinery and equipment:

3 radial drilling machines of different sizes  
4 column and bench-type drilling machines of different sizes  
4 welding machines of different types and sizes  
1 guillotine shears 5 x 2000 mm  
1 centre lathe dia 400 x 1000 mm  
1 combined profile shears  
1 bending rolls

Electrical repair shop

Without machine tools, only simple equipment and measuring instruments.

Forge shop

1 open hearth  
2 anvils

There are other 4 workshops in South Vietnam with 20 - 60 employees producing spare parts, machinery and equipment for small rice mills and drying plants.

These workshops, partly in the private sector, were not visited by the team of experts.

There will be no substantial improvement in the machinery and equipment or the production capacity of these workshops in the near future.

7. PRODUCTION OF RUBBER ROLLERS FOR PADDY HUSKING MACHINES IN VIETNAM

At present there are 3 producers of rubber rollers in Vietnam:

- 1) Yellow Star Rubber Factory produces approximately 10 000 couples of rubber rollers per year. The General Management of the Ministry of Chemistry would like to stop this production and transfer it to the Ministry of Food.
- 2) The Rubber cooperative in Thai Binh produces only a small quantity of rubber rollers.
- 3) Rice Mill Yen My - production of rubber rollers.

The production started three years ago. The production was in

1972 - 742 couples of rubber rollers

1980 - 1452 couples of rubber rollers

1981 - the plan was for 2000 couples of rubber rollers but the production was higher.

In the future the majority of rubber rollers for paddy husking machines will be produced in this factory, i.e. approx. 20 000 couples of rubber rollers. (Some paddy husking machines are fitted with two flat sheller

discs with emery and/or corundum surfaces produced in another factory).

Due to an improper formula of preparation of the rubber mixture the products have a short service life (25-30% of that of imported ones). The couple of rubber rollers manufactured in this factory husks 60 - 80 tons whereas imported rollers have a capacity of 250 - 300 tons per one pair of rollers. The low quality of rubber rollers leads to a high ratio of broken rice and to the blackening of rice grains.

Description of the existing technological process:

Size of mostly used rubber rollers: length 335 mm, steel shaft max. dia 120 mm, rubber sheath outside dia 170 mm.

The steel shaft is turned on a universal lathe, the remnants of the old rubber roller are removed and the surface is roughened in a shallow screw-shaped notch. The shaft is then covered by a special sort of adhesive gum.

Rubber mixture substances are manually weighed and then mixed on a mixer (pair of rollers). The mixture is formed into a sheet of approx. thickness of 2-3 mm and approx. width of 350 mm on a calender (pair of rollers) and wound up on the steel shaft. After winding the roller is pressed manually into a hand-operated die and then vulcanized with the die in an autoclave at the temperature of 152°C for four hours.

The most frequent defects of rubber rollers:

1. The rubber sheath tears from the steel shaft.
2. Under the surface there is a deep breach along the shaft in the rubber sheath; during husking the sheath splits into two parts.
3. There are several small breaches, in the rubber sheaths, mostly along the shaft.
4. The rubber sheath wears out quickly and blackens the husked grains.

Recommendation:

1. To decrease the rubber roller sheath wear, the formula of rubber rollers should be changed. The composition of rubber mixture should be close to that for tyre treads.
2. There are two possibilities of improving the cohesion of the rubber roller sheath and the shaft.
  - 2.1. Use of a chemical binding agent (bonding agent) - e.g. Chemosil Medum and the like. Disadvantage of this method: steel shafts must be sand blasted and then degreased; chemical binding agent are expensive, they must be imported and cannot be stored for longer periods.
  - 2.2. The shaft is prepared in the same way as above. First, <sup>02</sup>2-3 layers of 2-3 mm thick ebonite sheets are wound on it followed by 2-3 mm thick sheets of rubber mixture close to that used for tyre treads. Then it is coated with a solution of ebonite with petrol.

Then the rubber roller is wrapped in cotton bandages and vulcanized in an autoclave.

After vulcanization the bandages are removed (and can be used again) and the rubber roller is ground on a centre lathe by a toolpost grinding machine.

This method will probably be better for the Vietnamese conditions than the first one.

8. THE TEAM'S DRAFT PROJECT FOR THE ESTABLISHMENT OF CENTRAL REPAIR AND MAINTENANCE PLANT AND SPARE PARTS PRODUCTION FOR RICE MILLS IN HOANG LIET FACTORY IN HANOI AND PRODUCTION OF RUBBER ROLLERS IN YEN MY

To improve the situation in the production of rice, i.e. to improve -

- the yield obtained in rice mills from 61% to better results,
- the quality of final product with minimum broken rice,
- rehabilitation, restoration and maintenance of industrial processing equipment already installed and in use in Vietnam so as to achieve the full planned capacity, it is advisable to do the following:

8.1. UNDP Inputs - Machinery and Equipment

8.1.1. To purchase, install and test a set of the following modern machines in one rice mill

- stoner to separate stones from paddy or brown rice by utilizing the difference in specific gravity between rice and stone, capacity of 4 tons per hour
- paddy separator to separate brown rice from paddy, gravity type utilizing the difference in weight and surface roughness of paddy and brown rice, capacity of 4 tons per hour;



- paddy grader to separate long grain paddy from short grain one before husking, capacity of 4 tons per hour .

For specification of these machines see Annex No. 1.

- 8.1.2. To purchase Shore a hardness tester A and D for testing the hardness of rubber rollers in the Yen My Factory. For specification see Annex No. 1. (The rubber wear testing apparatus is not included in the specification of UNDP Inputs as according to the experience from other rubber factories it does not give comparable results and is used only in big laboratories but not for testing of finished products).
- 8.1.3. To purchase modern machinery and equipment, special accessories, measuring instruments and tool for the improvement of the machining, technological process and to raise the capacity of the Central Repair and Maintenance Plant and Spare parts Production Plant for Rice Mills in Hoang Liet Factory in Hanoi. For specification see Annex 1.

## 8.2. UNDP Inputs - Assignment of International Staff

### 8.2.1. Chief Technical Adviser

He will be responsible for overall operation of the project and for the direction and coordination of the work of experts.

### 8.2.2. Experts on Erection of Machinery and Equipment

They will perform the erection of complicated machinery and equipment, purchased as UNDP contribution.

8.2.3. Expert on rubber rollers

He should determine the new formula for rubber mixture and a new process of manufacture of rubber rollers, starting from the mixing up to the vulcanization, machining and testing of rubber rollers, including specification of the machinery and equipment.

8.2.4. Experts on Designing Rice Machinery and Equipment

Based on the tests and experience with new machinery and equipment for rice mills - (UNDP Inputs - see para 8.1.1.), two experts should design modern machines, mainly

- stoner to separate stones from paddy or brown rice
- paddy separator to separate broken rice from paddy
- paddy grader - to separate long grade paddy from short one before husking, eventually
- rotary sifter to sift milled rice into 3 classes: head rice, large broken rice and fine broken rice.

8.2.5. Expert on Machining Technology

He should train Vietnamese staff and workers in modern machining technology (turning, milling, boring, shaping, grinding etc.).

8.2.6. Expert on Maintenance

He should train Vietnamese engineers in the planning and execution of preventive repairs.

For details on the assignment of international staff see Annex 2.

### 8.3. UNDP Inputs - Fellowships

Within the framework of UNDP Inputs, six international fellowships for technical on-the-job training of Vietnamese technical staff should be arranged:

- 8.3.1. Fellowship for one person in the machining of components and parts for repairs (turning, milling, grinding, boring, shaping etc.)
- 8.3.2. Fellowship for one person in the maintenance and servicing of electrical and electronic equipment (testing, repairs etc.)
- 8.3.3. Fellowship for one person in the welding process (electric arc welding, gas welding etc.)
- 8.3.4. Fellowship for one person in metal forming process (pressing, forging, bending, heat treatment).
- 8.3.5. Fellowship for one person in the planning of preventive repairs.
- 8.3.6. Fellowship for one person in the management of the repair plant, organization process etc.

For details on fellowships see Annex 2.

SUGAR FACTORIES

1. GENERAL

Sugar forms an important part of the diet in the Socialist Republic of Vietnam. All sugar in Vietnam is made of sugar cane. The quantity produced is approx. 5,1 kg per capita per year, i.e. below the nutrition standard and therefore the Government of Vietnam have decided to increase the production of sugar cane by enlarging the area for sugar cane cultivation and by better extraction and utilization of sugar cane in big and small sugar cane factories.

2. Sugar cane production

Sugar cane is produced mainly in two areas: the Red River Delta in the North of Vietnam (smaller) and the Mekong River Delta in the South (bigger).

Harvest of Sugar Cane in Vietnam

<u>Year</u>	<u>Hectares</u>	<u>Tons</u>	<u>Tons/hectare</u>
1976	79 300	2 739 800	34,55
1977	74 600	2 758 700	36,98
1978	71 800	2 847 580	39,66
1979 estim.	110 000	3 700 000	33,63

From the total harvest of 3 700 000 tons of sugar cane, approximately 550 000 - 600 000 tons are processed in sugar cane factories, approximately 2 700 000 tons go to small sugar processing units with a capacity of 15-30 tons of sugar cane/day and to the smallest units with a capacity of 0,8-2 tons/day and 400 000 tons are consumed directly.

South Vietnam

Year	Sugar cane total - tons	Sugar cane, tons	Factories Sugar, tons	Number	Small Units Sugar cane, tons	Units Sugar, tons
1975-6	2,228.222	212.289	19.299	886	990.000	90.000
1976-7	2,190.400	359.000	32.703	1138	1,210.000	110.000
1977-8	2,290.870	370.000	35.000	1200	1,300.000	120.000
1978-9	2,254.670	405.000	38.000	1414	1,500.000	140.000

3. SUGAR CANE COMPOSITION

The sugar cane is a giant grass with sword-shaped leaves producing solid stalks. Some of the varieties produce stalks of only 12 mm dia, while other make stalks with diameters up to 60 mm, the length of stalks being between 2 m and 4 m. Sugar cane grows best on rich, moist soil. It requires plenty of water and sunny weather.

The stalk contains 67 - 72% water, 12-18% sucrose, 9-11% fibrous material (cellulose), traces of proteins, acids and fats. Juice extracted from sugar cane contains 14-26% sucrose.

4. SUGAR CANE HANDLING

In Vietnam sugar cane is still harvested manually. The stalks are chopped off right above the ground by sharp knives especially designed for this purpose and then cut up into suitable lengths for convenient handling.

Harvested sugar cane is mostly transported on animal-drawn carts and wagons partly by motor trucks or by boats (sugar factory in Hiep Hoa).

5. SUGAR FACTORIES

There are six sugar factories in Vietnam - three in the South and three in the North and two refineries in the South:

In the South of Vietnam

1. Hiep Hoa sugar factory in the Long An province with a capacity of 1500 tons of sugar cane per day. The sugar factory was built in the years 1924-27 by France for the capacity of 100 tons of sugar cane per day and was enlarged to the present capacity in 1938.
2. Binh Duong sugar factory in the Song Be province with a capacity of 1500 tons of sugar cane per day. Production started in this factory in 1975.
3. Quang-Ngai sugar factory, built by Japan, with a capacity of 1500 tons of sugar cane per day. Production started in 1974-5.
4. Khan Hoi sugar refinery, built by France in 1953, with a capacity of approximately 1200 tons of sugar per day.
5. Bien Hoa sugar refinery, with a capacity of 200 tons of refined sugar per day, built by Japan, commissioned in 1969.

In the North of Vietnam

1. Van Diem sugar factory in the Ha Son Binh province, capacity of 1000 tons of sugar cane per day. The sugar factory was built by Poland in 1960.

2. Viet Tri sugar factory in the Vinh Phu province with a capacity of 500 tons of sugar cane per day. The sugar factory was commissioned by China in 1958.
3. Song Lam sugar factory in the Nghe Tinh province with a capacity of 350 tons of sugar cane per day. The sugar factory was built by China in 1958.

The second group of sugar factories are small plants with a capacity of 15-30 tons of sugar cane per day; they belong to cooperatives. Such a plant is mostly equipped with a simple milling unit (two rolls set horizontally one above the other) driven by a Diesel engine or an electric motor, a simple juice liming station (lime milk  $\text{Ca}/\text{OH}/2$ , simple evaporating station and a crystallizer.

In the private sector there are even smaller units, handicraft sugar units, with a capacity of 0,8-2 tons of sugar cane per day. The machinery and equipment is very simple - in some cases there are wooden mills driven by a buffalo or a cow. These units will be abolished in the future and they will be gradually replaced by small units with a capacity of 15-30 tons/day.

Sugar cane is transported to sugar mills by lorries, carts and in Hiep Hoa even by boats. Sugar cane is unloaded by means of special cane unloaders onto feeder tables. There are cane levellers on horizontal conveyors and inclined carriers are fitted with cane cutters. The cut cane is transported to the milling station the core of a modern cane sugar factory.

The milling stations are arranged in 4 tandem mill units with suitable roll diameters, in accordance with the re-



quired milling capacity. The resulting extraction is at most 90-91 % (in modern milling stations it is 93-97%). The rolls sheaths are made of special coarse-grain cast iron and hot forced - fitted on to forged steel shafts and their surface is grooved. There are different shapes of grooves employed: Chevron grooves for better drawing in of sugar cane, Meshaert grooves for the flowing off of the juice, Fulton grooves of different depths etc.

The cane mills are driven separately by steam turbines, only in the Hiep Hoa sugar mill two sugar tandem mill units are driven by a turbine and a gear box. The employed turbines are of the single-stage, back-pressure design and they employ a two-rim Curtiss wheel.

The transport of bagasse between the mills is provided for by slot or rake intermediary conveyors. Their drive is either derived from the bottom input or top roll via a gear box and clutch or they are powered by a separate motor.

Both methods, i.e. maceration of bagasse as well as juice and water imbibition are used. The moisture of the bagasse leaving the last mill is approximately 50%. As the bagasse is used as fuel in all Vietnamese sugar factories, power units of sugar factories are supplemented by special bagasse furnaces in boiler houses. All sugar cane factories are driven by backpressure steam turbines with generators; standby units are Diesel generating sets.

The juice from the milling station is acidic and it contains colloidal dissolved non-sugars, therefore

the juice must undergo chemical treatment before it can be filtered satisfactorily. Chemical agents used are quicklime in the form of lime cream or milk -  $\text{Ca}(\text{OH})_2$ , sulphur dioxide gas -  $\text{SO}_2$ , alternatively carbon dioxide gas -  $\text{CO}_2$  and occasionally phosphoric acid -  $\text{H}_3\text{PO}_4$ . The effect of these chemicals is completed by heating the juice at various stages in juice-heaters.

The settlings are filtered by filter presses or rotary drum vacuum filters of high capacity and high efficiency. Surplus water is evaporated from the juice in closed vessels in a vacuum.

Crystallization of the syrup is performed in vacuum pans.

Separation of crystals from mother liquor is effected by centrifugal action in centrifugals, i.e. metal drums suspended on vertical spindles and rotated at speeds of 1200-1500 r.p.m. In the Binh Duong sugar factory there are four modern fully continuous flow centrifugals. Crystals are dried in the drier and then stored in the silos.

Marketing and dispatching unit usually follows after the silos, with bagging line used for packing. Raw sugar from sugar factories is either sold directly to consumers or refined in refineries in Bien Hoa and Khan Hoi.

#### By-products of Sugar Mills

1. Bagasse - the crushed sugar cane residue contains 50% of water. In modern sugar factories the final bagasse contains 48-50% of water, 1 to 4% of sucrose and about 48 to 50% of fibre and around 2 % of ash. In Vietnam, bagasse is used in all sugar factories as fuel.

2. Filter cakes from filter presses containing settlings are used as fertilizer.
3. Molasses, a thick treacle that drains from sugar contains approx. 50% of sugar, 20% of organic impurities and 10% of inorganic impurities and 20% of water. Sugar mills and refineries in Vietnam produce from molasses alcohol and yeast. For example, the Bien Hoa sugar refinery produces 30 000 hl of alcohol per year, mostly rum for export as well as for local consumption, the Hiep Hoa sugar factory produces 20 000 hl of alcohol per year etc. The remaining molasses is used as cattle food or fertilizer.  
By-products of sugar mills in Vietnam are well utilized.

#### Auxiliary Workshops

Lime works and lime slakers for the production of quick lime  $Ca(OH)_2$  belong to the auxiliary processes of a sugar factory.

Each sugar factory has a small repair shop, not sufficient to perform the necessary repairs of machinery and equipment. Machine tools, metal forming machines, welding machines etc., if any, are old and worn out.

As already mentioned, sugar factories and refineries may be supplemented by distilleries and the production of liquers.

The Bien Hoa sugar factory has a weaving shop for the production of jute cloth, a shop for sewing jute bags and the production of plastic bags.

## 6. CENTRAL REPAIR SHOP

The General Management of Sugar Factories in Ho Chi Minh City was entrusted by the Government of the Socialist Republic of Vietnam to build a Central Repair Plant for the maintenance and repairs of sugar machinery and equipment and for the production of spare parts for existing factories and to replace, step by step, the smallest handicraft sugar units by small-size units with the capacity of 15-30 tons of sugar cane per day. The capacity of the Central Repair Plant should be 700 tons of products per year in the first stage of construction and 2000 tons per year in the final stage.

It was decided that this Central Repair Plant will be built in the vicinity of the Bien Hoa refinery in the big industrial area of Bien Hoa. The site for this Central Repair Plant covers 4,02 hectares. A geological survey is said to have been carried out, the levelling of the site has already begun and should be ready in three months, the fencing of the site is near completion.

The selected site is convenient. There is a high tension line near the site which will provide the plant with 2000 kVA, water is also available and the access road is good.

Project documentation: building have been designed and the steel structure ordered; approximately 70 % of the steel structures are already stored on the site.

The technological part of the project documentation is not ready. There is only a very rough idea of the maximum parameters of machines which are to be installed in the above-mentioned buildings. These parameters

are too big for a repair shop and their price will be much higher than the inputs by UNIDO and the Government of Vietnam.

The Government allocated 50 million Dongs to this project: 5 million have already been invested, at an estimate, the price of the buildings will be approximately 15 million Dongs, i.e. 35 million Dongs remain for the technological part of the project.

Discussions between the representatives of the Ministry of Food Industry, General Management of Sugar Factories and the UNIDO team were held between 17th and 22nd December 1981 in Ho Chi Minh City and between 28th and 31st December, 1981 in Hanoi.

7. TEAM'S PROJECT PROPOSAL FOR THE ESTABLISHMENT OF CENTRAL REPAIR AND MAINTENANCE PLANT AND SPARE PARTS PRODUCTION FOR SUGAR MILLS IN BIEN HOA

7.1. Production Programme and Capacity

Central Repair and Maintenance Centre and spare parts production for sugar mills

1. Repair of rolls, i.e. repairs of grooves of sheaths, machining of new sheaths and repairs of shafts. Castings of sheaths and forgings of shafts will be made in cooperation with the existing foundry and forge shop outside the Ministry of Food Industry.
2. Production of cane cutters - approximately 2000 pcs/year.

3. Repairs of machinery and equipment for other parts of sugar factories, and production of new machinery and equipment, within the range of the parameters of the main machinery and equipment, capacity 700 tons per year in the first stage of construction and 2000 tons per year in the final stage of construction.

#### 7.2. Layout

As the layout of the Repair and Maintenance Centre and the size of buildings have been designed and steel structures ordered by the Vietnamese investor, the team of experts is obliged to use this documentation without any changes and to make the best possible use of the existing steel structures - see Annex 3.

#### 7.3. UNDP Inputs - Machinery and Equipment

Machine Tools, special accessories, spare parts, tools and measuring instruments in the total value of US \$ 900 000 purchased as the UNDP contribution are stated in Annex 4.

#### 7.4. UNDP Inputs - International Staff and Fellowships for Sugar Factories

In order to get the best results during the preparation of the engineering part of project documentation, the construction of the central Repair Plant and to achieve the designed capacity and the best performance of the designed machinery and equipment, the following international staff should be assigned to the Project:

7.4.1. Chief technical adviser

He will be responsible for overall operation of the project and for the direction and coordination of the work of experts - 21 men/months US \$ 144 000.

7.4.2. Consultants on the preparation of engineering  
7.4.3. and electrical part of project documentation

They will design working drawings of the engineering and electrical part of the project documentation, i.e. spacing of machinery and equipment, their foundations, electric conduits, switchboards and distribution boards etc. - 11 men/months US \$ 81 400.

7.4.4. Experts on the erection of machinery and equipment

They will perform the erection of complicated machinery and equipment purchased as the UNDP contribution - 10 men/months - US \$ 69 000.

7.4.5. Expert on the repair of rolls and machining of sheaths for sugar cane mills

He will render advice to Vietnamese counterparts on how to repair rolls and sheaths, i.e. how they should be disassembled, machined, heat treated and assembled - 6 men/months - US \$ 41 400.

7.4.6. Expert on electrical repair

He will train Vietnamese workers in repairing the electrical outfit of machinery and equipment for sugar factories - 6 men/months - US \$ 41 400.

7.4.7. Expert on technological process studies

He will train Vietnamese technicians in elaborating technological process studies of repairs of the machinery and equipment for sugar factories.

7.4.8. Expert on designing machinery and equipment for sugar factories

The central Repair Plant should produce, among other things, new machinery and equipment for small sugar factories with the capacity of 15 to 30 tons of sugar cane per day, i.e. a milling unit (two-roll set), simple juice liming station, a simple evaporating station and a crystalizer. The expert will design these machines and equipment with Vietnamese counterparts, 8 men/months US \$ 55 200.

All international staff to be assigned to the Project is stated in Annex 5.

7.5. Fellowships

Six international fellowships for technical on-the-job training of local technical staff are suggested:

7.5.1. Fellowship training for one person in the machining of components and parts for repairs of sugar mills (turning, milling, grinding, drilling etc.)

7.5.2. Fellowship training for one person in the maintenance and servicing of electrical and electronic equipment (repairs, testing etc.)



7.5.3. Fellowship training for one person in the welding process (welding of pressure boilers, pans and vats).

7.5.4. Fellowship training for one person in the heat treatment (hardening, tempering etc.).

7.5.5. Fellowship training for one person in the planning of preventive repairs.

7.5.6. Fellowship training for one person in the management of the repair plant, organization process etc.

All fellowships are stated in Annex 5.

ANNEX 1

UNDP INPUTS - MACHINERY AND EQUIPMENT FOR RICE MILLS

1. Machinery and equipment for rice mill

1.1. Stoner to separate stones from paddy or brown rice by utilizing the difference in specific gravity between rice and stone, capacity 3-3,5 tons of paddy per hour, 5-6 tons of brown rice per hour, with electric motor 1,5 kW, case and spare parts  
3 pcs

1.2. Paddy separator to separate brown rice from paddy, gravity type, utilizing the difference in weight and surface roughness of paddy and brown rice, capacity 4 tons per hour with tank, electric motor 0,75 kW and spare parts  
3 pcs

1.3. Paddy grader to separate long-grain paddy from short-grain one before husking, capacity 2-2,5 tons per hour, with electric motor 0,75 kW and spare parts  
4 pcs

Total estimated price 1983 CIF Hanoi 1.1. to 1.3.  
incl. spare parts

US \$ 105.000,-.



## ANNEX 1

3. MACHINERY AND EQUIPMENT FOR HOANG LIET FACTORY

Item	denomination	pcs	input in kW	weight in tons	price US \$
3.1.	Universal knee-type milling machine	1	5,5	2,6	40.000,-
	- table clamping surface 320 x 1250 mm				
	- max. distance between spindle centre line and table 420 mm				
	- spindle taper ISO 50				
	Special accessories:				
	- Vertical milling attach- ment with taper ISO 50	1			
	- Universal milling attach- ment	1			
	- Slotting attachment	1			
	- Tool-lifting device	1			
	- Overarm braces	1			
	- Longitudinal dividing attachment	1			
	- Power-operated rotary table	1			
	- Hand-operated rotary table	1			
	- universal dividing head	1			
	- Fixed machine vice	1			
	- Swivelling machine vice	1			
	- Swivelling machine vice and tilting	1			
	- Self-centring machine vice	1			
	- Boring head	1			
	- Working table protective shield	1			
	- Set of long milling arbors ISO 50	4			
	- Set of short milling arbors ISO 50	3			
	- Cooling system	1			
	- Lighting	1			

Item	Denomination	pcs	input in kW	weight in tons	price US \$
	- Set of adapters	4			
	Tools:				
	- travelling steady	4			
	- underclamp steady	8			
	- T-slot nut	4			
	- T-screws	24			
	- U-clamp	4			
	- gooseneck clamp	4			
	- clamping angle	2			
	- face milling cutter	5			
	- shell-type end milling cutter	15			
	- side-and-face cutter	9			
	- T-slot cutter	6			
	- keyway milling cutter	28			
	- concave cutter	4			
	- arbor-type cutter	4			
	- angular cutter	37			
	- milling head	1			
3.2.	Universal centre lathe	1	7,5	3,3	44.000,-
	- swing over bed 700 mm				
	- swing over carriage 400 mm				
	- distance between centres 3000 mm				
	Special accessories:				
	- small steady rest	1			
	- big steady rest	1			
	- follow rest	1			
	- four-jaw face plate	1			
	- self-centring hand- operated three-jaw chuck	1			
	- self-centering hand- operated four-jaw chuck	1			
	- rear tool block	1			
	- indexing driving plate	1			
	- drilling table	1			
	- taper turning attach- ment	1			

Item	Denomination	pcs	input in kW	weight in tons	price US \$
-	hydraulic copying attachment	1			
-	spring-loaded centre	1			
-	indexing attachment mounted on spindle	1			
-	milling attachment for splines and gears	1			
-	tool post grinder for external and internal grinding	1			
-	chuck cover	1			
-	cross micrometric stop	1			
-	longitudinal micrometric stop	1			
-	mandrel for face plate fitting	1			
Tools:					
-	centre drill	2			
-	drill chuck incl. spanner	1			
-	set of adapters	4			
-	carrier	4			
-	left-hand threading tool	4			
-	right-hand threading tool	4			
-	inside threading tool	4			
-	right-hand roughing tool	4			
-	left-hand roughing tool	4			
-	right-hand bent roughing tool	3			
-	left-hand bent roughing tool	3			
-	right-hand corner tool	4			
-	left-hand corner tool	4			
-	inside roughing tool	4			
-	inside corner tool	4			
-	right-hand necking tool	2			
-	left-hand necking tool	2			
-	recessing tool	2			

Item	Denomination	pcs	input in kW	weight in tons	price US \$
	Set of spare parts for two years of operation	1 set			
3.3.	Universal tool and cutter grinder	1	4	1	26.000,-
	- swing 280 mm				
	- distance between centres 760 mm				
	- table clamping surface 980 x 140 mm				
	Special accessories:				
	- cylindrical grinding attachment	1			
	- internal grinding attach- ment incl. spindles	1			
	- surface grinding attach- ment	1			
	- attachment for grinding between centres	1			
	- attachment for grinding backed-off disc-type milling cutters	1			
	- attachment for grinding reamer drills	1			
	- attachment for grinding carbide-tipped tools	1			
	- attachment for grinding twist drills	1			
	- dust exhausting equip- ment	1			
	- cooling equipment	1			
	- lighting	1			
	- radius grinding attach- ment	1			
	- collet chuck equipment, controlled from the rear	2			
	- collet chuck equipment, controlled from the front	2			
	- set of collets	4 sets			

Item	Denomination	pcs	input in kW	weight in tone	price US \$
-	wheel radius dressing attachment	1			
-	wheel profile dressing attachment	1			
-	grinding attachment for cutter heads	1			
-	hob sharpening attachment	1			
-	quick clamping fixture	1			
-	equipment for hydraulically operated longitudinal table feed	1			
-	magnetic chucking plate	1			
-	holder with taper shank Morse 1	1			
-	three-jaw chuck	1			
-	three-jaw chuck with flange for attaching to quick clamping fixture	1			
-	four-jaw chuck with flange for attaching to quick clamping fixture	1			
-	four-jaw chuck	1			
-	three-jaw chuck with Morse No. 5 taper shank	1			
-	quick action head	1			
-	circular magnetic chucking plate	1			
-	spacer permitting accessories	1			
-	face-plate	1			
-	lighting	1			
Tools:					
-	centre 60°	2			
-	live clamping centre	2			
-	clamping bush	1			
-	clamping bush inserts - set	8			
-	template for measuring back-off angles of plain milling cutters	1			



Item	Denomination	pcs	input in kW	weight in tons	price US \$
	- milling arbor	2			
	- set of grinding wheels	16			
	Set of spare parts for two years of operation				
3.4.	Pneumatic spot welding machine	1	90	0,78	18.000,-
	- max. pneumatic thrust 1200 kp				
	- rated power output 80 kVA				
	- overhang 750 mm				
	- water cooling				
	Spare parts for two years of operation				
3.5.	Sheet metal bending rolls	1	7,5	3,5	18.000,-
	- working width 2000 mm				
	- plate thickness 8 mm				
	Spare parts for two years of operation				
3.6.	Guillotine shears	1	11	7,4	26.000,-
	- max. cutting length 2000 mm				
	- max. plate thickness 6,3mm				
	Special accessories:				
	- stroke counter	1			
	- handling truck	1			
	- extension rule with adjustable stops	1			
	Spare parts for two years of operation				
3.7.	Horizontal boring machine	1	10	17,5	145.000,-
	- working spindle diameter 100 mm				

Item	Denomination	pcs	input in kW	weight in tons	price US \$
	- taper in spindle Morse 6				
	- maximum boring diameter 560 mm				
	- maximum face turning diameter 900 mm				
	- table clamping surface 1250 x 1250 mm				
	Digital position readout:				
	For measuring positions of moving machine assemblies a single digital position readout is employed. The position readout provides for a cyclic-absolute measuring of positions of the workpiece or the tool in three axes:				
	in transverse direction - X -				
	slide with table				
	in vertical direction - Y -				
	headstock				
	in longitudinal direction - Z -				
	slide with table.				
	Linear inductosyns with one track of 2 mm pitch are used as measuring units in this system. Reading is shown in the metric system. The values are shown on a five-digit display.				
	Special accessories:				
	- telescopic holder	1			
	- spindle guiding support	1			
	- spindle clamping support	1			
	- tool cooling equipment	1			
	- vertical milling attachment	1			
	- set of changeable gears for thread cutting	1 set			
	- set of long plain boring bars	1 set			
	- bearing bushes, supports for boring bars	2			

Item	Denomination	pcs	input in kW	weight in tons	price US \$
-	set of boring heads for boring bars	1			set
-	boring attachment	1			
-	universal boring head	1			
-	attachment for clamping and ejection of tools	1			
-	clamping angle plate	2			
-	clamping block	1			
-	auxiliary pendant control panel	1			
-	anchoring material	1			set
Tools:					
-	support for clamp 16x50	4			
-	stand for clamp dia 63	16			
-	flat clamp 23x160	4			
-	stop for workpiece fixing	4			
-	right-hand cutting shell-end milling cutters	1			set(8 pcs)
-	face roughing cutters	1			set (12 pcs)
-	cutter arbor spanner No. 27, 40	2			
-	distance collars	2			sets
-	cutter arbors with face carrying	3			
-	ejection wedges No. 1,3,5	3			
-	supports with centre 130	4			
-	supports with notch 125	2			
-	drilling chuck 16	1			
-	arbor for drilling chuck	1			
-	clamping bush	1			
-	clamping bush inserts	1			set
-	adaptor	3			
-	tool post	1			set
-	roughing tool	2			sets
-	broaching tool	2			sets
-	boring and roughing head incl. accessories	1			set
-	milling head arbor	1			
-	centring attachment	1			

Item	Denomination	pcs	input in kW	weight in tons	price US \$
	- adjustable boring head	2			
	- universal boring head	1			
	- spare tools for boring rough- ing head	5 sets (à 40 pcs)			
	- spare tools for adjustable boring head	3 sets (à 20 pcs)			
	- spare tools for universal boring head	5 sets (à 20 pcs)			
	- single ended spanners	1 set			
	- double ended spanners	1 set			
	Spare parts for two years of operation				
3.8.	Radial drilling machine	1	4	4,1	38.000,-
	- maximum drilling capacity in solid stock 50 mm				
	- maximum boring capacity 200 mm				
	- maximum distance between spindle and base 1500 mm				
	- taper in spindle Morse No. 5				
	Special accessories:				
	- cooling equipment incl. electric pump	1			
	- adapters	1			
	- box-type table	1			
	- tilting table	1			
	- cross table	1			
	- machine vice	1			
	- supporting column	1			
	Tools:				
	- clamp support 16x80, 20x50, 20x80	6			
	- stand for supports Ø 63, Ø 90	4			
	- flat clamps 23 x 200	2			
	- gooseneck clamps 11,5 x 100	2			
	- adaptor with taper Morse No. 5x4, 5x3, 3x2	3			

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Item	Denomination	pcs	input in kW	weight in tons	price US \$
-	ejection wedge 3, 5	2			
-	drilling chuck 16	1			
-	spanner for chuck	1			
-	machine reamers from $\emptyset$ 11 to $\emptyset$ 20 mm H7	2 sets			
-	machine reamers from $\emptyset$ 21 to $\emptyset$ 32 mm H7	1 set			
-	skewering reamers from $\emptyset$ 32 to $\emptyset$ 60 mm H7	1 set			
-	counterbores for screws M 10 to M 20	1 set			
-	snail countersinks for screws M 10 to M 24	1 set			
-	countersinks for screws M 10 to M 16	1 set			
-	machine taps M 10 to M 20	1 set			
-	reamer drill holder $\emptyset$ 32, 40, 50	1			
-	centering drill 4	10			
-	short drills from $\emptyset$ 10 to $\emptyset$ 16	1 set			
-	taper-shank drills from $\emptyset$ 15 to $\emptyset$ 75 mm	1 set			
-	taper-shank reamer drills $\emptyset$ 9,8 to 31,6 mm	1 set			
-	fixed changeable insert	1 set			
-	traversable changeable insert	1 set			
	Spare parts for two years of operation				
3.9.	Single-column vertical boring and turning mill	1	40	9	180.000,-
	- maximum swing 950 mm				
	- table diameter 800 mm				
	- maximum distance between table and turret face 750 mm				

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Item	Denomination	pcs	input in kW	weight in tons	price US \$
Special accessories:					
	- electrohydraulic copying attachment	1			
	- electrohydraulic chucking	1			
	- cross-rail tool head cooling equipment	1			
	- cone turning and thread cutting attachment	1			
	- set of tool holders	1 set			
	- extending grinding attachment	1			
	- side head cooling equipment	1			
Tools:					
	- hand-operated chucking	1			
	- right/left-hand screw-cutting tools	8			
	- external screw-cutting tools	4			
	- right/left-hand roughing tools	12			
	- right/left-hand cranked roughing tools	12			
	- right/left-hand side roughing tools	12			
	- right/left-hand angle cutting tools	12			
	- internal angle cutting tools	12			
	- right/left-hand recessing tools	12			
Spare parts for two years of operation					
3.10.	Centre-type universal grinding machine	1	16	6	80.000,-
	- swing 320 mm				
	- distance between centres 2000 mm				

Item	Denomination	pcs	input in kW	weight in tons	price US \$
Special accessories:					
-	equipment for internal grinding without spindle and three- jaw chuck	1			
-	closed supporting steady	1			
-	tilting wheel dresser, mounted on table (without diamond)	1			
-	stop box	1			
-	three-jaw chuck, dia 200 mm	1			
-	wheel dresser, without diamond	1			
-	wheel dresser, mounted on tailstock, without diamond	1			
-	wheel dresser, mounted on table, without diamond	1			
-	table-mounted wheel dresser with adjustable inclination angle, without diamond	1			
-	table-mounted form wheel dresser without template and diamond	1			
-	Solid grinding wheel flanges for widths from 80 to 200	1 set			
-	flanges of built-up grinding wheels widths from 0 to 225	1 set			
-	auxiliary workpiece steadies dia 65 to 135	2			
-	fine table swivelling attachment	1			
-	balancing stand	1			
-	magnetic clamping plate dia 200	1			
-	hand-operated clamping collet	1			
-	additional collets 5 to 15 mm, 3/16 to 9/16"	18			
-	shims for machine bed lengthwise levelling	1 set			

Item	Denomination	pcs	input in kW	weight in tons	price US \$
Tools:					
	- tapered centre Morse No. 5 - 60°	2			
	- flattened centre Morse No. 5 - 60°	2			
	- rotary centre Morse No. 5 60°	2			
	- arbor up dia 10 to 50	1 set			
	- grinding wheel, dia 500x80	1 set			
Spare parts for two years of operation					
3.11.	Horizontal surface grinding machine	1	9,3	3,4	28.000,-
	- table clamping surface 320 x 1000 mm				
	- max. grinding width 320 mm				
	- max. grinding length 1000 mm				
	- max. workpiece height 350 mm				
Special accessories:					
	- complete cooling equipment	1			
	- dust exhausting equipment incl. accessories	1			
	- balancing stand	1			
	- electromagnetic clamping plate 300 x 1000 incl. a set of clamps	1			
	- wheelhead-mounted wheel dresser (without diamond)	1			
	- additional grinding wheel flange	1			
Tools:					
	- side sliding steady	2			
	- grinding wheel dia 250x20	10			



Item	Denomination	pos	input in kW	weight in tone	price US \$
<b>3.12. <u>Measuring instruments and gauges</u></b>					
-	flat steel rule 1000 mm	4			
-	flat steel rule with scale on bevelled edge 500 mm	4			
-	flexible steel rule 300 mm	4			
-	flexible steel rule 500 mm	4			
-	calliper rule with auxiliary jaws for inside measurement and with depth gauge 1/20 - 150	4			
-	calliper rule with adjusting device and with auxiliary jaws for outside measurement 1/50 - 400	2			
-	calliper rule with adjusting device 1/50 - 600	2			
-	sliding depth gauge 1/50 - 250	2			
-	outside calliper 200	1			
-	outside calliper 300	1			
-	inside calliper 200	1			
-	inside calliper 300	1			
-	universal protractor	2			
-	sliding depth gauge 1/20 - 600	1			
-	protractor for measuring of tool edge angle	1			
-	feeler gauges 0,02 to 0,20	2			
-	feeler gauges 0,05 to 1,00	2			
-	sine bar 300	1			
-	sine bar with centres 200	1			
-	sine bar with centres 300	1			
-	external radius gauges(set)	1			
-	radius gauges 1 to 7	1			
-	radius gauges 7,5 to 15	1			
-	metric thread gauges	1			
-	Whitworth and pipe thread gauges	1			
-	checking rule 500	1			

Item	Denomination	pcs	input in kW	weight in tons	price US \$
-	checking rule 1000	1			
-	precision flat square 160	2			
-	precision try square 160	1			
-	precision try square 250	1			
-	set square 630	1			
-	spring bow compasses 200	2			
-	spring bow compasses 300	2			
-	metal bar divider with divisions in mm 500	1			
-	metal bar divider with divisions in mm 1000	1			
-	marking gauge with scale 300	2			
-	marking gauge with scale 500	2			
-	marking gauge with scale 1000	1			
-	marking-awl small	10			
-	marking-awl large (big)	10			
-	stand for adjustable gauge	2			
-	flat steel rule for stand 500	2			
-	flat steel rule for stand 1000	2			
-	ribbed marking-off plate 1000	1			
-	ribbed marking-off plate 2000	1			
-	checking and marking-off V-block with two grooves 100	6			
-	checking and marking-off V-block with four grooves 130	6			
-	marking-off V-block with clamp 140	4			
-	support with centre 80	6			
-	support with centre 130	6			
-	support with notch 95	4			

Item	Denomination	pcs	input in kW	weight in tons	price US \$
	- support with notch 165	4			
	- micrometer calliper gauge 0 to 25	2			
	- micrometer calliper gauge 25 to 50	2			
	- micrometer calliper gauge 50 to 75	2			
	- micrometer calliper gauge 75 to 100	2			
	- micrometer calliper gauge 100 to 125	2			
	- micrometer calliper gauge 125 to 150	2			
	- micrometer calliper gauge 150 to 175	2			
	- micrometer calliper gauge 175 to 200	2			
	- micrometer calliper gauge 200 to 300	1			
	- micrometer calliper gauge 300 to 400	1			
	- micrometer calliper gauge 400 to 500	1			
	- micrometer calliper gauge 500 to 600	1			
	- micrometer calliper gauge 600 to 700	1			
	- micrometer calliper gauge 700 to 800	1			
	- micrometer calliper gauge 800 to 900	1			
	- micrometer calliper gauge 900 to 1000	1			
	- inside micrometer calliper 3 to 10	2			
	- inside micrometer calliper 5 to 45	2			
	- inside extension micrometer 100 to 1300	1			
	- set of extension rods	1 set			

Item	Denomination	pcs	input in kW	weight in tons	price US \$
-	micrometer calliper gauge for sheet metal 0 to 10	2			
-	micrometer calliper gauge base	4			
-	micrometer calliper gauge for gears 0 to 25	1			
-	micrometer calliper gauge for gears 25 to 50	1			
-	dial indicator with 0,01 mm divisions	2			
-	dial indicator with 0,001 mm divisions	2			
-	lever dial indicator with 0,01 mm divisions	2			
-	three-contact inside calliper with dial indicator	1			
-	inside calliper with dial indicator 180	1			
-	inside calliper with dial indicator 260 29,5 to 55,5	1			
-	inside calliper with dial indicator 260 55 to 155	1			
-	inside calliper with dial indicator 407	1			
-	micrometric passameter 0 to 25	1			
-	micrometric passameter 25 to 50	1			
-	measuring stand with permanent magnet	5			
-	centres	2			
-	measuring table accessories	2			
-	hand-operated hardness tester	1			
-	Brinell's magnifier	2			
-	Longitudinal spirit level	1			
-	frame-type spirit level 200	1			
Total price					16.500,-

Item	Denomination	pcs	input in kW	weight in tons	price US \$
3.13.	Electric low-frequency melting furnace for non-ferrous metals melting on the base of copper alloys	1			92.000,-
	- frequency 50 c/s				
	- melting pot capacity 120 kg				
3.14.	Slotting machine	1	11	8,2	41.000,-
	slotting stroke 400-500 mm				
	table clamping surface dia 800mm				
	tool overhang 710 mm				
	Tools:				
	- vice 160 mm	1			
	- U-clamps 23x160 mm, 23x200 mm	4			
	- fixed gooseneck clamps 11,5 x 100	2			
	- clamp supports 16x50 mm, 20x80 mm				
	- slotting and roughing tool	2 sets			
	- slotting tool for grooves	3 sets			
	- double-edged slotting tools	2 sets			
	Spare parts for two years of operation.				
	Total estimated price 1983 CIF Hanoi				792.500,-
	Total estimated price 1, 2, 3 1983 CIF Hanoi				<u>900.000,-</u>

ANNEX 2

UNDP INPUTS - INTERNATIONAL STAFF AND FELLOWSHIPS FOR  
RICE MILLS

The following international staff will be assigned to the project:

a) Chief Technical Adviser

The Chief Technical Adviser should have a degree in science or engineering with experience in construction and operation of repair shops. He will be responsible for the overall operation of the project and for the direction and coordination of the work of experts in accordance with timing and details specified in the Work Plan. He will start at the beginning of 1983 for a period of 18 months. His duty station will be Hanoi.

21 x \$ 6 900 = \$ 144 900

Vietnamese input: office, furniture, transport facilities etc.

b) Experts on the erection of machinery and equipment

The experts should have experience in the erection of machinery and equipment, either in the mechanical part or in the electrical part. The number of experts will depend on the number of complicated machines and the number of suppliers; the total will be approximately 10 man/months. They will work in close cooperation with the Chief Technical Adviser. The exact number will be fixed later. Duty station: Hanoi in the years 1983 and 1984.

10 x \$ 6 900 = \$ 69 000

Vietnamese input: workers, erection material, electrical installation, means of transport, electricity, erection of foundations etc.

c) Expert on rubber rollers

The expert should have a degree in science, mechanical engineering or chemistry with experience in the production of rubber rollers for rice mills. He should determine the new formula for rubber mixture suitable for the production of rubber rollers in compliance with the climatic conditions in Vietnam and be properly acquainted with the process of mixing, forming, vulcanizing, with the specification of suitable machinery and equipment, with estimate C and F prices. He will work in cooperation with the Chief Technical Adviser. His duty station will be Hanoi and he will start approximately at the beginning of 1983 for a period of 4 months.

$$4 \times \$ 6 900 = \$ 27 600$$

Vietnamese input: office, furniture, means of transport, raw materials for rubber mixtures, workers, electricity, steam etc.

d) Experts on designing the rice machinery and equipment

These experts should have a degree in science or engineering with experience in designing modern machinery and equipment, mainly:

- stoner to separate stones from paddy or brown rice by utilizing the difference between specific gravity of rice and stone, capacity of 4-6 tons per hour;

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paddy separator to separate brown rice from paddy, gravity type, utilizing the difference in weight and surface roughness of paddy and brown rice, capacity of 4 tons per hour;

- paddy grader - to separate long grain paddy from short grain one before husking, capacity of 4 tons per hour.

They will work in cooperation with the Chief Technical Adviser.

Duty station: Hanoi. Two experts for a period of 14 man/months each, total 28 man/months. The work will start in mid-1983.

$$28 \times \$ 6 900 = \$ 193 200$$

Vietnamese input: 15-20 engineers and draftsmen, office, rooms, drafting boards, furniture, transport facilities etc.

e) Expert on machining technology

This expert should have a degree in science or engineering with experience in modern machining technology, use of modern machine tools and training of workers and engineers in this field. He will work in close cooperation with the Chief Technical Adviser. His duty station will be Hanoi and he will start in 1983 for a period of 12 months.

$$12 \times \$ 6 900 = \$ 62 800$$

Vietnamese input: office room, furniture, means of transport etc.



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f) Expert on maintenance

This expert should have a degree in science or engineering with experience in maintenance of machinery and equipment in rice mills with regard to permanent periodical repairs (preventive repairs). He should train engineers in the planning and execution of preventive repairs. His duty station will be Hanoi and he will start approximately at the end of 1983 for a period of 6 months.

$$6 \times \$ 6\,900 = \$ 41\,400$$

Vietnamese input: office room, furniture, means of transport etc.

International staff	total	\$ 558 900
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Fellowships

Six international fellowships of 20 man/months for technical on-the-job training of local technical staff at foreign big rice mills with repair shops or rice milling machinery and equipment producers in which relevant activities are well established.

1. Fellowship for one person in the machining of components and parts for repairs - 4 months.
2. Fellowship for one person in the maintenance and servicing of electrical and electronic equipment - 3 months.
3. Fellowship for one person in the welding process - 3 months.
4. Fellowship for one person in metal forming process - 3 months.

5. Fellowship for one person in the planning of preventive repairs - 3 months.
6. Fellowship for one person in the management of the repair plant, organization process etc. - 4 months.

Total                      20 x \$ 2 000 = \$ 40 000

International staff and fellowships for rice mills

T o t a l                                      \$ 598 000

ANNEX 3

CENTRAL REPAIR AND MAINTENANCE PLANT AND SPARE  
PARTS PRODUCTION FOR SUGAR MILLS  
IN BIEN + HOA

PROJECT STUDY

Central Maintenance and Repair Shop at the Bien-Hoa  
Sugar Refinery

1. Foreword

The Government of Vietnam has entrusted the General Management of Sugar Mills in Ho Chi Minh City with the construction of a central maintenance shop for the repair of sugar mills and for the manufacture of equipment for small sugar mills with the total capacity of 2,000 tons of products per year.

The Government has approved capital expenditure for the construction of the maintenance plant in the value of 50 million Dongs including the construction and technological deliveries.

The building site is situated within the sugar mill industrial area and covers 4,08 ha.

The documentation worked out by the Vietnamese party and presented to UNIDO experts in the course of negotiations has been worked out - in their point of view - more or less as a study and it does not design operating units in detail from the technological and designing aspect.

The study includes the demand for the construction of a foundry. In view of the fact that the requirements of the Vietnamese party were maximized (grey iron castings up to 8 t, steel castings up to 1 t and the possibility of casting malleable iron and non-ferrous metals) they could not be met and that is why the enclosed specification of machinery and equipments does not include foundry equipment and the UNIDO experts do not recommend its construction.

It has been agreed in the course of negotiations that the UNIDO mission would only work out the specificat-

ion of machinery necessary for the repair and production of sugar mill equipment with the capacity required and indicate the necessary floor space for the separate operating units in layout drawings of the shops.

This project is promoted enthusiastically by the Government itself; all the Vietnamese officials taking part in the discussions have been quite reassuring on this point. The UNIDO mission has been assured that the Government has agreed to make the purchases of all the equipment (apart from the UNDP inputs) and to stick to the deadlines laid down in the workplan (see time schedule, pages 37 and 38 and Annex 7).

The machine to be supplied through UNIDO Vienna in the value of 900.000,- US \$ and the technical personal assistance in the value of 600,000,- US \$ will be specified in a special appendix. The remaining machinery will be provided for by the Vietnamese customer himself, either by import or from local resources.

## 2. Basic Production Data

The contemplated production of simple sugar mill equipment and spare parts includes crushing rolls, tanks, discharging hoppers, receiving hoppers, storage bins, traps, cleaners, tubular devices, conveyer links, sugar case cutting blades, steel structures, pipings and repairs of sugar mill rollers. According to the specification, the anticipated volume of output, amounts to 2,000 t per annum. The production assortment is as follows:

a) Tubular devices (tanks, discharging hoppers, receiving hoppers, storage bins)	350 t per annum
b) Traps, cleaners, separators, vessels and agitators, conveying and mechanical equipment etc.	510 t per annum
c) Repairs and manufacture of sugar mill rolls and manufacture of small sugar mills	240 t per annum
d) Steel structures	500 t per annum
e) Receivers and sheet-metal parts	100 t per annum
f) Sheet metal piping	150 t per annum
g) Drawn piping	100 t per annum
h) Shop equipment and inventory	50 t per annum
Total	<u>2,000 t per annum</u>

The specification of technological equipment, operating areas, workers and other technical parameters of the contemplated plant is based on long years experience of the UNIDO experts.

### Regime of work:

Number of working days per annum	300 days
Number of shifts a day	2
Number of working hours in a shift	8

3. Material

For the considered production, the following average annual consumption of production material with the indicated specification will be necessary:

- metal sheets, thickness up to 10 mm approx. 920 t
- plates up to 40 mm approx. 240 t
- tubes (seamless and welded) and bars  
(rounds, squares, flats) of different  
diameters approx. 280 t
- L, T, U, I sections of different  
sizes approx. 620 t
- grey iron castings, steel castings approx. 180 t
- non-ferrous metal castings (copper-  
base alloys, aluminium base alloys  
etc.) approx. 35 t
- forged pieces approx. 80 t
- paints, varnishes, thinners, putty approx. 15 t
- subcontract supplies:
  - jointing material (bolts, nuts,  
washers, rivets)
  - welding electrodes of different  
qualities and sizes
  - electric wiring material, cables  
etc.
  - electric motors of different sizes
  - electric starters, switches, breakers  
etc.
  - ball bearings of different sizes
  - measuring instruments for remote  
control etc.
- wood of various quality approx. 340 t

All materials mentioned are imported, except for instance grey iron and steel castings, non-ferrous metal castings, small sizes of jointing material, small electric switches and some kinds of wood.

Storing capacity:

grey iron castings, steel castings and subcontract supplies	12 months
all other kinds of raw materials	6 months

As sugar factories and refineries were supplied by different suppliers from different countries in the period of fifty years it is impossible to work out a list of spare parts for emergency repairs for the interim period.

If UNDP concentrated on extensive assistance to the repair and maintenance activities that are being undertaken by the small workshops attached to the different sugar mills or refineries, it would be in effect going counter to the efforts being made to create a centralized repair and maintenance system.

Some degree of standardization of spare parts will be achieved at the time when the new Central Maintenance and Repair Shop is in operation, mainly in the production of spare parts for simple sugar mill equipment; the production of spare parts for old, big sugar mills will always remain piece production.



#### 4. Organization of Production

The production of sugar mill equipment can be classified according to the production areas as follows:

- material storerooms
- material preparation shop (cutting shop)
- manufacture of steel structures and drawn pipework
- forging shop and heat treatment
- boiler shop (manufacture of tubular devices, and sheet metal piping including pressure tests)
- repairs and manufacture of sugar mill rolls and manufacture of small sugar mills
- sub-contractor supplies (bearings, jointing material etc.) will be stored in a shed
- machining shop
- mechanical shop (for assembly of agitators and driving units and manufacture of mechanical parts)
- engineering inspection in individual workshops
- surface treatment
- maintenance of tools and fixtures (mechanical and electrical shop, wood workshop)
- in-process stores including tool-issuing room
- tool grindery
- forwarding department

The main production material will be stored in the open area on racks or on the ground according to the assortment. In the preparation shop, material will be cut by means of mechanical equipment, shears, power saws or manually by means of oxy-acetylene cutting so as to prepare it for further processing. The material will be dispatched as necessary to working sites such as boiler shop, forging shop, machining shop, welding shop and the mechanical department.

In the steel structures shop the supplied material is to be straightened, marked out, assembled to sub-assemblies, drilled, welded or rivetted together, straightened, surface treated (sand-blasted and painted). This shop co-operates with the mechanical workshop, forging shop and machining shop.

In the boiler shop, the material is marked out for the planing and drilling of tube plates. The shell, cone and neck as well as tube bottoms are flame cut here. The material prepared in this way is pre-bent, bent and welded at the separate workplaces either by hand or on a semi-automatic welding machine. The individual vessels and devices shall be pressure tested.

The repair of sugar mill rolls and the manufacture of small sugar mills are carried out in the factory building housing the forging shop, heat treatment, mechanical and assembly shop. The sugar juice yield depends on the quality of the rolls and that is why it is necessary to give great care to them. The roll is a metal shaft on which the roll sheath is mounted. The sheaths are made of special coarse-grained grey cast iron. The rolls composition and manufacturing process are patented. Open-hearth furnaces using hematite pig iron are used for melting cast iron followed by upright casting in permanent moulds. The roll sheaths are fitted with grooves of different profiles to ensure juice runoff and better drawing of sugar cane between the rolls. When the harvest is over, each roll has to be dismantled from the mill, checked and clamped together with the shaft in a centre lathe and the grooves in the sheath are to be turned. They can be turned 4 to 6 times. Then the roll sheath has to be renewed and

a new sheath manufactured. The roll sheaths are machined on a centre lathe and the hole is bored in a simple boring device separately. The bored hole is smaller than the shaft diameter.

The roll sheath is heated gradually in a furnace up to the temperature of 250°C at the maximum rate of 30°C per hour. Once the temperature has been achieved, a dwell at the required temperature should follow for 8 to 10 hours.

Then the roll is inserted into the sheath with the aid of a crane and allowed to cool slowly in the furnace. Then the corresponding grooves are turned and flanges screwed on. The shaft will withstand approximately 15 seasons and then it has to be replaced with a new forged piece which will be machined on the same centre lathe. The capacity of the lathe and the furnace is sufficient for the maintenance of all rolls from the sugar mills of both North and South Vietnam.

In the forging shop, parts are hot-pressed or cold-pressed on a hydraulic press and an eccentric press. In the machining shop, the material and the component parts are marked out and machined on machine tools according to their technological character - on lathes, milling machines, shaping machines, boring machines etc.

In the mechanical workshop, semi-products are processed, gears are fitted, fittings and chains assembled, sub-assemblies and individual assemblies welded including the surface treatment and functional tests.

The products are then passed over for heat treatment, assembly, checking and surface treatment.

Finished and tested products are then transported to the finished stock room and forwarded through the forwarding department to the customers.

5. Area requirement

The areas necessary to ensure the spare parts manufacture and maintenance and repairs of sugar mill equipment can be divided into production and ancillary areas:

a) Production areas

The production areas are located inside the factory buildings.

<u>Operating unit</u>	<u>Total area in sq.m.</u>
Material cutting	400 sq.m.
Boiler shop	900
Forging shop, pressing shop, heat treatment	600
Repair shop of rolls and manufacture of small sugar mills	120
Mechanical assembly shop	300
Mechining room	900
Surface treatment	200
Manufacture of steel structures and pipework is situated in a shed in the open area	1,500
In-process stores, tool stores and tool issuing rooms	400
Ancillary shops:	
Tool grindery and tool shop	350
Maintenance shops: mechanical	350
electrical	80
wood workshop	200
 Total production area	 6,300 sq.m.

b) Ancillary areas

The ancillary storage and forwarding areas will be situated in the open area on hardened surfaces.

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Sub-contractor supplies store	300 sq.m.
Metal sheet and semiproduct store	900 sq.m.
Profile material store	900 sq.m.
Forwarding department and finished stock room	1,500 sq.m.
Total ancillary areas	3,300 sq.m.

The administrative building for the management and technical staff of the plant including changing rooms and personal service facilities could not be considered as no drawings have been submitted.

6. Manpower requirements

The data on the number of workers for the considered plant in the basic classification are indicated in the following survey for the contemplated two-shift operation.

Categories of employees	production workers	auxiliary workers
- sheet metal and semi-products store	2	1
- sections store	2	1
- cutting and preparation of material	6	1
- manufacture of steel structures	24	4
- boiler shop	34	6
- repair of sugar mill rolls	2	2
- forging shop	8	2
- heat treatment	4	1
- surface treatment	6	-
- machining shop	30	4
- machine adjusters	4	-
- mechanical and assembly shop	12	4
- mechanical maintenance shop	4	-
- electrical maintenance shop	2	-
- wood workshop maintenance shop	3	-
- tool grindery	3	-
- engineering inspection	8	-
- tool issuing room	3	-
- in-process store and sub-contractor supplies store	3	-
- forwarding department and finished stock store	6	2
- laboratory	4	-
- crane operators	14	10
- in-process transport	12	8

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- foreman and masters	12	-
- administrative workers in production (planner, dispatcher)	10	-
- technical workers (design engineers, technologists etc.)	11	-
- plant management	Number according to local practice	

Recapitulation of employees:

Production workers	126
Auxiliary workers	46
Workers in stores and tool-issuing room	16
Engineering inspectors and adjusters	12
Maintenance workers	12
Transport workers	26
Technical workers in operation sections	16
Technical workers of the plant	11
Administrative workers in operation sections	10
Total of workers	<u>275</u> ===

The Central Repair Plant for maintenance and repairs of sugar machinery and equipment is being set up in a region that has many industries. It will be therefore easy to lap the different skills and the general manpower requirements from the surrounding industries. The Government will do everything to ensure that all the manpower requirements of the project are fully met.

## 7. Power supply system

### 7.1. Electric energy

It drives machines and equipments and feeds various consumers.

Total power input installed	approx. 1,500 kW
Voltage	3x380/220 V - 50 Hz
Utilization factor	0,3
Maximum anticipated load	approx. 480 kW
Utilizable time capacity of the machine	1,920 hours
Approximate yearly consumption	approx. 900,000 kWh

The data include only the consumption of electric power for technological equipment, not for lighting. The indicated power consumption will be covered from public high-voltage mains via the plant's own transformer station which is not included in the specification of machinery and equipment.

### 7.2. Water for Technological purposes

It is used for the preparation of cooling emulsion, for the cooling of machinery and for pressure tests.

Maximum consumption	150 l.p.min.
Annual consumption	approx. 43,000 cu.m. per annum

If water reservoir is not considered for pressure tests, it is necessary to dimension water supply for the consumption of 300 l.p.min.



### 7.3. Pressure air

It is used for sand blowing of objects, paint application, machine operation and blowing of cuttings.

maximum consumption ...	approx. 300 c.m./hr
working pressure	0,4 to 0,6 MPa
average full consumption	approx. 210 c.m./hr

The compressor plant shall be situated outside the factory building and shock- and sound-insulated.

### 7.5. Oxygen and acetylene

Oxygen and acetylene are used for flame cutting machines, pre-heating and welding of material.

Yearly consumption of acetylene 600 cylinders  
Yearly consumption of oxygen 2,500 cylinders

## 8. Materials handling

All material will be transported into the plant and finished products will be dispatched by means of trucks and trailers.

### Handling by Overhead Travelling Cranes

<u>Workshop</u>	<u>capacity</u>	<u>qty.</u>	<u>span</u>	<u>lift</u>
sheets, plates, semiproducts and sections store	8 t	1	18 m	8 m
manufacture of steel structures	5 t	1	18 m	8 m
cutting shop and material preparation	8 t	1	18 m	8 m
Boiler shop	10 t	1	18 m	8 m
Forging shop	10 t	1	18 m	8 m
Machining shop	8 t	1	18 m	8 m
Forwarding and finished products store room	10 t	1	18 m	8 m

A platform rail truck with the loading capacity of 10 Mp will be used for the transportation of heavy semi-products between the separate workshops. Platform dimensions 2,300 x 1,200 mm, track gauge 800 mm, height of the platform above floor 620 mm - quantity 4 pieces.

### Handling by Wheel Trucks

- high-lift truck with a loading capacity of 3,200 kg - 1 pc
- high-lift truck with a loading capacity of 1,000 kg - 2 pcs
- hand platform trucks, loading capacity of 630 kg - 4 pcs

positioners from dia 500 to dia 4000 mm are necessary for welding big rotary component parts with the following loading capacity:

- 5 t - 2 sets (1 of these with driving gear)
- 10 t - 3 sets (2 of these with driving gear).

9. LIST OF MACHINES AND EQUIPMENT9.1. Material Dividing Shop

- 9.1.1. Guillotine shears 1 pc  
- max. plate thickness 6,3 mm  
- max. cutting length 2000 mm
- 9.1.2. Guillotine shears 1 pc  
- max. plate thickness 16 mm  
- max. cutting length 3150 mm
- 9.1.3. Hack saw 2 pcs  
- max. material diameter 280 mm  
- max. square iron dimensions  
250 x 250 mm
- 9.1.4. Circular saw 2 pcs  
- max. material diameter 290 mm  
- max. square iron dimensions  
260 x 260 mm  
- saw blade diameter 600 to 810 mm
- 9.1.5. Section shears 1 pc  
- max. flat iron dimensions  
50 x 12 mm  
- max. square iron dimensions  
25 x 25 mm  
- max. round iron diameter 25 mm

9.2. Boiler Shop

- 9.2.1. Hydraulic tube bending machine 1 pc  
- max. dimensions of bent pipe  
dia 40 x 2 mm  
- max. bending radius 200 mm
- 9.2.2. Hydraulic tube bending machine 1 pc  
- max. dimensions of bent tube  
dia 114 x 7 mm  
- max. bending radius 600 mm
- 9.2.3. Mechanical tube bending machine 1 pc  
- min. internal bending radius  
80 mm  
- max. internal bending radius  
270 mm
- 9.2.4. Plate and section bending rolls 1 pc  
- max. thickness of rolled plate  
10 mm  
- max. L-section size 100x100x10 mm  
- min. rolling diameter 550 mm  
- working width 3150 mm
- 9.2.5. Plate bending rolls 1 pc  
- max. thickness of rolled plate  
4 mm  
- min. rolling diameter 220 mm  
- working width 2000 mm
- 9.2.6. Plate bending rolls 1 pc  
- max. thickness of rolled plate  
8 mm  
- min. rolling diameter 250 mm  
- working width 2000 mm

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9.2.7. Sheet bending machine	1 pc
- max. thickness of sheet 6 mm	
- working width 2000 mm	
9.2.8. Sheet bending machine	1 pc
- max. thickness of sheet 25 mm	
- working width 3000 mm	
9.2.9. Hand-operated sheet bending machine	1 pc
- max. thickness of sheet 2 mm	
- working width 2000 mm	
9.2.10. Press brake	1 pc
- pressing force 1120 kN	
- working width 3150 mm	
9.2.11. Cutting-out shears	1 pc
- max. thickness of sheet 2 mm	
- overhang 800 mm	
9.2.12. Hand-operated lever shears	2 pcs
9.2.13. Hand-operated universal shears for sheets and sections	1 pc
9.2.14. Guillotine shears	1 pc
- max. sheet thickness 25 mm	
- max. cutting length 3150 mm	
9.2.15. Plate-edge planing machine	1 pc
- max. planing length 12000 mm	
- max. sheet thickness 80 mm	
9.2.16. Hack saw	1 pc
- max. material diameter 280 mm	
- max. square iron dimensions 250 x 250 mm	

- 9.2.17. Column drilling machine 1 pc  
- max. drilling diameter 20 mm  
- max. drilling depth 160 mm  
- table clamping surface 288x330 mm
- 9.2.18. Radial drilling machine 1 pc  
- max. drilling capacity in  
solid stock dia 50 mm  
- max. distance between spindle centre  
line and sleeve 1600 mm  
- max. distance between spindle and  
base 1500 mm
- 9.2.19. Double-wheel grinding machine 2 pcs  
- grinding wheel dimensions  
dia 350 x dia 127 x 63 mm
- 9.2.20. Welding tractor 1 pc  
- welding current up to 1000 A  
- welding wire dia up to 5 mm  
consisting of:  
- proper tractor incl. operating case  
- control box  
- interconnecting material  
- set of attachments
- 9.2.21. Supporting structure for welding tractor 1 pc  
- height 4000 mm
- 9.2.22. Silicon-type welding machine 4 pcs  
- max. welding current 380 A
- 9.2.23. Rotary arc welding machine 6 pcs  
- max. welding current 315 A

9.2.24. Marking-off plate incl. pedestal - dimensions 2500 x 1600 x 350 mm	3 pcs
9.2.25. Oxygen cutting machine	2 pcs
9.2.26. Hand-operated pressure tester - max. working pressure 10 MPa	1 pc
9.2.27. Hand-operated pressure tester - max. working pressure 5 MPa	1 pc
9.2.28. Positioner - lifting capacity 5000 kg - dimension range of welded tanks 300-3300 mm	2 pcs
9.2.29. Positioner - lifting capacity 10 000 kg - dimension range of welded tanks 500-4200 mm	3 pcs
9.2.30. High-pressure airless spraying device	3 pcs
9.2.31. Oxy-acetylene welding set	6 pcs
9.2.32. Pneumatic spot welding machine - max. welding force 1,6 kN - throath depth 250 mm	1 pc

9.3. Forging shop

- |   |       |
|---|-------|
| 9.3.1. Hydraulic drawing press          | 1 pc  |
| - rated force 2500 kN                   |       |
| - stroke 1000 mm                        |       |
| - clamping table 1600 x 1200 mm         |       |
| 9.3.2. Electric chamber furnace         | 1 pc  |
| - working space 3000x1200x500 mm        |       |
| - working temperature 1100°C            |       |
| 9.3.3. Spring hammer                    | 1 pc  |
| - ram weight 63 kg                      |       |
| 9.3.4. Anvil incl. pedestal             | 2 pcs |
| - weight 250 kg                         |       |
| 9.3.5. Tank for water and oil hardening | 2 pcs |
| - dimensions 1500 x 800 x 1000 mm       |       |
| 9.3.6. Blacksmith's hearth              | 1 pc  |
| 9.3.7. Eccentric press                  | 1 pc  |
| - rated force 4000 kN                   |       |
| 9.3.8. Spindle press                    | 1 pc  |
| - rated force 4000 kN                   |       |
| 9.3.9. Straightening plate              | 1 pc  |
| - dimensions 3000 x 1000 mm             |       |



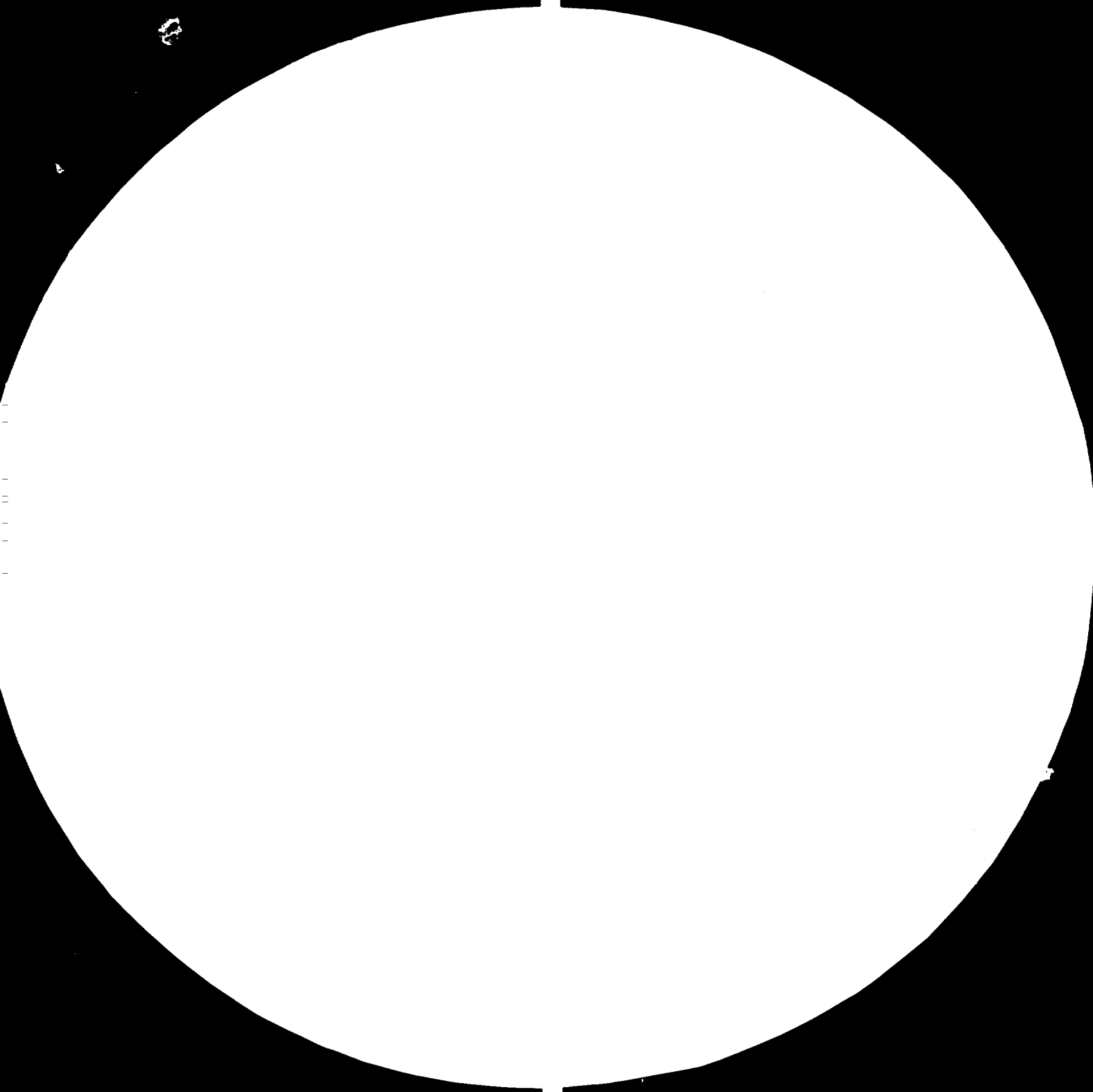
9.4. Rolls of sugar cane mills repair shop

- 9.4.1. Centre lathe 1 pc  
- swing over bed 1250 mm  
- swing over carriage 950 mm  
- distance between centres 5000 mm
- 9.4.2. Heating furnace for roll sheaths 1 pc  
- working temperature max. 250°C  
- dimensions of working space dia  
1400 x 2400 mm
- 9.4.3. Cylinder hanging attachment 1 pc
- 9.4.4. Simple boring attachment 1 pc  
- boring diameter from 300 to  
600 mm  
- boring length 2000 mm  
incl. boring rod

9.5. Machining shop

- 9.5.1. Horizontal boring machine 1 pc  
- spindle diameter 100 mm  
- max. boring diameter 560 mm  
- max. face turning diameter 900 mm  
- table clamping surface 1250x1250 mm
- 9.5.2. Centre lathe 2 pcs  
- swing over bed 380 mm  
- distance between centres 1250 mm
- 9.5.3. Centre lathe 1 pc  
- swing over bed 550 mm  
- distance between centres 3000 mm
- 9.5.4. Centre lathe 1 pc  
- swing over bed 1050 mm  
- distance between centres 4000 mm
- 9.5.5. Turret lathe 1 pc  
- swing over bed 510 mm
- 9.5.6. Universal knee-type milling machine 1 pc  
- dimensions of table 320 x 1250 mm
- 9.5.7. Vertical knee-type milling machine 1 pc  
- dimensions of table 400 x 1600 mm
- 9.5.8. Gear milling machine 1 pc  
- max. gear diameter 1000 mm  
- max. module 10
- 9.5.9. Shaping machine 1 pc  
- stroke 710 mm

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Microcopy Resolution Test Chart (NBS 1963-A)

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9.5.10. Slotting machine - stroke 500 mm	1 pc
9.5.11. Universal cylindrical grinding machine - swing 320 mm - distance between centres 2000 mm	1 pc
9.5.12. Surface grinding machine - clamping table 320 x 1000 mm	1 pc
9.5.13. Open-side planing machine - clamping table 900 x 3000 mm - max. height of workpiece 900 mm	1 pc
9.5.14. Double-wheel grinding machine - grinding wheel dimensions 350 x 127 x 63 mm	2 pcs
9.5.15. Open-side vertical lathe - max. turning diameter 1000 mm	1 pc
9.5.16. Radial drilling machine - max. drilling diameter 50 mm	1 pc
9.5.17. Column drilling machine - max. diameter drilling 20 mm	3 pcs
9.5.18. Column drilling machine - max. drilling diameter 32 mm	2 pcs
9.5.19. Marking-off plate - dimensions 1500 x 1000 mm	2 pcs

9.6. Mechanical - assembly shop

- |   |       |
|---|-------|
| 9.6.1. Centre lathe                                   | 1 pc  |
| - swing over bed 380 mm                               |       |
| - distance between centres 750 mm                     |       |
| 9.6.2. Universal knee-type milling machine            | 1 pc  |
| - table dimensions 400 x 1600 mm                      |       |
| 9.6.3. Column drilling machine                        | 1 pc  |
| - max. drilling diameter 20 mm                        |       |
| 9.6.4. Radial drilling machine                        | 1 pc  |
| - max. drilling diameter 50 mm                        |       |
| 9.6.5. Marking-off plate                              | 2 pcs |
| - dimensions 2500 x 1600 mm                           |       |
| 9.6.6. Hydraulic assembly press                       | 1 pc  |
| - pressing force 800 kN                               |       |
| - stroke 185 mm                                       |       |
| 9.6.7. Hand-operated rack press                       | 2 pcs |
| - pressing force 15 kN                                |       |
| 9.6.8. Hand-operated spindle press                    | 2 pcs |
| - pressing force 400 kN                               |       |
| 9.6.9. Double-wheel grinding machine                  | 2 pcs |
| - grinding wheel dia 400 x 50 mm                      |       |
| 9.6.10. Thyristor-type welding machine                | 2 pcs |
| - welding current 50 to 630 A                         |       |
| 9.6.11. Oxy-acetylene welding set -<br>universal type | 2 pcs |

- 9.6.12. Mobile compressor 1 pc  
- compressed air output 50 cu.m/hour
- 9.6.13. Spraying gun 2 pcs
- 9.7. Surface finishing shop
- 9.7.1. Portable blasting machine 1 pc  
- pressure tank volume 320 cu.dm  
- air pressure 0,6 MPa
- 9.7.2. Tank-type degreasing machine 1 pc  
- tank dimensions 1500 x 850 x  
1000 mm
- 9.7.3. Hot-air electric spraying-type  
degreasing machine 1 pc
- 9.7.4. High-pressure airless spraying  
device 3 pcs



9.8. Steel structures production

- 9.8.1. Horizontal hydraulic straightening press 1 pc  
- pressing force 3000 kN
- 9.8.2. Section shears 2 pcs  
- flat iron 50 x 12 mm  
- square iron 25 x 25 mm  
- round iron dia 25 mm
- 9.8.3. Hack saw 2 pcs  
- max. diameter 280 mm  
- max. dimensions of square iron  
250 x 250 mm
- 9.8.4. Portable oxygen cutting machine 1 pc
- 9.8.5. Oxy-acetylene welding set 6 pcs
- 9.8.6. Silicon welding machine 5 pcs  
- max. welding current 380 A
- 9.8.7. Rotary arc welding machine 3 pcs  
- max. welding current 315 A
- 9.8.8. Marking-off straightening plate incl. pedestal 2 pcs  
- dimensions 2500 x 1200 mm
- 9.8.9. Double-wheel grinding machine 2 pcs  
- dimensions of grinding wheel  
dia 350 x 127 x 63 mm
- 9.8.10. Radial drilling machine 1 pc  
- max. diameter of drilling 50 mm  
- distance between spindle centre line  
and sleeve 1600 mm

- max. distance between spindle and  
base 1500 mm

9.8.11. High-pressure airless spraying device 2 pcs  
(complete set)

9.9. Grinding and tool-making shop

9.9.1. Universal tool-making grinding machine 1 pc  
- grinding diameter 280 mm  
- distance between centres 760 mm  
- clamping table 980 x 140 mm

9.9.2. Universal tool-making milling machine 1 pc  
- longitudinal table feed 800 mm  
- cross feed of table 370 mm  
- vertical feed of table 450 mm

9.9.3. Column drilling machine 1 pc  
- max. drilling diameter 32 mm

9.9.4. Horizontal surface grinding machine 1 pc  
- table clamping surface 1000 x 320 mm

9.9.5. Double-wheel grinding machine 1 pc  
- dimensions of grinding wheel  
dia 350 x 127 x 63 mm

9.9.6. Twist drill sharpening machine 1 pc

9.9.7. Marking-off plate 1500 x 1000 mm 1 pc  
incl. pedestal

9.9.8. Saw discs and saw blades sharpening 1 pc  
machine  
- dia of saw discs from 200 to 1000 mm  
- length of saw blades from 110 to 1950 mm

9.10. Maintenance shop9.10.1. Mechanical maintenance

- |   |      |
|---|------|
| 9.10.1.1. Centre lathe                                  | 1 pc |
| - swing over bed 380 mm                                 |      |
| - distance between centres 1250 mm                      |      |
| 9.10.1.2. Column drilling machine                       | 1 pc |
| - max. drilling diameter 20 mm                          |      |
| 9.10.1.3. Hand-operated lever shears                    | 1 pc |
| - max. sheet thickness 2 mm                             |      |
| 9.10.1.4. Double-wheel grinding machine                 | 1 pc |
| - grinding wheel dia 400 x 50 mm                        |      |
| 9.10.1.5. Hand-operated spindle press                   | 1 pc |
| - pressing force 400 kN                                 |      |
| 9.10.1.6. Thyristor welding machine                     | 1 pc |
| - welding current from 50 to 630 A                      |      |
| 9.10.1.7. Oxy-acetylene welding set -<br>universal type | 1 pc |

9.10.2. Electro-maintenance shop

9.10.2.1. Electric hand-operated drilling machine - max. drilling diameter 13 mm	3 pcs
9.10.2.2. Universal measuring set	2 pcs
9.10.2.3. Electric instrument tester	1 pc
9.10.2.4. Earth-resistance measuring instrument	1 pc
9.10.2.5. Insulation resistance measuring instrument	1 pc
9.10.2.6. Voltage testers	2 pcs
9.10.2.7. Clip-on volt-ammeter	2 pcs
9.10.2.8. Phase sequence indicator	1 pc

9.10.3. Maintenance - woodworking shop

- |   |       |
|---|-------|
| 9.10.3.1. Band saw                      | 1 pc  |
| - table dimensions 900 x 840 mm         |       |
| 9.10.3.2. Thicknessing machine          | 1 pc  |
| - planing width 630 mm                  |       |
| - max. material thickness 200 mm        |       |
| 9.10.3.3. Universal woodworking machine | 1 pc  |
| 9.10.3.4. Joiner's bench                | 2 pcs |
| - dimensions 2200 x 620 mm              |       |

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9.11. Stores

Semi-products and materials stores, in-process stores and tool issuing room are equipped with shelf and skeleton racks to store particular kinds of materials and tools.

Bulky products will be stored in the open area in the forwarding department.

9.12. Engineering In-process Inspection

It is fitted with individual measuring instruments to check the dimensions, thickness and hardness of materials.

9.13. Laboratory

It performs the testing of mechanical properties of materials (tensile tests and impact tests) and measures hardness by Brinell test, Rockwell test and Vickers test including metallographic analysis.

9.14. In-process Handling

Overhead travelling cranes are used for the in-process handling of big and heavy products in factory buildings, storehouses and the forwarding department.

9.14.1. Overhead Travelling Cranes

lifting capacity 5 t - 1 pc  
lifting capacity 8 t - 3 pcs  
lifting capacity 10 t - 3 pcs

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9.14.2. Rail Platform Truck

with a loading capacity of 10 Mp - 4 pcs  
track gauge 800 mm  
platform dimensions 2300 x 1200 mm

9.14.3. High lift truck

with a loading capacity of 3 200 kg - 1 pc

9.14.4. High lift truck

with a loading capacity of 1 000 kg - 2 pcs

9.14.5. Hand platform truck

with a loading capacity of 630 kg - 4 pcs

9.14.6. Positioner for welding big rotary parts

with a loading capacity of 5 t - 2 pcs  
(1 pc with driving gear)

with a loading capacity of 10 t - 3 pcs  
(2 pcs with driving gear)

TOTAL PRICE

6 500,000 US Dollars

This price covers all machines provided by the Vietnamese Government and the UNDP machines specified in Annex 4. Seven cranes are also included in the price - these are Government inputs.

10. Evaluation and Commentaries on the Design of the Maintenance and Repair Plant by the Vietnamese Customer

The following can be stated on the basis of the supplied technical documentation, personal negotiations with the Vietnamese customer in the SRV and an inspection of the building site in the Bien-Hoa plant:

- 1) The building site of the maintenance and repair plant has been chosen properly and linked with the sugar refinery which has a very good engineering standard and it is therefore possible to expect a good starting of the contemplated production in the maintenance plant.
- 2) The total fenced-in area of the plant of 4,08 ha is fully sufficient for the fixed capacity of 2,000 t of products per annum and for further extension of the plant. The lay-out drawings were submitted by the Vietnamese.

When inspecting the building site according to the presented comprehensive plan of the plant the UNIDO experts found out that the location of one of the factory buildings corresponds to a place where filling of marshy land was just being carried out. Doubt was expressed about the ground bearing capacity in this very place and about whether it would meet the demands laid upon the bearing capacity for the factory building. The UNIDO asked for the results of geological survey to be presented. This demand has, however not been met. The Vietnamese partner has assured the experts that the ground bearing capacity is sufficient and meets the building requirements.

At the same time, large areas of the best building



site part were left unutilized. Unfortunately, this situation cannot be helped as the construction of the building is already underway. The best that the UNIDO experts could do was to design the most convenient flow of material - see para. 10.4.

- 3) The height of production buildings for the boiler shop and forging shop is insufficient and it has to be increased for technological reasons. For example: in the sugar mill rolls repair shop, the minimum height of 8 m is necessary for the crane hook so that rolls can be placed safely in the shaft furnace. This furnace has to be installed under the floor level to ensure the required handling height. The UNIDO experts recommend to ensure the required height of 8 m for the crane hook by raising concrete footings, since the factory building steel structure has already been supplied and its accommodation is therefore not possible.
- 4) The UNIDO experts do not agree with the arrangement of factory shops and buildings as drawn in the site layout from the point of view of the production flow. The following layout is recommended:
  - sheets and plates, semi-products and sub-contractor supplies store would be connected with the section material store by means of an overhead travelling crane with a load-carrying capacity of 8 t;
  - the cutting and surface treatment shop situated behind the sheets and plates store is fitted with a rail platform truck for 10 t;
  - production of steel structures is situated behind the section material store in a shed in the open area. The two buildings are linked by means of a rail platform truck;

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- the cutting shop is next to factory buildings of the boiler and machining shops which are also linked with each other by means of rail platform trucks;
- on the opposite side, production of steel structures is linked with two factory buildings. One of them houses the forge and heat treatment shop, the mechanical shop, assembly shop and the repair shop of sugar mill rolls.

The other building houses auxiliary shops (tool grindery, tool shop, maintenance shop), laboratory, in-process stores and tool storerooms;

- ~~behind~~ The forwarding department and the finished products store are situated behind the factory buildings. They are connected with the machining room by means of a rail platform truck.

- 5) The plant will also manufacture conveyer links and sugar cutter blades as required by the Vietnamese party.

Technological processes used:

a) Conveyer links

- shearing
- heating to the temperature of 850°C in the furnace prior to pressing
- hot pressing on a hydraulic press 2500 kN
- cold sizing on the same press
- hole punching on an eccentric press
- surface treatment

b) Sugar cane cutter blades

Material - tool steel according to CSN 19132 - GOST U 7

Machining after soft annealing - strength 73 kg/mm<sup>2</sup>:

- cut the basic form on power saw
- straighten (screw press)
- mill the cutting edge on both sides
- drill holes in the blade and holder
- heat treatment of the edge (hardening, tempering).

11. SUPPLEMENTS

- Time schedule
- Lay-out of production, dwg. No. P-0-1896
- Lay-out of workshops, dwg. No. P-0-1897
- Conveyer links, dwg. No. P-4-4223
- Sugar cane cutter blades, dwg. No. P-4-4224

TIME SCHEDULE - WORKED OUT AND APPROVED BY THE MINISTRY OF FOOD INDUSTRY IN HANOI

NAME OF BUILDING	1982												1983											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Detailed Project Report	-----	-----	-----																					
Fencing	-----	-----	-----	-----																				
Transformer station				-----	-----	-----	-----																	
Machining shop															-----	-----	-----	-----						
Material cutting shop	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----														
Forging and pressing shop															-----	-----	-----	-----						
Boiler shop															-----	-----	-----	-----						
Assembly shop															-----	-----	-----	-----						
Steel structures shop															-----	-----	-----	-----						
Stores								-----	-----															
Water distribution and drainage				-----	-----	-----	-----																	
Roads									-----	-----	-----	-----			-----	-----	-----	-----						
Administration office															-----	-----	-----	-----						
Gate															-----	-----	-----	-----						
Dwelling houses for workers															-----	-----	-----	-----						

Sign: ----- Construction  
 ----- Erection

TIME SCHEDULE WORKED OUT BY UNIDO'S EXPERTS

MONTHS :																								
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10		
Technological part of project documentation (working drawings)																								
International staff-chief technical adviser																								
Consultant on preparation of engineering																								
Consultant on preparation of electrical part of project documentation																								
Civil engineering part and power system																								
Fencing																								
Gate house																								
Roads , Sidewalks																								
Transformer station																								
Outdoor distribution system and lighting																								
Water main and sewerage system																								
Buildings:- Stores																								

C. VERGARA



TIME SCHEDULE WORKED OUT BY UNIDO'S EXPERTS

MONTHS :																								
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10		
- Boiler shop																								
-- Shop for production of steel structures																								
- International staff-experts on erection on machinery and equipment																								
<u>Production</u>																								
- Expert on repairs of rolls and machining of sheaths for sugar cane mills																								
- Expert on electric repair																								
- Expert on technological process studies																								
- Expert on designing and equipment																								
- Fellowships																								

ANNEX 5

## ANNEX 4

UNDP INPUTS - MACHINERY AND EQUIPMENT FOR SUGAR MILLS

Item	Denomination	pcs	input in kW	weight in tons	price US \$
4.1.	Horizontal boring and milling machine	1	10	17,5	145.000,
	- spindle diameter 100 mm				
	- taper in spindle Morse No. 6				
	- max. boring diameter 500 mm				
	- max. face turning diameter 900 mm				
	- table clamping surface 1250 x 1250 mm				
	- digital position readout:				
	For measuring of positions of the moving machine assemblies a simple digital position readout is employed. The position readout provides for a cyclic absolute measuring of positions of the work-piece or the tool in three axes:				
	in transverse direction - X - slide with table				
	in vertical direction - Y - headstock				
	in longitudinal direction - Z - slide with table				
	Linear inductosyns with one track of 2 mm pitch are used as measuring units in this system. Reading is done in metric measure. The values are shown on a five-digit display.				
	Special accessories:				
	- telescopic holder	1			
	- spindle guiding support	1			
	- spindle clamping support	1			
	- cooling system	1			
	- vertical milling attachment	1			
	- set of change gears for thread cutting	1 set			
	- long boring bars	1 set			
	- sliding sleeves, bearings, boring bar supports	2			
	- set of boring heads for boring bars	1 set			



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Item	Description	Qty	input in kW	weight in tone	price US \$
-	boring attachment	1			
-	universal boring head	1			
-	tool clamping and ejection device	1			
-	clamping angle plates	2			
-	clamping block	1			
-	auxiliary pendant control panel	1			
-	anchoring material	1 set			
Tools:					
-	clamp support 16x50	4			
-	clamp stand dia 63	16			
-	flat clamp 23 x 160	4			
-	workpiece setting stop	4			
-	shell-end milling cutter, right-hand	1 set (8 pcs)			
-	face roughing cutter	1 set (12 pcs)			
-	cutter arbor spanner, No. 27, 40	2			
-	distance rings	2 sets			
-	cutter arbors with face carrying	3			
-	ejection wedge No. 1,3,5	3			
-	support with centre 130	4			
-	support with notch 125	2			
-	drilling chuck 16	1			
-	arbor for drilling chuck	1			
-	clamping bush	1			
-	clamping bush inserts	1 set			
-	adaptor	3			
-	tool holder	1 set			
-	roughing tool	2 sets			
-	spot facer	2 sets			
-	rough boring head incl. accessories	1 set			

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Item	Denomination	pcs	input in kW	weight in tons	price US \$
	- milling head arbor	1			
	- centring attachment	1			
	- adjustable boring head	2			
	- universal boring head	1			
	- spare tools for rough boring head	5 sets (à 40 pcs)			
	- spare tools for adjustable boring head	3 sets (à 20 pcs)			
	- spare tools for universal boring head	5 sets (à 20 pcs)			
	- single-ended spanners	1 set			
	- double-ended spanners	1 set			
	Spare parts for two years of operation				
4.2.	Open-side planing machine	1	40	27,5	78.000,-
	- table dimensions 900x3000 mm				
	- planing width 1000 mm				
	- planing length 3000 mm				
	- maximum workpiece height 900 mm				
	- maximum tool cross-section 60x80 mm				
	Tools:				
	- U-clamp 23x160, 23x200	4			
	- slide gooseneck clamp 11,5 x 100	2			
	- rough planing tool, right-hand	2 sets			
	- left-hand rough planing tool	2 sets			
	- Right-hand corner tool	2 sets			
	- left-hand corner tool	2 sets			
	- smoothing tool	2 sets			
	- recessing tool	2 sets			
	Spare parts for two years of operation.				

Item	Description	pcs	input in kW	weight in tons	price US \$
4.3.	Slotting machine	1	11	8,2	41.000,-
	- slotting wheel 500 mm				
	- table clamping surface dia 800 mm				
	- distance between table and stroke guide 700 mm				
	- tool overhang 710 mm				
	- max. tool cross-section 40x45 mm				

Tools:

- vice 160 1
- U-clamps 23x160, 23x200 4
- fixed gooseneck clamps  
11,5x100 2
- clamp supports 16x50, 20x80 4
- rough slotting tools 2 sets
- slotting tools for grooves 3 sets
- double-edged slotting tools 2 sets

Spare parts for two years of operation

4.4.	Universal centre-type grinding machine	1	16	6	80.000,-
	- swing 320 mm				
	- distance between centres 2000 mm				
	- max. grinding wheel width 200 mm				
	- taper in spindle Morse No. 5				

Special accessories:

- internal grinding attachment  
without spindle and three-  
jaw chuck 1
- closed steady 1
- table-mounted tilting wheel  
dresser without diamond 1
- stop box 1

Item	Denomination	pcs	input in kW	weight in tons	price US \$
-	three-jaw chuck, dia 200	1			
-	radius tracing dresser, without diamond	1			
-	tailstock-mounted wheel side dresser without diamond	1			
-	table-mounted wheel side dresser without diamond	1			
-	table-mounted side and angle dresser, without diamond	1			
-	table-mounted wheel shape dresser, without template and diamond	1			
-	solid grinding wheel flanges for widths 80 to 200 mm	1 set			
-	built-up grinding wheel flanges for widths up to 225 mm	1 set			
-	auxiliary workpiece steadies dia 65 to 135 mm	2			
-	fine table tilting attachment	1			
-	balancing stand	1			
-	magnetic clamping plate dia 200 mm	1			
-	hand-operated collet clamping	1			
-	additional collets 5 to 15 mm, 3/16 to 9/16"	18			
-	machine bed levelling shims for the length of 2000	1 set			

## Tools:

- tapered centre Morse No. 5 - 60° 2
  - Flattened centre Morse No. 5 - 60° 2
  - rotary centre Morse No. 5 - 60° 2
  - arbor dia 10 to 50 1 set
  - grinding wheel dia 500x80 1 set
- Spare parts for two years of operation

Item	Denomination	pcs	input in kW	weight in tons	price US \$
4.5.	Table shears	1	30	6,1	48.000,-
	- max. sheet thickness 16 mm				
	- max. cutting length 3150 mm				
	-				
	Special accessories:				
	- stroke counter	1			
	- waste handling truck	1			
	- extended front rule with stops	1			
	- angular cutting guide bar	1			
	Spare parts for two years of operation				
4.6.	Sheet metal and section bending rolls	1	76	40	85.000,-
	- maximum sheet length 3150 mm				
	- maximum plate thickness 16 mm				
	- minimum bending diameter 550 mm				
	- minimum size of L-section 100 x 100 x 10 mm				
	- minimum L-section dia 1000 mm				
	Spare parts for two years of operation				
4.7.	Arc welding machine	1	34 kVA	0,5	10.000,-
	semi-automatic machine with or without carbon dioxide shielding atmosphere				
	- solid welding wires dia 0,8 to 1,6 mm				
	- tubular welding wires dia 3 mm				
	- welding current from 20 A to 600 A				
	- voltage from 13,5 to 44 V				

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Item	Description	no	input in kW	weight in tons	price in US \$
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## Special accessories:

- truck with telescopic stand,  
feeder and remote control 1
- set of welding holders 1 set
- foot-operated switch 1
- interconnecting conductor 1

Spare parts for two years of operation.

4.8.	Universal centre lathe	1	40	16,5	180.000,-
	- swing over bed 1250 mm				
	- distance between centres 5000 mm				
	- maximum workpiece weight 10000 kg				

## Special accessories:

- pulley-type steady dia  
630 x 480 mm 1
- pulley-type steady dia  
500 x 200 mm 1
- thread-cutting attachment 1

-

## Tools:

- left-hand threading tool 4
- right-hand threading tool 4
- inside threading tool 4
- right-hand roughing tool 4
- left-hand roughing tool 4
- right-hand bent roughing  
tool 3
- left-hand bent roughing  
tool 3
- right-hand corner tool 4
- left-hand corner tool 4
- inside roughing tool 4
- inside corner tool 4
- right-hand necking tool 2
- left-hand necking tool 2
- recessing tool 2

Spare parts for two years of operation

Item	Denomination	pcs	input in kW	weight in tons	price US \$
4.9.	Simple boring unit	1	4		46,000,-
	- boring diameter 330-600 mm				
	- boring length 2000 mm				
	Special accessories:				
	- boring rod	1			
	- set of tools	1 set			
	Spare parts for two years of operation				
4.10.	Heating furnace for roll sheaths	1			94.000,-
	- oil-fired furnace				
	- viscosity 2,5 to 3 <sup>o</sup> E at 20 <sup>o</sup> C				
	- heating value 9500 kcal				
	- consumption 12 kg per hour				
	- max. temperature of waste gases 300 <sup>o</sup> C				
	- max. heating temperature 260 <sup>o</sup> C for sketch of furnace, see drawing P-0-1897)				
	incl.: fuel tank				
	Spare parts for two years of operation				
4.11.	Universal knee-type milling machine	1	5,5	2,6	40.000,-
	- table clamping surface 320 x 1250 mm				
	- max. distance between spindle centre line and table 420 mm				
	- spindle taper ISO 50				
	Special accessories:				
	- vertical milling attachment with taper ISO 50	1			
	- universal milling attachment	1			
	- slotting attachment	1			

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Item	Description	QTY	Input in kW	Weight in tons	Price US \$
-	tool-lifting device	1			
-	overarm braces	1			
-	longitudinal dividing attachment	1			
-	power-operated rotary table	1			
-	hand-operated rotary table	1			
-	universal dividing attach- ment	1			
-	simple machine vice	1			
-	swivelling machine vice	1			
-	swivelling and tilting machine vice	1			
-	self-centring machine vice	1			
-	boring head	1			
-	working table protective shield	1			
-	set of long milling arbors ISO 50	4			
-	set of short milling arbors ISO 50	3			
-	set of reducing sleeves	4			
-	cooling equipment	1			
-	lighting unit	1			
Tools:					
-	travelling steady	4			
-	underclamp steady	8			
-	T-slot nut	4			
-	T-screws	24			
-	U-clamp	4			
-	gooseneck clamp	4			
-	clamping angle	2			
-	face-milling cutter	5			
-	shell-type end milling cutter	15			
-	side-and-face cutter	9			
-	T-slot cutter	6			
-	keyway milling cutter	28			
-	concave cutter	4			



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Item	Denomination	pcs	input in kW	weight in tons	price US \$
	- arbor-type cutter	4			
	- angular cutter	37			
	- milling head	1			
	- saw disc	40			
	Set of spare parts for 2 years of operation				
4.12.	Radial drilling machine	1	4	4,3	38.000,-
	- maximum drilling capacity in solid stock 50 mm				
	- maximum boring capacity 200 mm				
	- maximum distance between spindle centre line and sleeve 1600 mm				
	- maximum distance between spindle and base 1500 mm				
	- taper in spindle Morse No. 5				
	Special accessories:				
	- cooling system incl. electric pump	1			
	- adapters	1			
	- box-type table	1			
	- tilting table	1			
	- cross table	1			
	- machine vice	1			
	- supporting column	1			
	Tools:				
	- clamp support 16x80, 20x50, 20x80	6			
	- support stand dia 63, dia 90	4			
	- flat clamps 23x200	2			
	- gooseneck clamps 11,5x100	2			
	- adaptor with taper Morse No. 5x4, 5x3, 3x2	3			
	- ejection wedge 3, 5	2			
	- drilling chuck 16	1			
	- chuck spanner	1			

Item	Denomination	pcs	input in kW	weight in tons	price US \$
-	machine reamers from dia 11 to dia 20 mm H7	2 sets			
-	machine reamers from dia 21 to dia 32 mm H7	1 set			
-	skewering reamer from dia 32 to dia 60 mm H7	1 set			
-	counterbores for screws M 10 to M 20	1 set			
-	snail countersinks for screws M 10 to M 24	1 set			
-	countersinks for screws M 10 to M 16	1 set			
-	machine taps M 10 to M 20	1 set			
-	reamer drill holder dia 32, 40, 50	1			
-	centering drill 4	10			
-	short drills from dia 10 to dia 16	1 set			
-	taper-shank drills from dia 15 to dia 75 mm	1 set			
-	taper-shank reamer drills dia 9,8 to 31,6 mm	1 set			
-	fixed changeable insert	1 set			
-	traversable changeable insert	1 set			
	Spare parts for two years of operation				

4.13. Metallizing machine for repairs  
of metallic and aluminium  
surfaces, for building up  
chippy and wearing tools,  
for capillary soldering of  
very small parts and for  
welding cast iron and other  
metals

1 15.000,-

Total estimated price 1983 CIF Hanoi 900.000,- US Dollars

ANNEX 5

UNDP INPUTS - INTERNATIONAL STAFF AND FELLOWSHIPS FOR SUGAR FACTORIES

The following international staff will be assigned to the Project:

a) Chief Technical Adviser

The Chief Technical Adviser should have a degree in science or engineering, with experience in construction of factories or repair shops. He will be responsible for the overall operation of the project and for the direction and coordination of the work of experts in accordance with timing and details specified in the Work Plan. He will start at the beginning of 1983 for a period of 21 months. His duty station will be Ho Chi Minh City.

$$21 \times \$ 6\ 900 = \$ 144\ 900$$

Vietnamese input: Office, furniture, means of transport etc.

b) Consultant on preparation of the engineering part of project documentation

The Consultant should have a degree in science or engineering with experience in designing the technological part of project documentation (working drawings) of the sugar factory repair shop and proper layout of machines and equipment to achieve their correct performance. He will work in cooperation with the Chief Technical Adviser. His duty station will be

Ho Chi Minh City. He will start approximately at the beginning of 1983 for a period of 6 months.

$$6 \times \$ 7\,400 = \$ 44\,400$$

c) Consultant on preparation of the electrical part of project documentation

The Consultant should have a degree in science or engineering with experience in designing the electrical part of project documentation (working drawings) of any engineering factory. He will work in close cooperation with the consultant on preparation of the engineering part of project documentation. His duty station will be Ho Chi Minh City and he will start approximately at the beginning of 1983 for a period of 5 months.

$$5 \times \$ 7\,400 = \$ 37\,000$$

Vietnamese input for b) and c): 8 - 10 engineers and draftsmen, office, furniture, drawing boards, means of transport etc.

d) Experts on the erection of machinery and equipment

The experts should have experience in erection of machinery and equipment, either in the mechanical part or in the electrical part. They will work in close cooperation with the Chief Technical Adviser. The number of experts will depend on the number of complicated machines and the number of firms that will supply machinery and equipment. The total will be approximately 20 man/months; the exact number will be fixed

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later. Duty station: Bien Hoa, 1983 to 1985.

$$20 \times \$ 6\,900 = \$ 138\,000$$

Vietnamese input: workers, erection material, electrical installation, means of transport, electricity, execution of foundations etc.

e) Expert on the repair of rolls and the machining of sheaths for sugar cane mills

The expert should have a degree in engineering with experience in the repair of rolls and the machining of sheaths for sugar cane mills. He will work in cooperation with the Chief Technical Adviser. His duty station will be Bien Hoa for a period of 6 months.

$$6 \times \$ 6\,900 = \$ 41\,400$$

f) Expert on electric repair

The expert should have a degree in electrical engineering with experience in repairs of electrical machinery and equipment in sugar factories with regard to preventive repairs. His duty station will be Bien Hoa for a period of 6 months.

$$6 \times \$ 6\,900 = \$ 41\,400$$

He will work in cooperation with the Chief Technical Adviser.

g) Expert on technological process studies

The expert should have a degree in mechanical engineering with experience in preparation of technolo-

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gical process studies for repairs in sugar factories. He will work in cooperation with the Chief Technical Adviser. His duty station will be Bien Hoa for a period of 8 months.

$$8 \times \$ 6 900 = \$ 55 200$$

Vietnamese input for d) - g): office, furniture, means of transport etc.

h) Expert on designing machinery and equipment for sugar factories

The expert should have a degree in science or engineering with experience in designing machinery and equipment for sugar factories, mainly for small sugar cane milling units having the capacity of 15 - 30 tons of sugar cane per day. He will work in cooperation with the Chief Technical Adviser. His duty station will be Bien Hoa for a period of 8 months.

$$8 \times \$ 6 900 = \$ 55 200$$

Vietnamese input: 8-10 engineers and draftsmen, office, furniture, drawing boards, means of transport etc.

International staff    t o t a l    \$ 557 500

Fellowships

Six international fellowships of a total 21 man/months for technical on-the-job training of local technical staff members at foreign sugar cane factories with

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repair shops or sugar cane machinery and equipment producers, in which relevant activities are well established.

1. Fellowship training for one person in the machining of components and parts for repairs - 4 months
2. Fellowship training for one person in the maintenance and servicing of electrical and electronic equipment - 4 months
3. Fellowship training for one person in the welding process - 3 months
4. Fellowship training for one person in the heat treatment - 3 months
5. Fellowship training for one person in the planning of preventive repairs - 3 months
6. Fellowship training for one person in the management of the repair plant, organization process etc. - 4 months

T o t a l                      21 x \$ 2 000 = \$ 42 000

International staff and fellowships for  
sugar mills

t o t a l                      \$ 599 500

ANNEX 6

RICE MILLS - PROJECT BUDGET - GOVERNMENT AND UNDP  
CONTRIBUTION

Project Budget Covering Government Contribution in  
1000 Dongs

	1982	1983	1984	1985
Erection of machinery and equipment, transportation, project personnel	-	800	800	600

Elaborated by UNIDO experts, approved by the Ministry  
of Food in Hanoi

Project Budget Covering UNDP Contribution in US \$ 1000

	1982	1983	1984	1985	Total
Machinery and Equip- ment	-	350	350	200	900
International staff and fellowships	-	200	250	150	600
T o t a l		550	600	350	1500



ANNEX 7

SUGAR FACTORIES - PROJECT BUDGET - GOVERNMENT AND  
UNEP CONTRIBUTION

Project Budget Covering Government Contribution in 1000 Dongs

Year	1981	1982	1983	1984	1985
Civil engineering part	5410	6000	3000	600	-
Machinery and equipment	-	10000	15000	10000	-
T o t a l	5410	16000	18000	10600	-

Approved by the Ministry of Food in Hanoi

Project Budget Covering UNDP Contribution in US \$ 1000

Year	1982	1983	1984	1985	Total
Machinery and Equipment	-	300	400	200	900
International staff and fellowships	-	200	200	200	600
T o t a l	-	500	600	400	1500

SOME FIGURES  
OF THIS DOCUMENT  
ARE TOO LARGE  
FOR MICROFICHING  
AND WILL NOT  
BE PHOTOGRAPHED.

