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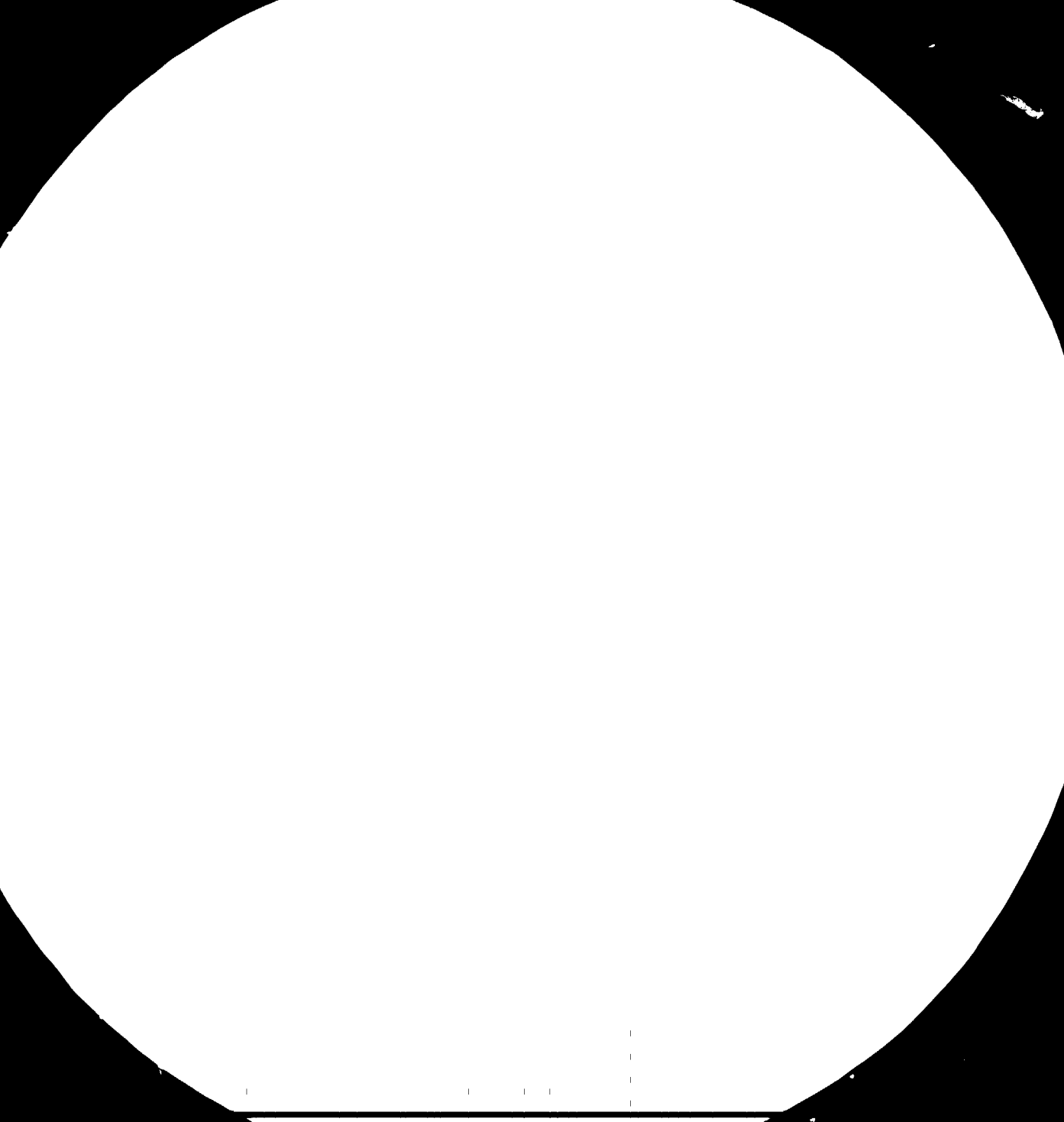
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FTO "MACHINEEXPORT"

BULGARIA

11217-E

FEASIBILITY STUDY

on the Establishment of a Repair and Maintenance Centre for the Metalworking Industry in NICARAGUA.

UNIDO Contract Nr. T81/36  
Project Nr. UC/NIC/80/063  
Activity Code 13 21 31.9A

Sofia, January 1982

Sofia, 5 Aksakov Str., Tel. 88 53 21; Telex: 023-425

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## A N N O T A T I O N

This feasibility study has been carried out on the ground of a contract concluded between UNIDO /International Organization for Industrial Development to the United Nations Organization/ and the Bulgarian foreign trade organization for export and import of metalworking machines and engineering activities "MACHINOEXPORT".

Technological sizing of the repair capabilities and facilities necessary for the metalworking sector in Nicaragua has been made, determining the following: the necessary types and quantities of machines and equipments; the operating staff; the necessary materials; the structure of the proposed centre for repair and maintenance. A general estimate of the value of the project has been prepared and techno-economic calculations have been made. An exemplary table of the planned repairs of the metalworking machines available in the metalworking sector has been drawn up; a work schedule for the study, designing, construction of the centre and putting it into operation has also been worked out. Drawings for the location of the centre / general layout/ and for the disposition of the separate sections have been drawn up.

The results of the technological calculations for determination of the repair facilities and maintenance of metalworking machines in the other branches of the industrial sector, as well as the results of the calculations for augmenting of their repair capabilities, are also shown.

The feasibility study is wound up with conclusions. It may be used for making analysis and drawing conclusions, or it may serve as a basis for the following studies and designing.

The separate sections are worked out as follows:

1. Dipl. Eng. Valentin Assenov Petkov - Section I; Section II excluding the economic calculations; Section III; Section IV.
2. Dipl. Econ. Petko Vassilev Grosev - Section II - Economic Calculations and General Methodological Consultancy on the



Feasibility Study.

3. Dipl. Arch. Aneta Todorova Athanassova - architectural  
general layout.



S E C T I O N I

G E N E R A L

1. GENERAL NOTES

This feasibility study has been carried out on the basis of a contract concluded between UNIDO and FTO MACHINOEXPORT - Bulgaria. The ultimate aim of it is the "Establishment of a Repair and Maintenance Centre for the Metalworking Industry in Nicaragua". It determines the necessity of studying the present status of the metalworking machines, measuring and cutting tools and instruments, the repair technology and maintenance of such machines as well as the qualification of the attending and operating staff.

The initial aim of the feasibility study is to assess the existing workshops for repair of metalworking machines in Nicaragua and to elaborate a short-term programme for reinforcement of one or two of them by installing equipment to the total amount of 60.000 US\$.

It is envisaged to develop, on the basis of above assessment, a concrete plan for the establishment of a repair and maintenance centre of metalworking machines in Nicaragua. In this centre ought to be secured possibilities for manufacture of spare parts, training and perfection of the Nicaraguan specialists.

To ensure the performance of the job, FTO Machinoexport sent to Nicaragua two specialists to carry out the study and collect the data and information, necessary for the feasibility study. It has been done in October, November and December 1981.

By the study our specialists availed themselves of the help of Nicaraguan specialists from the Ministry of Industry - mainly from COIP and Dirección Tecnológica. All establishments within the system of the Metalworking Sector as well as large number of establishments in other sectors of COIP have been visited. The Nicaraguan side did not secure the possibility to visit and study establishments out of the system of COIP.

Parallel to the work carried out in connection with the main tasks of the study, two additional investigations have been performed, which found their place in the feasibility study:

- investigation aimed at establishing the necessity of repair capabilities and facilities for the repair and maintenance of the metalworking machines in the other branches of the industrial sector /and not only in the metalworking sector/;

- investigation aimed at augmenting of the repair capabilities and facilities of the particular sectors of COIP / excluding the metalworking sector/ for repair and maintenance of the main technological equipment.

They have been carried out with the knowledge and at the request of the Nicaraguan side.

It has been pointed out in the feasibility study that owing to the impossibility to collect data for the establishments out of the system of COIP, the experts assessment has been used by the technological calculations. Similarly, such assessments have been used in other cases, when not possible to collect adequate data and information. This method is widely applied by carrying out of feasibility studies for determination of the possibilities and advisability of installing of capacities. At the next stage, usually a preliminary design, the feasibility study is carried out on the basis of accurate data and the results are being specified.

At the end of November in the Ministry of Industry were considered and talked over the preliminary results of the feasibility study. The recommendations of the Nicaraguan side have been taken into consideration and they had an impact on the final drawing up.

The performance of the feasibility study has been accomplished with the collaboration of IPP "Mashproject" - Sofia, making use of the help of qualified specialists in the field of industrial designing.

After the feasibility study had been completed it was considered and accepted by the Technical Council by department "Technological Designing" to the Institute.

## 2. CHARACTERISTIC FEATURES OF THE COUNTRY

### 2.1. GENERAL DATA

The Republic of Nicaragua is situated in the middle part of Central America. On the north it borders on Honduras, on the south - on Costa Rica. The East border of the country is the coast of the Caribbean Sea /length about 541 Km/ and the West border is the coast of the Pacific Ocean /length about 352 km/.

The territory of the country is approximately 148.000 sq.km., including about 9.000 sq. km. occupied by lakes, the largest of which are Nicaragua and Managua.

The population of the country, according to 1980's data, is 2,6 million, being classified approximately as follows:

- metises - 69%
- white people 17%
- black people 9%
- indians 5%

The capital of Nicaragua is Managua, having about 500.000 inhabitants. The official language is the Spanish language and the ruling religion - the catholic one.

The average annual temperature is ranging between 23-32°C for the flat part of the country and -18°C for the upland /making up about 40% of the country's territory/.

The rainy period is lasting from May to November and the dry period - from December to April.

The currency of the country is called Córdoba, 10 Córdoba making one US Dollar.

The internal road network is 17941 km., including 1600 km paved roads. The PanAmerican Highway is passing through the country. The railway system is poorly developed. There is a railway line /403 km/ connecting the Pacific Ocean Port of Corinto through Leon city with the capital Managua, from there continuing to the city of Granada - a port on the Nicaragua Lake. The motor transport is the main kind of transportation in the country.

The average annual income per capita is extremely low - about 840,- US\$ in 1978.

After the Civil War in 1979 the Republic of Nicaragua started along the road of the non-aligned countries, fighting for peace and social independence.

## 2.2. ECONOMY

The Republic of Nicaragua, as a result of the centuries-long political and economic dependence up to mid-1979, is a backward agricultural country. The dictator A. Somoza, unseated through a national revolution, left to the nation a vast debt of more than 2 billion Dollars.

Agricultural production is the basis of the economy of the country. About half of the able-bodied population is engaged in it. The main crops which are cultivated and which are of economic importance for the country are the cotton, the coffee and the sugar-cane. Rice, beans, Indian corn, bananas, tobacco and cocoa are also grown. Regardless of the favourable climatic conditions, the yields are not high owing to lack of fertilizers and relatively low level of the agrotechnics used.

According to data submitted by FAO, in 1978 were produced:

cotton -	164.000 tons	beans	-	51.000 tons
coffee -	60.000 tons	millet	-	58.000 tons
Indian corn -	209.000 tons	bananas	-	157.000 tons

The industry in the Republic of Nicaragua is very poorly developed. The larger part of the industrial enterprises are engaged in the

processing of agricultural products : meat and meat-processing industry, coffee-processing factories, cotton mills, sugar cane processing establishments, tanneries, etc. The largest enterprise in the country is the oil refinery in Managua, having capacity of about 0,8 mill tons of oil annually.

During the Civil War in the country /1978-1979/ for different reasons and not without the fault of the dictatorial regime and its followers, the industrial production dropped significantly, 90% of the industrial establishments being not in operation immediately before the end of the Civil War /summer of 1979/. Vast damages have been caused to the economy of the country, same being approximately assessed to 1,3 billion Dollars.

The main tasks facing the Republic of Nicaragua after the Civil War were determined by the necessity of restoring and developing the country's economy. In the following table are shown some characteristic features of the economy:

Nr.	Denomination of the criterion	Standard	Years				
			1977	1978	1979	1980	1981/plan/
1.	2	3	4	5	6	7	8
1.	Gross national product	million Córdobas	29186	26677	19357	20740	22334
2.	Growth	%	base	-8,6	-27,5	7,1	7,7

An expression of the desire of the Nicaraguan people for the restoration and development of the country is the promulgation of 1981 as an year of defence of the revolution and year of increase of the industrial and agricultural production.

During their visits to a large part of the establishments within the system of COIP in connection with the study, the team of specialists from FTO Machinoexport was able to come round to the opinion that for different reasons / lack of spare parts, shortage or lack of qualified specialists and workers, lack or shortage of basic inputs and raw materials, etc,etc./ a significant part of the facilities in them stay unused or the pre-war capacity had not been reached.

The subjective factor, determined by the shortage of experts to engage in the management of the country's economy, should not be ignored also. The nature of the study predetermines the turning of the attention exclusively to analyzing of local capabilities and facilities for repair and maintenance of the main technological equipment and to manufacture of spare parts. In this connection the conclusion might be drawn that they are not adequate to the country's needs and that spare parts manufacture has not been organized. Namely owing to the lack of spare parts, regardless of the large volume of import/part of which could be produced in Nicaragua/ many machines and equipment stay idle and therefore the economy of the country sustains large losses.

The industrial production of Nicaragua is managed by the Ministry of Industry. It performs direct guidance over COIP /a corporation for public property/ established immediately after the Civil War, as well as methodological guidance over the corporation uniting the private owners. COIP, on its part, does not run only enterprises which are entirely state-owned, but also enterprises in which part of the facilities are state-owned, and the remaining part is private property.

The following sectors of industry are covered:

- food, wine and tobacco industries;
- metalworking industry;
- clothes and shoes' industry
- building materials manufacture;
- textile industry;
- wood-processing industry;



- chemico-pharmaceutic industry;
- paper industry;
- plastic processing;
- agricultural products processing;
- fish industry;
- oil refining industry.

The main, structure-determining branches of the industrial sector are the textile industry, the food, wine and tobacco industries, building materials production /especially the cement industry/ and the agricultural products processing.

### 2.3. TRADE

Of primary significance in the export list of the country are the cotton, the cotton seeds, the coffee, the meat, the sugar, the timber. Before 1979 the main trade partners of the country were USA, Japan and FRG. Below is shown data concerning the trade partners of Nicaragua in 1976.

	export - %	import - %
USA	31	31
FRG	10	6
Japan	13	8
Costa Rica	8	9
Guatemala	6	8
Salvador	5	7
Venezuela	-	11

In the following table are shown data characterising the foreign trade of Nicaragua.

Nr.	Denomination	Standard	Year			
			1976	1978	1979	1980
1	2	3	4	5	6	7
I.	EXPORT	Million Doll.	541,9	646,0	315,97	450,4

1	2	3	4	5	6	7	8
	INCL: coffee	"	119,4	140,2	107,57	no data avail.	
	cotton	"	130,6	103,9	94,16	"	
	meat	"	37,6	47,6	23,95	"	
	sugar	"	52,8	no data avail.	8,97	"	
II.	IMPORT	"	532,1	418,8	245,5	802,9	
	incl. oil	"	56,7	no data avail.	10,8	no data avail.	

Below are shown data characterising the exportation of basic goods:

Mr.	Denomination of goods	Standard	Years	
			1977/78	1978/79
1.	Cotton	th. bales	565	500
2.	Coffee	million of sacks	0,99	1,10
3.	Sugar	th. tons	213	225

Nicaragua imports machines and equipment, consumer goods, raw materials and source materials as well as oil products / in 1978 - making up about 21% of the total import/. Main partners of Nicaragua before the war were USA, Japan, Costa Rica, Venezuela, FRG, Guatemala.

#### 2.4. BALANCE OF PAYMENT

It is characterised by passive balance shown below in millions of Córdoba by years:

1977	1978	1979	1980
-182,0	-25,0	-180,0	-387,0

#### 2.5. INVESTMENTS

The main sources of investments before the war were private firms and banks - in and outside the country. After July 1979 the main source of investments became the state. But, owing to its limited possibilities,

resulting mainly from unrestored economy as well as from some other factors, it can not secure the funds necessary for the adequate development of the textile industry, food, wine and tobacco industries, energetics, machinebuilding, etc.

Below are shown some characteristic data concerning the investments in millions of Córdoba by years:

1978 - 2886,9;      1980 - 3296,8;      1981 - 3989,5;

### 3. PROSPECTS FOR THE INDUSTRIAL DEVELOPMENT OF THE COUNTRY

Regardless of the great difficulties resulting from different factors, the Republic of Nicaragua is looking for ways for restoring and developing its economy. This is the main task facing all Nicaraguans. Their efforts are united and guided by JGRN - a national junta for national reconstruction / in Spanish - Junta de Gobierno de Reconstrucción Nacional/, headed by the President of the Government.

Nicaragua is a member of the following international institutions:

- International Exchange Fund;
- International Bank for Reconstruction and Development.

In its striving for restoration and development, Nicaragua finds the support of the International Organization for Industrial Development to the United Nations Organization as well as the support of many friendly disposed countries.

The more significant tasks confronting Nicaragua on its way to the industrial development are the following:

- training of local specialists;
- creating of local skilled workers;
- securing of the resources for the existing capabilities and facilities;
- development of the capabilities and facilities for repair and maintenance and manufacture of spare parts with a view of securing of proportions in the different sectors of industry;
- elaboration of programmes and securing the conditions for their execution by stages, in accordance with the possibilities of the country,

reconstruction, modernization and expansion of the production facilities;

- elaboration of programmes and providing the conditions for their execution for the introduction of new facilities in accordance with the prospect plans for the economic development of the country.

#### 4. METALWORKING SECTOR

Metalworking is poorly developed in Nicaragua. According to data of 1980, items for 495,5 millions of Córdobaes have been produced, this hardly making up 4% of the total industrial production of the industrial sector.

In the existing establishments in the sector are produced as follows: nails, barbed wire, metal constructions, trailers for cereals and cotton; bent steel profiles, steel reservoirs, drill-ploughs, fertilizer-spreading machines, etc.

In the following table are shown data concerning metalworking establishments in the system of COIP /we do not have available data concerning the private sector/:

Nr.	Denomination	Standard	1980		1980	
			reported		plan	
			TIP	%	TIP	%
1	2	3	4	5	6	7
	COIP	Millions of Córdobaes	2145,2	100	3480,3	100
	incl. the metalworking sector, by establishments	"	229,99	10,7	470,4	13,5
	1. METASA	"	68,98	30,0	159,4	34,0
	2. INCA	"	102,0	44,3	84,2	17,8
	3. INTERCASA	"	29,3	12,7	135,3	28,7
	4. ENVACASA	"	3,8	1,7	27,5	5,9
	5. EMENSA	"	7,6	3,3	19,9	4,4

1	2	3	4	5	6	7
6. IMEP		"	10,5	4,6	21,8	4,6
7. EDISON		"	2,3	1,0	4,0	0,8
8. REDELSA		"	2,5	1,1	4,1	0,8
9. FERRO ARTE		"	-	-	2,3	0,5
10. ELISA		"	3,1	1,4	2,2	0,4
11. IMPLAGSA		"	-	-	10,0	2,1

The table shows that the main establishments of this sector are METASA, INCA and INTERCASA.

The metalworking sector is taking part in the export of the country, but this participation is rather small - only 3,6% of the total export of the industrial sector is being manufactured by this sector. The items being exported are mainly metal products. The following establishments have the largest share in the export:

	1980	1981 - plan
METASA	93,4%	44,1%
INCA	61,1%	20,5%
INTERCASA	4,5%	32,0%
EMENSA	1,0 %	3,4%

Nicaragua is not manufacturing input materials and raw materials and the needs of the metalworking sector are met through import.

The existing metalworking machines in the COIP establishments - metalworking sector, are shown in Appendix Nr. 1.

In the following table is shown the personnel engaged in the production in the metalworking sector in 1981 /COIP/:

Nr.	Denomination	Staff engaged in production	
		number	%
	COIP, incl. metalworking	16729	100%
	sector, by establishments	1500	20
1.	METASA	501	33,4
2.	INCA	471	31,4
3.	INTERCASA	213	14,2
4.	ENVACASA	84	5,6
5.	EMENSA	95	6,3
6.	IMEP	79	5,3
7.	EDISON	19	1,3
8.	REDELSA	4	0,3
9.	ELISA	8	0,5
10.	FERO ARTE	26	1,7

The productivity of one person of the staff engaged in production is shown in the following table.

Nr.	Denomination	Productivity of a person from the personnel engaged in pro- duction in thousands of Córdobaes	
		1980 /report/	1980/plan/
	COIP,	160,7	208,0
	incl. the metalworking sector by establishments	153,8	313,6
1.	METASA	132,7	318,2
2.	INCA	198,8	178,8
3.	INTERCASA	134,3	635,3
4.	ENVACASA	86,4	321,8
5.	EMENSA	82,3	209,7
6.	IMEP	135,0	275,5
7.	EDISON	120,0	209,4
8.	REDELSA	618,2	1135,7
9.	ELISA	43,91	284,5
10.	FERO ARTE	-	90,9

## Appendix Nr. 1.

Nr.	Denomination of machine; establishment where it is mounted.	Distribution of machines according to their age											
		up to 5 years		5-10		10-15		15-20		over 20 years		Total- ly	
		pcs.	%	pcs.	%	pcs.	%	pcs.	%	pcs.	%		
1	2	3	4	5	6	7	8	9	10	11	12	13	
1.	LATHES	3	14,3	10	47,6	7	33,3	-	-	1	4,8	21	
	incl. in METASA	-	-	1	33,3	2	66,7	-	-	-	-	3	
	EMENSA	1	25,0	3	75,0	-	-	-	-	-	-	4	
	IMPLAGSA	-	-	2	50,0	1	25,0	-	-	1	25,0	4	-
	INTERCASA	2	100,0	-	-	-	-	-	-	-	-	2	17
	INCA	-	-	4	50,0	4	50,0	-	-	-	-	8	-
2.	MILLING MACHINES	2	33,3	-	-	1	16,4	1	16,4	2	33,6	6	
	incl. in INTERCASA	1	100,0	-	-	-	-	-	-	-	-	1	
	INCA	1	33,3	-	-	1	33,3	-	-	1	33,3	3	
	METASA	-	-	-	-	-	-	1	30,0	1	30,0	2	
3.	SHAPING MACHINES	2	50,0	-	-	-	-	-	-	2	50,0	4	
	incl. in EMENSA	1	100	-	-	-	-	-	-	-	-	1	
	INTERCASA	1	100	-	-	-	-	-	-	-	-	1	
	INCA	-	-	-	-	-	-	-	-	1	100,0	1	
	METASA	-	-	-	-	-	-	-	-	1	100,0	1	



1	2	3	4
4.	RADIAL-DRILLING MACHINES	-	-
	incl. in EMENSA	-	-
	INCA	-	-
	METASA	-	-
5.	PILLAR AND BENCH DRILLING MACHINES	5	35,7
	incl. in EMENSA	-	-
	IMPLAGSA	2	100
	INTERCASA	1	100
	FERO ARTE	2	100
	REDELSA	-	-
	INCA	-	-
	METASA	-	-
6.	SAWS	2	20,0
	incl. in EMENSA	-	-
	IMPLAGSA	-	-
	INTERCASA	1	100
	FERO ARTE	1	100
	INCA		
	METASA		
	IMEP		
7.	GRINDING MACHINES	2	50,0
	incl. in INTERCASA	1	100

5	6	7	8	9	10	11	12	13
-	-	2	66,7	1	33,3	-	-	3
-	-	1	100,0	-	-	-	-	1
-	-	-	-	1	100,0	-	-	1
-	-	1	100,0	-	-	-	-	1
3	21,4	-	-	4	28,6	2	14,3	14
-	-	-	-	3	100	-	-	3
-	-	-	-	-	-	-	-	2
-	-	-	-	-	-	-	-	1
1	100,0	-	-	-	-	-	-	2
-	-	-	-	-	-	2	100,0	1
2	66,7	-	-	1	33,3	-	-	2
3	30,0	3	30,0	-	-	2	20,0	3
2	100	-	-	-	-	-	-	10
-	-	2	100,0	-	-	-	-	2
1	100	-	-	-	-	-	-	1
-	-	1	100	-	-	2	100	1
-	-	1	25,0	-	-	1	25,0	2
								1

1	2	3	4
	INCA	1	50,0
	METASA		
8.	HYDRAULIC PRESSES	6	66,7
	incl. in EMENSA	1	50,0
	IMPLAGSA	4	100
	INCA	1	100
	METASA		
9.	OTHER MACHINES	21	50,0
	incl. in IMEP	6	100
	EMENSA	7	100
	INCA	3	50,0
	METASA	-	-
	IMPLAGSA		
	ELISA	5	83,3
10.	EQUIPMENT FOR ELECTRIC WELDING	48	34,0
	incl. in EMENSA		
	IMPLAGSA		
	INTERCASA	3	100
	FERO ARTE	7	77,8
	REDELSA	1	20,0
	METASA	15	22,1
	INCA	3	75,0
	IMEP	19	95,0

5	6	7	8	9	10	11	12	13
-	-	1	50,0					2
						1	100	1
-	-	1	11,1	-	-	2	22,2	9
-	-	1	50,0	-	-	-	-	2
								4
								1
						2	100	2
7	16,7	4	9,5	-	-	10	23,8	42
								6
								7
2	33,3					1	16,7	6
-	-	1	10,0	-	-	9	90,0	10
4	57,1	3	42,9	-	-	-	-	7
1	16,7							6
91	64,5	2	1,5					141
27	100							27
5	83,3	1	16,7					6
								3
2	22,2							9
2	40,0	1	40,0					4
53	77,9							68
1	25,0							4
1	5,0							20

SECTION II

F E A S I B I L I T Y   S T U D Y

1. GENERAL

By virtue of the recommendation of the Contract the study should cover the repair facilities for the metalworking machines in the metalworking sector to the industrial sector of Nicaragua. The study has been performed in the volume proceeding from the obligations of Machinoexport's side, at the same time an attempt being made to expand its range over the whole industrial production. In such a way the considered problem could be solved on a national level, increasing the effectiveness of the study at the same time.

The recommendation of the Contract for elaboration of short-term programme for initial reinforcement of one or two of the existing repair workshops for metalworking machines could not be realized. The reason is that there are no such workshops in the public industrial sector. There is no data available on the existence of such workshops in the private sector also. With a view to the above, the investigation and pre-feasibility study orientated to the setting-up of a new repair and maintenance centre for the existing metalworking machines on the basis of present necessities. The next stage of its development - 1985, is solved by expansion in accordance with the anticipated growth of the quantity of the metalworking machines. The future development of the Centre to be determined by the prospects for increase of the necessities for repair facilities is also taken into consideration.

Prior to setting forth this feasibility study it is necessary to be emphasised that the amount of 60.000 US\$ stated in the Contract is not adequate as here is concerned an entirely new centre to be set up and this amount will turn out to be only a small part of the necessary capital investments, the determination of which is the subject matter of this feasibility study.

Below is cited an example giving information on the losses to sustain the Nicaraguan side in case of stay due to failures of the metalworking machines. We dispose of the data on two factories:

- METASA - 377,24 Córdobas / per hour
- INCA - 1212,76 " / "

## 2. TECHNOLOGICAL SIZING OF THE REPAIR FACILITIES FOR METALWORKING MACHINES IN THE METALWORKING SECTOR

### 2.1. PRODUCTION PROGRAMME

The production programme which served as a basis for the technological sizing has been determined by the necessities for repair and maintenance of the existing metalworking machines at the first stage /1980/ as well as by the anticipated dynamics of the development of this sector for the second stage /1985/. For the calculations we had data only on the existing metalworking machines in COIP. The relative share of the machines in the private sector of the metalworking industry is mentioned as anticipated percentage part of the total quantity of the metalworking machines on the basis of the proportion of the total industrial production, i.e.:

- COIP - 49%
- private sector - 51%

With a view to the above the results of the feasibility study are subject to further specifying. The reason for this is the lack of data on the existing metalworking machines in the private sector by types and quantities as well as the lack of realistic data on the types and quantities of the machines at the II stage.

The calculations for the II stage have been carried out at anticipated growth of the machines in the sector by 40%.

The centre has been sized on the basis of the following production programme for the I stage.

Nr.	Denomination of machine	Existing machines in COIP	Existing machines in the private tor /presumed/	Totally
1.	Combination lathes	21	22	43
2.	Universal Milling Machines	6	6	12
3.	Shaping machines	4	4	8
4.	Radial-drilling machines	3	3	6
5.	Bench and pillar drilling machines	14	14	28
6.	Hack-sawing machines	10	10	20
7.	Grinding machines	4	4	8
8.	Hydraulic presses	9	9	18
9.	Other machines	42	44	86
10.	Equipment for electric welding	141	147	288
11.	TOTALLY	254	263	517

The grinders are not included in the total quantity of machines as their repair is extremely simple. For the same reason are not included also some of the machines under the caption "Other machines" /hand shears, pantographs, nut-tighteners, etc./

## 2.2. TECHNOLOGICAL CALCULATIONS

On the basis of the above-mentioned types and quantities of machines are determined the labour- and machine-consumption for carrying out the repair and maintenance of same. The calculations are made on the basis of the norms concerning the repair and technical maintenance of metalworking machines and equipment existing in Bulgaria, using the

literature mentioned at the end of the feasibility study. The labour- and machine consumption necessary for the repair and maintenance of the metalworking machines existing in COIP are shown in Appendix Nr. 1.

The quantities of the basic metalworking machines needed are determined by the formula:

$$n_{MH} = \frac{CMC \cdot SPC}{AAFWH \cdot \eta} / \text{pcs.}/$$

where: CMC is the calculated machine-consumption - machine/hour

AAFWH is the actual annual fund of working hours of 1 machine - 1600machine/hours

SPC is the coefficient accounting for the spare parts manufacture - 1.3

$\eta$  is the utilization coefficient for the machine 0,8

As usually by calculation a fraction is obtained, it is rounded off to the next larger whole number.

The quantities of the particular types of machines are determined as percentage part of the calculated total number of the basic machines in the following limits:

- combination lathes	45-50%
- heavy-duty lathes	2-3%
- radial-drilling machines	2-3%
- pillar drilling machines	2-6%
-universal milling machines	7-9%
- shaping machines	2-3%
- grinding machines	10-12%
- gear-cutting machines	6-7%
- other machines	they add to 100%



The quantity of the auxiliary machines /hack-sawing machines, hydraulic presses, welding machines, universal stationary and portable sharpening machines - grinders, etc./ is determined in accordance with the norms - depending on the number of basic machines in the repair unit. Usually for repair units having up to 30 pcs. of basic machines are provided by 1 piece of each type of auxiliary machines.

The number of the principal workers is determined in the following way:

-for operation of the basic metalworking machines - according to their number /it is taken for granted that the centre will work at one shift/, i.e. the number of the principal workers coincides with the number of basic machines computed.

- for carrying out of fitting and electrical fitting operations - depending on the labour-consumption computed by the formula:

$$n_{pm} = \frac{CLC}{AAFWH} \quad /pcs./$$

where: CLC is the computed labour-consumption - man/hour

AAFWH is the actual annual fund of working hours for

1 worker - 1500 man/hours

The result of the calculation is rounded off to the next larger number.

The number of the ancillary workers/to perform subsidiary activities, necessary for operations in the departments, for the outside transport, unskilled labour, cleaning of the working areas, etc./ is determined by experts' assessment. On the basis of the results from Appendix 1 calculations are made for the necessary basic machine tools and principal workers. By the calculations it is taken in mind that the relative share of COIP is 49% of the total volume of the metalworking sector, the remaining part being attributed to the private sector.

Calculations have been made for the I and II stage.

I stage - 1980

a/ Calculated labour-consumption

- fitter's operations -  $8940/0,49 = 18245$  man/hours

CLC = 18245 man/hours

- electric fitter's operations -  $2483/0,49 = 5067$  man/hours

CLC = 5067 man/hours

- repair of equipment for electrical welding -  $6338/0,49 = 12935$  man/hours

CLC = 12935 man/hours

- other operations -  $\frac{1758 \cdot 1,3}{0,49} = 4664$  man/hours

CLC = 4664 man/hours

b/ Calculated machine-consumption

CMC =  $5663/0,49 = 11557$  man/hours

CMC = 11557 man/hours

c/ Calculated number of basic machines

$$\eta_{CMC} = \frac{CMC \cdot PC}{AAFWH} = \frac{11557 \cdot 1,3}{1600 \cdot 0,8} = 11,7$$

= 12

d/ Calculated number of principal workers

- for handling of the basic machine tools - 12 persons

- fitters

$$\eta_{CLC} = \frac{CLC}{AAFWH/man} = \frac{18245}{1500} = 12 \text{ persons}$$

- electric fitters

$$CLC = \frac{CLC}{AAFWH/man} \frac{5067}{1500} = 3,4$$

$n_p = 4$  persons

- electric fitters engaged in the repair of equipment for electrical welding:

$$n_{pu} = \frac{CLC}{AAFWH/man} \frac{12935}{1500} = 8,6$$

- workers engaged in thermal processing, electrical operations, gas welding operations, tinsmith's operation and dyeing.

$$n_{pu} = \frac{CLC}{AAFWH/man} \frac{4664}{1500} = 3,1$$

$n_{p,pu} = 4$  persons

Total number of the principal workers

$n_{p,pu} = 41$  persons

## II stage - 1985.

The dynamics of the development of this sector is expected to reach by 1985 a growth of 40% as compared to the T stage. As we have no other data available we assume the growth of the metalworking machine in the sector shall be the same. On this basis are made the respective calculations.

### a/ Labour-consumption

- fitter's operations

$$CLC = 1,4 \cdot 18245 = 25543 \text{ man/hours}$$

- electric fitter's operations

$$CLC = 1,4 \cdot 5067 = 7094 \text{ man/hours}$$

- repair of electric welding equipment

$$CLC = 1,4 \cdot 12935 = 18109 \text{ man/hours}$$

- other operations

$$CLC = 1,4 \cdot 4664 = 6530 \text{ man/hours}$$

b/ Calculated machine-consumption

$$CMC = 1,4 \cdot 11557 = 16180 \text{ machine/hours}$$

c/ Calculated number of basic machines

$$n_{\text{ми}} = \frac{16180 \cdot 1,3}{1600 \cdot 0,8} = 16,4$$

$$n_{\text{мпр}} = 17$$

d/ Calculated number of main repair workshops

- for service of the basic metalworking machines - 17 persons
- fitters

$$n_{\text{ри}} = 25543/1500 = 17; \quad n_{\text{рпр}} = 18 \text{ persons}$$

- electric fitters

$$n_{\text{ри}} = 7094/1500 = 4,7 \quad n_{\text{р.рр}} = 5 \text{ persons}$$

- electric fitters for repair of electric welding equipment

$$n_{\text{ри}} = 18109/1500 = 12 \quad n_{\text{р.рр}} = 12 \text{ persons}$$

- workers engaged in thermal processing, electrical operations, gas welding operations, tinsmith's operations, painting:

$$n_{\text{ри}} = 6530/1500 = 4,4 \quad n_{\text{рпр}} = 4 \text{ persons}$$

Total number of the principal workers:

$$n_{\text{рпр}} = 56 \text{ persons.}$$

### 2.3. MACHINES AND EQUIPMENT

On the basis of the calculations, the norms derived from the literature cited and of the experts' assessment are chosen the types and quantities of machines and equipment to be used for repair and maintenance of

the metalworking machines in the metalworking sector. They are shown in Appendix Nr. 2.

The small differences which might be noticed by a comparison of the calculated quantity of basic machines and the assumed quantity, included in the Appendix, are due to the author's desire to expand the nomenclature of the machines to be mounted in the centre. Furthermore, the tendency of minimum capital investments by setting-up of the project has been followed. For the same reason of all machines shown in the table is provided only by 1 piece.

#### 2.4. TECHNOLOGY

The different kinds of repair operations and their volume, provided for in the so-called integrated system for upkeep of machines and equipment in the machinebuilding and metallurgical establishments in the People's Republic of Bulgaria, which is the main and obligatory document for the preventive repair activities, are shown in Appendix Nr.3.

The present feasibility study envisages centralized performance of all activities connected with the repair and maintenance of the metalworking machines in the metalworking sector. The centralized system corresponds to the scale of the metalworking industry in Nicaragua. In our opinion it is the only possible solution for organizing of preventive repair activities in the prevailing conditions in the country. This is determined on the first place by the lack of qualified specialists and workers to lay the foundations of such activity in the separate establishments and by the objective possibilities for spare parts manufacture.

It is envisaged that in the centre shall be varried out all overhauls of the metalworking machines having up to 5 tons incl. weight. The machines weighing over 5 tons shall be repaired on the spot - in the establishment where they are mounted. On the spot shall be performed all current repairs and planned check-ups for inspection of the tech-

nical condition of the machines and equipment and elimination of small defects. The above-said holds good also for failure repairs.

The worked out schedule for repair and maintenance of metalworking machines in the metalworking sector of COIP / for we have no data available for the private sector/ , Appendix Nr. 4, envisages planned check-ups of each machine which is to be repaired in the centre. In addition to that, the types and quantities of spares necessary for the repair, shall be specified with adequate precision. Sufficient time is envisaged between the check-ups and the repairs, so that the necessary spare parts could be supplied or manufactured. Only such an organization of the work shall make possible the repairs to be carried out in accordance with the schedule and reaching good quality.

#### 2.5. OPERATING STAFF

The number of the principal workers by stages has been determined in section "Technological Calculations". On this basis, in accordance with the technological equipment chosen to be mounted and the experts' assessment, is determined the operating staff of the repair and maintenance centre for metalworking machines. It is shown in Appendix Nr. 5.

The number of the workers and the total number of the staff of the centre is as follows:

	I stage	II stage
- workers	48	65
- overall operating staff	60	75

The principal part of the above-mentioned operating staff is very highly or highly skilled in the respective speciality and from our short stay in Nicaragua we were left with the impression that this part is not on hand.

#### 2.6. ORGANIZATIONAL STRUCTURE OF THE PROPOSED CENTRE FOR REPAIR AND TECHNICAL MAINTENANCE OF METALWORKING MACHINES

By elaboration of the structure of the centre are taken into consideration the scale of production - single production, showing tendency

towards small-scale at the II stage. The accepted group form of production organization determines the organizational structure as follows:

Repair and maintenance centre for metalworking machines

1. Repair and maintenance workshop
  - 1.1. Disassembly shop
  - 1.2. Section "Survey of workpieces, units and products"
  - 1.3. Mechanical treatment section
  - 1.4. Mechanical fitting section
  - 1.5. Electromechanical treatment section
  - 1.6. Coiling of electric motor section
  - 1.7. Repair of electric welding devices section
  - 1.8. Heat treatment shop
  - 1.9. Welding section
  - 1.10. Cutting section
  - 1.11. Assembly shop
2. Functional sections
  - 2.1. Store "Metals"
  - 2.2. Store "Bought-out parts and spares"
  - 2.3. Tool and delivery store
  - 2.4. Canteen

2.7. LOCATION OF THE CENTRE

During our study our attention was drawn by the site of the factory "ALUNISA", region "Franca", not far away from the airport "A.S. SANDINO", as suitable place for setting-up of a repair centre for metalworking machines. On the site is erected a building consisting of 2 production halls, each having length 54 m, width 20 m and module 6 m, and a administration and public services building, having length of 6 m and two floors, being adjoined to its facade.

The total built up production area is 2160 sq.m. and the total built up volume is 14040 m<sup>3</sup>. The total built up area for administration and public services needs on both floors is about 480 sq.m. and the total built up volume is 1788 m<sup>3</sup>. The structure of the building is metal, with monolythic external and internal walls in the administration and public services part of it. The site is electricity and water supplied and there are communications. By the time of the study in one of the production halls were mounted some machines but they were out of exploitation. The management of COIP has been made familiar with our proposal but has not given its official position on using this site for the centre, nor has it agreed for some other site.

The roads at the site as well as the main approaches to it are built. Big inconvenience is the lack of hoisting cranes and the impossibility of affixing of such to the structure of the building or at the supporting columns, as well as the relatively small height - about 4,5 m to the lower edge trusses supporting the roof construction. The question for installing of crane in part of one of the halls /where it shall be necessary for the technology/ is subject to further examination as to whether it is soluble from a technical point of view - by erection of new supporting columns among the existing and suspension under-crane rails on them, or by portal crane.

This site gives the possibility for immediate proceeding to the erection of the repair and maintenance centre for metalworking machines considered in this feasibility study, while the determination of new site and development such possibility would drift away significantly. This is not advantageous for the Nicaraguan side.

The general solution of the question should be sought at the next stage of the feasibility study by setting up the centre on other site and new construction in accordance with the needs of the centre.



## 2.8. NECESSARY BOUGHT-OUT PRODUCTS AND MATERIALS

The quantity of the necessary materials and blanks are determined by the formula:

$$Q_{M_i} = d \cdot H \cdot (\Sigma V_0 + \beta \Sigma V_T)$$

where:  $d; \beta$  is the coefficient accounting for the consumption of source materials by overhauls, maintenance and current repairs;

H is the consumption of materials for one overhaul of a conditional repair unit - kg

$\Sigma V_0; \Sigma V_T$  sum of the repair units of the machines and equipment which are to be put under current repair or overhaul. /Appendix Nr.1./

After the calculations respectively made and the experts' assessment for accounting of some peculiar features of the spare parts manufacture in Nicaragua are obtained the results shown in the following table:

Nr.	Denomination	Standard	Annual consumption	
			I stage	II stage
1	2	3	4	5
1.	Cast iron castings	kg	5600	7420
2.	Steel castings	"	4860	6940
3.	Bronze castings	"	1843	2580
4.	Aluminium castings	"	1570	1998
5.	Constructional steel	"	6246	8744
6.	Special steel	"	6763	9468

1	2	3	4	5
7.	Covered copper wire	kg	2000	2800
8.	Copper wire for repair of electric welding equipment	"	7173	10042
9.	Rolled brass	"	516	582
10.	Copper and brass rods	"	221	309
11.	Copper tubes	"	81	113
12.	Spring steel wire	"	154	216
BOUGHT-OUT PRODUCTS				
1.	Ball and roller bearings	pcs.	468	655
2.	Rubber wedge-shaped belts	"	724	1014
3.	Steel electrodes for welding	kg	583	816
OTHER MATERIALS				
1.	Petroleum	kg	932	1305
2.	Petrol	"	854	1197

Special attention should be drawn on a matter of extreme significance for the spare parts manufacture - i.e. the question for the blanks - ferrous and non-ferrous castings and alloys and forgings. At a further stage of the feasibility study it is absolutely necessary to examine the question for the existence and possibilities of foundry and forging facilities and capabilities in Nicaragua as the project here considered shall be not the only consumer of cast blanks and forgings. The high-quality and cheap spare parts manufacture is not possible without availability of production capacity for high-quality and forgings and castings.

#### 2.9. FOREIGN SPECIALISTS NEEDED; RECRUIT AND TRAINING OF LOCAL STAFF

The study indicated that at least in the metalworking sector of COIP /as already stated the private sector has not been studied/ there are no highly-qualified specialists and workers to take care of the preventive repair of the technological equipment in the metalworking sector.

In Appendix Nr. 5 are shown the qualification and skills requirements for the operating staff of the repair and maintenance centre for metalworking machines. It is evident that till the local staff potential is created the help of foreign specialists and workers should be used.

It is advisable to make use of the help of country having experience in the field of centralized preventive repair activities in the following directions:

- carrying out of feasibility study and designing of repair and maintenance centre for metalworking machines;
- making available technologies for repair and maintenance of metalworking machines, suitable for the conditions in Nicaragua;
- making use of the experience of specialists and workers from such country for the setting-up and putting into operation of the repair facilities, reaching of the planned capacity of the centre and training of local staff to wholly take over the operation of the centre;
- future development of the centre in direction "repair and updating of metalworking machines"

At the next stage of the feasibility study it would be advisable to examine the possibilities for concentrating of the repair activities and spare parts manufacture designed for metalworking machines for the whole country - for the industrial sector as well as for the transport, construction, farming and other branches of economy where metalworking machines are used. This recommendation is determined by the scale of the country and by the necessity of creating pre-requisites and conditions for the efficient utilization of the production capacities.

In Appendix Nr. 6 is shown the specification of the necessary foreign specialists and workers to organize, set up and put into operation the repair facilities and reach the planned capacity of the centre and to train the local staff.

The positions not envisaged to be filled by foreign specialists and workers shall be occupied by Nicaraguan people. Their training shall begin immediately after their appointment.

The recruit of local staff to be trained at the centre should be done upon proposal by the Nicaraguan side and must be co-ordinated with the management of the centre. It is recommended that to all positions held by foreign specialists and workers be appointed understudies suitably selected from among the local staff, so as to enable them to be trained every day.

At this stage it is difficult /and not advisable/ to work out specifications of the courses for training of local staff. Same holds good for the curriculum of such courses. It is better that it be done in Nicaragua by the foreign specialists to be engaged in the centre. Furthermore, being on the spot, they will avail of more information on the qualification and knowledge of the staff proposed for training.

The possibility for training of the Nicaraguan staff in the country the help of which will be made use of, is not excluded either. But these are matters which are subject to additional discussions and determination.

2.10. Determination of the total amount of the investments /general estimate/

By evaluation of the project it is assumed that the centre shall be located in the existing factory "ALUNISA", region "Franca" in Managua, with total area of the site about 8.000 sq.m., erected production halls with built-up area 2160 sq.m. and volume 14040m<sup>3</sup>, administration and public services building butted to them, with built-up area of 275 sq.m. and volume 1788m<sup>3</sup>. The site is power and water supplied and there are communications and sewerage set up. The administration and public services building is in two storeys. The value of the site and of the erected production facilities available is included in the total amount of the capital investments with a view of their buying off by the exploitation of the project.

Resources for reconstruction and expansion of the existing equipments and installations with a view of meeting the technology's requirements are also provided for.

Part I.

1. Land /site/ - about 8000 sq.m. - 110 Córdoba/m <sup>2</sup>	880000 Córdoba
2. Machines and equipments needed for production, incl.: spare parts, cutting tools, accessories for 2 years of operation, measuring instruments and tools, transport charges and assembly work	
I stage	10546616 Córdoba
II stage	1882594 Córdoba
3. Buildings - altogether for I and II stage:	
- production hall 14040m <sup>3</sup> , 350Córd/M <sup>3</sup>	4914000 Córdoba
- administration and public services building 1788m <sup>3</sup> , 480 Córd/m <sup>3</sup>	858240 Córdoba

4. Equipment and installations for the production hall - altogether for I and II stage: 14040m <sup>3</sup> , 150 Córd/m <sup>3</sup>	2106000	Córdobas
5. Contingecies		
I stage	1064541	Córdobas
II stage	117575	Córdobas
<u>Part I - TOTALLY:</u>		
I stage	19511157	Córdobas
II stage	2000169	Córdobas
<u>Part II - altogether for I and II stage</u>		
<u>Technological expenses</u>		
1. Licence fees	250000	Córdobas
2. Technical help rendered by foreign specialists:		
- with higher technical education 4 persons, 2 years, 12 months, 30000 Córd/monthly	2880000	Córdobas
- highly qualified workers 12 persons, 12 months, 20000 Córd/monthly	2880000	Córdobas
5 persons, 24 months, 20000 Córd./monthly	2400000	Córdobas
3. Training of local specialists and workers:		
- with higher technical education 4 persons, 12 months, 9000 Córdobas/monthly	432000	Córdobas
- technical college 2 persons, 12 months, 6000 Córdobas/monthly	144000	Córdobas
- workers 34 persons, 12 months, 3800 Córd/monthly	1550400	Córdobas
4. Purchase of construction and technological documentation	47008	Córdobas
<u>Part II - TOTALLY :</u>	11006480	Córdobas

Part III - altogether for I and II stage

Industrial designing	1320490	Córdoba
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RECAPITULATION:

Total amount of the capital investments:

I stage	31838127	Córdoba
II stage	2000169	Córdoba

Note: if the site and production facilities of the factory "ALUNISA" are assumed to be paid off, the total amount of the capital investments is as follows:

I stage	24185887	Córdoba
II stage	2000169	Córdoba

By determination of the total amount of the investments for the project the UNIDO Manual for Carrying out of Feasibility Study has been used.

Due to lack of data on the cost of the construction and assembly work and the equipment and installations in the production halls, especially for Nicaragua has been used similar data for the erection of other projects abroad and also the experts' assessment method has been applied. At next stage these costs should be specified.

Same holds good for the costs in Section II /technological expenses/, which are subject to negotiations and agreement with the country to render the technical assistance.

2.11. ECONOMIC CALCULATIONS

2.11.1. GENERAL

For doing these economic calculations the UNIDO Manual for carrying out of feasibility study has been used.

As there is no data available concerning social security outlay, depreciation rates, profit, etc. in Nicaragua, the experts' assessment method has been applied and analogies with data by the erection of other projects abroad have been made.

These techno-economic calculations are to be specified at the next stage of the feasibility study.

2.11.2. CALCULATIONS FOR FUND "SALARY"

I. DATA

		I stage	II stage
1. Principal workers	number	12	18
Average annual salary	Córdoba	45600	48000
2. Ancillary workers	number	7	9
Average annual salary	Córdoba	36000	38000
3. Clerical staff /incl. public services staff/	number	12	15
Average annual salary	Córdoba	50000	55000
4. Sales personnel	number	2	2
Average annual salary	Córdoba	48000	50000

II. FUND "SALARY"

1. Principal workers			
salaries	Córdoba	547200	864000
social securing	Córdoba	109440	172800
Totally:	"	656640	1036800
2. Ancillary workers			
salaries	"	252000	342000
social securing	"	50400	68400
Totally:	"	302400	410400



3. Clerical staff			
salaries	Córdoba	600000	825000
social securing	"	120000	165000
Totally:	"	720000	990000
4. Sales personnel			
salaries	"	96000	100000
social securing	"	19200	20000
Totally:	"	115200	120000
RECAPITULATION:		1794240	2557200

2.11.3. DEPRECIATION RATE CALCULATIONS

Nr.	Investments	Depreciation rate - %	I stage		II stage	
			Invest. Córdoba	Depreciat. Córdoba	Invest. Córdoba	Deprec. Córdoba
1.	Production machines and equipment	12	10546616	1265594	12429210	1491505
2.	Buildings	2	5772240	115445	5772240	115445
3.	Installations	5	2106000	105300	2106000	105300
	Totally:		18424856	1486339	20307450	1712250

2.11.4. CALCULATIONS OF THE general production costs

Nr.	Structure of costs	I stage			II stage		
		Costs - Córdoba					
		import	local	totally	import	local	totally
1	2	3	4	5	6	7	8
1.	Source materials and raw material	2671124	-	2671124	3713972	-	3713972
2.	Salaries of the operating staff	-	959000	959000	-	1447000	1447000
3.	Auxiliary materials	-	100000	100000	-	120000	120000
	Direct costs - to- tally:	2671124	1059000	3730124	3713972	1567000	5280972

1	2	3	4	5	6	7	8
4. Administration							
expenses	-	840000	840000	-	1140000	1140000	
incl. salaries	-	720000	720000	-	990000	990000	
Management expenses-							
totally:	-	120000	120000	-	150000	150000	
5. Sales costs							
incl. salaries	-	115200	115200	-	120000	120000	
claims, etc.	-	60000	60000	-	60000	60000	
6. Interest under credit -							
	-	100000	100000	-	100000	100000	
7. Depreciation							
	-	1486000	1486000	-	1712000	1712000	
Costs - totally:	2671124	3660200	6331324	3713972	4699000	8412972	
Profit:	-	2763000	2763000	-	3046000	3046000	
Total industrial							
production:	-	-	9094324	-	-	11458972	

#### 2.11.5. GENERAL ECONOMIC DATA

1. Designation of the feasibility study  
Ministry of Industry - Nicaragua
2. Availability of establishments carrying out similar activities  
For the time being in Nicaragua there is no other establishment engaged in repair of metalworking machines and spare parts manufacture.
3. Raw materials and source materials  
For the near future all materials and source materials necessary for the production will be imported.
4. Tentative location  
Managua, region "Franca".
5. Production activity  
Repair and maintenance of about 500 machines at the I stage and about 700 - at the II stage, annually.

6. Technological processes

The usual technological processes applied by repair activities.

7. General economic data

Economic feature of the country

Gross national product:	1977	1978	1979	1980	1981*
Totally - million \$	2919	2668	1936	2674	2234
Growth - %	-	-8,5	-27,5	7,1	7,7

For 1980 - 759 \$ per person

Balance of payments	1978	1979	1980	1981*
Export - million \$	646	616	450	797
Import "	593	389	803	793
Trade balance million \$	-93	-387	-353	-296

\* 1981 - expected data

Economic system:

There are public, co-operative and private sectors in Nicaragua. It is envisaged that <sup>the</sup> three sectors shall develop.

Economic policy:

The policy of the country is to encourage the development and expansion of the public sector of the economy. The foreign investments are under the control of the state.

Legal statute of the establishment

State industrial establishment, without special tax privileges.

Workers and management

I stage - 60 persons; II stage - 75 persons;

Duration of the term for erection of the establishment

It is subject to specifying among the investor, designer and building organization.

Financial analysis

Investments: about 20 million Córdobas for the I stage

Financing: to be specified.

Production costs:

Direct: 6600 thousand Córdoba  
Depreciation: 1700 thousand "  
Interests 100 thousand "  
Totally: 8400 " "

Trade profitability:

Total industrial production: 11500 thousand Córdoba  
Production costs: 6600 " "  
Depreciation: 1700 " "  
Production profit: 3200 " "  
Interests: 100 " "  
Gross profit: 3100 " "  
Taxes - 50% 1550 " "  
Net profit: 1550 " "

$$\text{Profitability: } \frac{\text{net profit} + \text{interest}}{\text{investments}} = 100 - \%$$

$$R = \frac{1550 + 100}{2000} \cdot 100 = 8,2\%$$

Term for buying off of the investments:

$$\frac{\text{investments}}{\text{net profit} + \text{interest} + \text{depreciation}} =$$

$$\frac{20000}{1550 + 100 + 1700} = \frac{20000}{3350} = 5,97 \text{ years, i.e., about 6 years}$$

investments for one working position:

$$\frac{20000000}{75} = 26700 \text{ Córdoba}$$

2.11.6. CONCLUSIONS

The repair and maintenance centre for metalworking machines and spare parts manufacture shall be a state-owned establishment with significant importance for the country's economy.

By not large amount of the investments, the effect by its erection shall be of significant importance for all branches of the country's economy.

During the first year immediately after its erection, at the centre shall be carried out:

- 206 planned preventive check-ups
- 226 current repairs
- 262 overhauls.

T A B L E

for determination of the machine-consumption and labour-consumption for the repair and maintenance of the metalworking machines in subsector "Metalworking" of COIP

Nr.	Denomination of machine and enterprise where it is mounted	Year of delivery	Age in years	Technical characterist.		Complexity of repair		Duration of repair cycle			Mechanical aspect			Electrical aspect		
				L b/n centres	Ømax	mech. aspect	electr. aspect	over-haul years	curr. rep. m.	plan. check-ups -m	mech. fit- m/h	machine- consumpt. man/h	other treat- ments m/h	electric. fit- m/h	machine- m-ne/h	other treat- mentt m/h
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	LATHES															
1.	METASA	1970	11	3200	250	10	8	12	16	8	T-60	T-40	T-2	T-32	T-18	-
2.	"	1970	11	2000	154	9	6	12	16	8	T-54	T-36	T-2	T-24	T-13	-
3.	"	1976	5	1600	160	8	5	15	18	9	T-40	T-20	T-1	T-18	T-10	-
4.	EMEMSA	1978	3	5180	250	10	8	15	18	9	T-60	T-40	T-2	T-32	T-18	-
5.	"	1976	5	2100	195	9	6	15	16	8	T-54	T-36	T-2	T-24	T-13	-
6.	"	1976	5	2100	216	9	6	15	16	8	T-54	T-36	T-2	T-24	T-13	-
7.	"	1976	5	1550	216	9	6	15	16	8	T-54	T-36	T-2	T-24	T-13	-
8.	IMPLASA	1912	69	1000	200	8	5	12	16	8	0-192	0-88	0-24	0-55	0.10	0-8
9.	"	1973	8	1000	300	8	6	15	18	9	T-48	T-36	T-2	T-24	T-13	-
10.	"	1973	8	1000	220	8	6	15	18	9	T-48	T-36	T-2	T-24	T-13	-
11.	"	1967	14	1000	140	14	14	15	16	8	T-84	T-56	T-3	T-52	T-30	-
12.	INTERKASA	1977	4	2100	260	9	6	15	18	9	T-54	T-36	T-2	T-24	T-13	-
13.	"	1977	4	1050	250	8	5	15	18	9	T-48	T-32	T-2	T-18	T-10	-

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
14.	INCA	1971	10	2000	190	8	6	15	18	9	T-48	T-32	T-2	T-24	T-13	-
15.	"	1972	9	1000	380	9	7	15	18	9	T-54	T-36	T-2	T-28	T-26	-
16.	"	1971	10	3000	260	10	8	15	18	9	T-60	T-40	T-2	T-32	T-18	-
17.	"	1973	8	3000	400	10	8	15	18	9	T-60	T-40	T-2	T-32	T-18	-
18.	"	1967	14	4500	450	12	8	15	16	8	T-84	T-56	T-3	T-32	T-18	-
19.	"	1963	18	2500	310	10	8	13	13	8	0-240	0-110	0-30	0-88	0-16	0-12
20.	"	1963	18	2500	256	10	8	13	18	8	0-240	0-110	0-30	0-88	0-16	0-12
21.	"	1967	14	480	170	6	4	15	16	8	T-36	T-24	T-1	T-16	T-9	-

Total for the group of LATHES

Po=28 Po=21  
Pt=166 Pt=123  
194 144

1672 976 120 715 301 32

II. MILLING MACHINES

L max.

1.	INTERKASA	1978	3	1100	-	10	6	15	18	9	T-60	T-40	T-2	T-24	T-14	-
2.	INCA	1975	6	1000	-	10	6	15	18	9	T-60	T-40	T-2	T-24	T-14	-
3.	"	1930	51	630	-	/	4	12	16	8	0-158	0-77	0-12	0-44	0-8	0-6
4.	"	1965	16	1100	-	10	6	12	16	8	0-240	0-110	0-30	0-66	0-12	0-9
5.	METASA	1960	21	1250	-	10	6	12	16	8	0-240	0-110	0-30	0-66	0-12	0-9
6.	"	1930	51	1200	-	10	6	12	16	8	0-240	0-110	0-30	0-66	0-12	0-9

Total for the group of  
MILLING MACHINES

Po=37 Po=22  
Pt=20 Pt=12  
57 34

1008 487 106 290 72 33

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17					
III. SHAPING MACHINES				L max																	
1.	EMEMSA	1977	4	1041	-	13	7	15	18	9	T-78	T-52	T-3	T-28	T-16	-					
2.	INTERKASA	1978	3	508	-	8	4	15	18	9	T-48	T-32	T-1	T-16	T-9	-					
3.	INCA	1925	56	914	-	12	6	10	16	8	0-288	0-132	0-36	0-66	0-12	0-9					
4.	METASA	1930	51	240	-	4	2	10	16	8	0-96	0-44	0-12	0-22	0-4	0-3					
Total for the group of the shaping machine						Po=16	Po=8														
						Pt=21	Pt=11									510	260	52	132	41	12
						37	19														

IV. RADIAL-DRILLING MACHINE				Ømax																	
1.	EMEMSA	1970	11	40	-	13	10	12	16	8	T-78	T-52	T-2	T-40	T-23	-					
2.	INCA	1960	21	20	-	6	4	12	16	8	0-144	0-66	0-18	0-44	0-8	0-6					
3.	METASA	1970	11	45	-	12	6	12	16	8	T-72	T-48	T-2	T-24	T-13	-					
Total for the group of the radial-drilling machines						Po=18	Po=10														
						Pt=13	Pt=10									294	166	22	108	94	6
						31	20														

V. PILLAR AND BENCH DRILLING MACHINES				Ømax												
1.	EMEMSA	1968	13	19	-	6	3	15	16	8	T-36	T-24	T-1	T-12	T-7	-
2.	"	1968	13	19	-	6	3	15	16	8	T-36	T-24	T-1	T-12	T-7	-
3.	"	1968	13	19	-	6	3	15	16	8	T-36	T-24	T-1	T-12	T-7	-



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
4.	IMPLASA	1976	5	13	-	6	3	18	16	8	T-36	T-24	T-1	T-12	T-7	-	
5.	"	1976	5	32	-	7	3	18	16	8	T-42	T-28	T-1	T-12	T-7	-	
6.	INTERKASA	1975	6	25	-	6	3	18	16	8	T-36	T-24	T-1	T-12	T-7	-	
7.	FERO ARTE	1977	4	13	-	6	3	18	18	9	T-36	T-24	T-1	T-12	T-7	-	
8.	"	1976	5	13	-	6	3	18	18	9	T-36	T-24	T-1	T-12	T-7	-	
9.	REDELSA	1971	10	6,3	-	5	2	18	18	9	T-30	T-20	T-1	T-8	T-4	-	
10.	INCA	1925	56	19	-	6	3	15	16	8	0-144	0-66	0-18	0-66	0-12	0-9	
11.	"	1930	51	13	-	6	3	15	16	8	0-144	0-66	0-18	0-66	0-12	0-9	
12.	METASA	1975	6	6,3	-	5	2	18	18	9	T-30	T-20	T-1	T-8	T-5	-	
13.	"	1960	21	13	-	6	3	15	16	8	0-144	0-66	0-18	0-66	0-12	0-9	
14.	"	1972	9	19	-	6	3	18	18	9	T-36	T-24	T-1	T-12	T-7	-	
Total for the group of pillar and bench drilling machines						Po=18 Pt=65 83	Po=9 Pt=31 40				822	438	65	322	108	27	48

#### VI. HACK-SAWING MACHINE

				$\varnothing_{max}$												
1.	EMEMSA	1972	9	180	-	6	3	15	18	9	T-36	T-24	T-1	T-12	T-7	
2.	"	1972	9	180	-	6	3	15	18	9	T-36	T-24	T-1	T-12	T-7	
3.	IMPLASA	1970	11	180	-	6	3	13	18	9	T-36	T-24	T-1	T-12	T-7	
4.	"	1970	11	180	-	6	3	13	18	9	T-36	T-24	T-1	T-12	T-7	
5.	INTERKASA	1978	3	180	-	6	3	15	18	9	T-36	T-24	T-1	T-12	T-7	
6.	FERO ARTE	1976	5	180	-	6	3	15	18	9	T-36	T-24	T-1	T-12	T-7	
7.	INCA	1972	9	200	-	6	3	15	18	9	T-36	T-24	T-1	T-12	T-7	
8.	METASA	1960	21	200	-	6	3	12	16	8	0-144	0-66	0-18	0-33	0-12	0.5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
9.	METASA	1960	21	200	-	6	3	12	16	8	0-144	0-66	0-18	0-33	0-12	0-5
10.	IMEP	1970	11	200	-	6	3	15	18	9	T-36	T-24	T-1	T-12	T-7	
Total for the group of the hack-sawing machines						Po=12 Pt=48 60	Po=16 Pt=24 30				675	324	44	150	80	10

#### VII. GRINDING MACHINES

1.	INTERKASA	1973	3	-	-	16	4	15	18	9	T-96	T-64	T-4	T-16	T-9	-
2.	INCA	1965	16	-	-	16	4	12	16	8	0-384	0-176	0-48	0-44	0-8	0-6
3.	"	1975	6	-	-	16	4	15	18	9	T-96	T-64	T-4	T-16	T-9	-
4.	METASA	1945	36	-	-	14	4	12	16	8	0-336	0-154	0-42	0-44	0-8	0-6
Total for the group of grinding machines						Po=30 Pt=32 62	Po=8 Pt=8 16				912	458	98	120	34	12

#### VIII. HYDRAULIC PRESS

				tons													
1.	EMEMSA	1976	5	50	-	8	3	15	18	9	T-48	T-32	T-2	T-12	T-7		
2.	"	1970	11	80	-	9	4	15	18	9	T-54	T-36	T-2	T-16	T-9		
3.	IMPLASA	1976	5	150	-	12	6	15	18	9	T-72	T-48	T-3	T-24	T-14		
4.	"	1976	5	150	-	12	6	15	18	9	T-72	T-48	T-3	T-24	T-14		
5.	"	1951	130	40	-	8	3	12	16	8	0-192	0-88	0-24	0-33	0-6	0-5	
6.	"	1976	5	150	-	12	6	15	18	9	T-72	T-48	T-3	T-24	T-14		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
7. INCA		1975	6	25	-	8	3	15	18	9	T-48	T-32	T-2	T-12	T-7	
8. METASA		1960	21	90	-	9	4	12	16	8	0-216	0-99	0-27	0-44	0-8	0.6
9. "		1960	21	200	-	14	7	12	16	8	0-336	0-154	0-42	0-27	0-14	0-11
Total for the group of hydraulic presses						Po=31	Po=14									
						Pt=61	Pt=28				1110	585	108	266	93	22
						92	42									

IX. OTHER MACHINES

Establishm.

1. Cam press	1976	5	10t	EMEMSA	5	3	15	18	9	T-30	T-20	T-1	T-12	T-7	
2. " "	1977	4	6t	"	4	2	15	18	9	T-24	T-16	T-1	T-8	T-5	
3. " "	1977	4	6t	"	4	2	15	18	9	T-24	T-16	T-1	T-8	T-5	
4. Guillotine	1977	4	6,3mm	"	8	4	15	18	9	T-48	T-32	T-2	T-16	T-9	
5. Shaping machine	1977	11	H-300	IMPLASA	5	3	12	16	8	T-30	T-20	T-1	T-12	T-7	
6. Guillotine	1965	16	6,3mm	"	7	3	20	14	8	T-42	T-28	T-2	T-12	T-7	
7. Guillotine	1975	6	3mm	REDELSA	5	3	15	18	9	T-30	T-20	T-1	T-12	T-7	
8. Combined press shears	1975	6	8t	"	5	3	15	18	9	T-30	T-20	T-1	T-12	T-7	
9. Hand edging m-ne	1975	6	6,3mm	"	3	-	15	18	9	T-18	T-12	T-1	-	-	
10. Hand guillotine	1970	11	6,3mm	"	3	-	12	16	8	T-18	T-12	T-1	-	-	
11. Hand edging m-ne	1975	6	3,15mm	"	3	-	15	18	9	T-18	T-12	T-1	-	-	
12. Hand guillotine	1975	6	6,3mm	"	3	-	15	18	9	T-18	T-12	T-1	-	-	
13. Shaping machine	1925	36	H=620	INCA	8	4	12	16	8	0-192	0-88	0-24	0-44	0-8	0-6
14. Slotting machine	1976	5		"	8	5	15	18	9	T-48	T-32	T-2	T-20	T-13	-
15. Hand guillotine	1973	8		"	3	-	15	18	9	T-18	T-12	T-1			

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
16.	Combined pressshears	1950	31	15t	METASA	6	2	12	16	8	0-144	0-66	0-18	0-22	0-4	0.3
17.	Guillotine	1960	21	1,9mm	"	8	2	12	16	8	0-192	0-88	0-24	0-11	0-16	0-12
18.	"	1968	13	6,3mm	"	6	2	13	16	8	T-36	T-24	T-1	T-8	T-5	
19.	"	1960	21	25mm	"	10	3	12	16	8	0-240	0-110	0.30	0-33	0-6	0-5
20.	Bending shaft	1960	21	"	"	4	2	12	16	8	0-96	0-44	0-10	0-22	0-4	0-3
21.	"	1960	21	8mm	"	4	2	12	16	8	0-96	0-44	0-10	0-22	0-4	0-3
22.	Combined press shears	1960	21	10t	"	6	2	12	16	8	0-144	0-66	0-18	0-22	0-4	0-3
23.	"	1960	21	6t	"	5	2	12	16	8	0-120	0-55	0-15	0-22	0-4	0-3
24.	"	1960	21	15t	"	6	2	12	16	8	0-144	0-66	0-18	0-22	0-4	0-3
25.	Hand guillotine	1950	31	"	"	3	-	12	16	8	0-72	0-33	0-9	-	-	-
26.	Guillotine	1975	6	10mm	IMEP	7	2	20	18	9	T-42	T-28	T-2	T-8	T-5	-
27.	Edging machine	1975	6	10mm	"	8	4	20	18	9	T-48	T-32	T-2	T-16	T-9	-
28.	Combined press shear	1975	6	8t	"	6	2	20	18	9	T-36	T-24	T-2	T-8	T-5	-
29.	"	1975	6	10t	"	6	2	20	18	9	T-36	T-24	T-2	T-8	T-5	-
30.	Bending shaft	1980	1	"	"	4	2	20	18	9	P-2	-	-	-	-	-
Total for the group						Po=60	Po=21									
"Other machines"						Pt=101	Pt=42	2036	1056	202	380	150	42			
						161	63									

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
X.	WELDING EQUIPMENTS			weld.curr.	PCS:											
1.	EMEMSA	1974	7	225-300	26	-	130	5	12	6	-	-	-	0-1430	-	0-295
2.	"	1975	6	255	1	-	5	5	12	6	-	-	-	0-55	-	0-8
3.	IMPLASA	1972	9	150-225	5	-	25	5	12	6	-	-	-	0-275	-	0-38
4.	"	1968	13	150	1	-	5	5	12	6	-	-	-	0-55	-	0-8
5.	INTERKASA	1976	5	250	1	-	5	5	12	6	-	-	-	T-20	-	-
6.	"	1980	1	400	2	-	5	5	12	6	-	-	-	T-40	-	-
7.	FERO ARTE	1970	11	225	1	-	5	5	12	6	-	-	-	0-55	-	0-8
8.	"	1976	5		1	-	5	5	12	6	-	-	-	T-20	-	-
9.	"	1980	1	225-400	7	-	5	5	12	6	-	-	-	T-140	-	-
10.	REDELSA	1965	16	150	1	-	5	5	12	6	-	-	-	0-55	-	0-8
11.	"	1973	8	180-400	2	-	5	5	12	6	-	-	-	0-110	-	0.16
12.	"	1980	1	400	1	-	5	5	12	6	-	-	-	T-20	-	-
13.	INCA	1970	11	250	1	-	5	5	12	6	-	-	-	0-55	-	0-8
14.	"	1976	5	500	2	-	12	5	12	6	-	-	-	T-48	-	-
15.	"	1979	2	25	1	-	6	5	12	6	-	-	-	T-24	T-16	-
16.	METASA	1972	9	250-600	53	-	265	5	12	6	-	-	-	0-2915	-	0-398
17.	"	1978	3	120-750	7	-	40	5	12	6	-	-	-	0-440	-	0-60
18.	"	1980	1	400	8	-	48	5	12	6	-	-	-	T-192	-	-
19.	IMEP	1977	4	300-500	12	-	60	5	12	6	-	-	-	T-240	-	-
20.	"	1974	7	200	1	-	4	5	12	6	-	-	-	0-44	-	0-6
21.	"	1980	1	225	7	-	35	5	12	6	-	-	-	T-140	-	-

Total for the group of welding equipments

141 pcs.

Po=539

Pt=151

690

6338 16 745

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17					
RECAPITULATION AND SIZING											8940	4750	817	2483	913	991					
														+ 6338							

O - overhaul; T- current repair  
P - check-up

Calculated labour-consumption: mechanical fitting - 8940 man/hour  
electrical fitting - 2483 man/hour  
repair of welding equipments - 6338 man/hour  
others - 1758 man/hour

Calculated machine-consumption: - 5663 month/man

The above values represent the calculated labour-consumption and machine-consumption for the repair and technical maintenance of the existing machines in sector "Metalworking" of COIP

Remark: Owing to the fact that in Nicaragua there are no norms for the between-repair terms and for the repair complexity by the repair and maintenance of metalworking machines, the Bulgarian norms have been used, applying also the method of "experts' assessment". For this reason the results from the calculations are subject to more precise specifying at the next stages of the study.

L I S T  
of the necessary metalworking machines and equipments

Nr.	Denomination of the machines and equipment	Technical characteristics	Necessary number of machines		Approx. prices	
			I stage	II stage	I stage	II st
1	2	3	4	5	6	7
<b>A. PRINCIPAL MACHINES</b>						
<b>1. LATHES</b>						
1.1.	Combination lathe	Ømax 320 L=1000	-	1	-	49340
1.2	" "	Ømax 420 L=1000	1	1	92450	-
1.3.	" "	Ømax560 L=1000	-	1	-	106000
1.4.	" "	Ømax560 L=2000	1	1	122130	-
1.5.	" "	Ømax630 L=1000	-	1	-	106000
1.6.	" "	Ømax800 L=3000	1	1	226300	-
Total number of lathes			3	6	440880	261340
<b>2. MILLING MACHINES</b>						
2.1.	Milling machine-universal	250/1120	-	1	-	123270
2.2.	" " "	320/1370	1	1	145150	-
Total number of milling machines			1	2	145150	123270
<b>3. DRILLING MACHINES</b>						
3.1.	Radial-drilling machine	Ømax=55	1	1	239500	-
3.2.	Pillar drilling machine	Ømax=30	-	-	-	191000
Total ly for the drilling machines			1	2	239500	191000
<b>4. GRINDING MACHINES</b>						
4.1.	Universal circular grinding machine	Ømax=320	1	1	279500	-
4.2.	Plane grinding machine	200/630	1	1	215500	-
Totally for grinding machines			2	2	495000	-

1	2	3	4	5	6	7
5.	Gear cutting machine	m=8	1	1	866500	-
6.	Gear shaping machine	m=8	1	1	473750	-
7.	Gear shaving machine	m=6	1	1	443630	-
8.	Slotting machine	Hmax=200	1	1	149750	-
9.	Plano-type surface grinding machine	800/4000	1	1	3017500	-
10.	Shaping machine	Hmax=630	-	1	-	95380
11.	One-pillar drill-layout machine	400/630	1	1	856250	-
12.	Horizontal boring machine	Ømax=90 900/1120	-	1	-	867500
<u>Totally for the principal machines:</u>			<u>13</u>	<u>20</u>	<u>7127910</u>	<u>1538490</u>

**B. ANCILLARY MACHINES AND EQUIPMENT**

1.	Hydraulic saw	Ømax=400	1	1	50250	-
2.	Universal sharpener /grind/	Ømax=400	2	2	32500	-
3.	Portable angle-grinding machine /hand grind/	Ømax=200	1	2	3950	3950
4.	Hydraulic press	160 tons	1	1	126000	-
5.	Device for electric welding	400a	1	1	12850	-
6.	Set of torches for gas welding	set	1	1	7650	-
7.	Non-standard wheelbarrow for bottles for oxygen and propane-butane	weight 120 kg	1	1	4950	-
8.	Washing machine non-stand.	weight 800 kg	1	1	128500	-
9.	Electric heating box furnace	weight 320 kg	2	2	84000	-
10.	Electric heating shaft furnace for gas carburizing	weight 400 kg	1	1	480000	-
11.	Salt bath furnace	weight 2100 kg	1	1	116250	-
12.	Combined quenching tub	weight 500 kg	1	1	26500	-
13.	Washing bath	weight 340 kg	1	1	15000	-
14.	Electric heating shaft furnace	weight 2120 kg	1	1	88250	-
Totally for ancillary machines and equipment:			16	17	1176650	3950



1	2	3	4	5	6	7
<b>C. OTHER EQUIPMENT</b>						
1.	Non-standard bench for assembly	weight 120kg	3	5	22500	15000
2.	Non-standard bench for disassembly	weight 120kg	3	5	22500	15000
3.	Non-standard booth for welding	weight 1200kg	1	1	33000	-
4.	Welding table with gas sucker	weight 250kg	1	1	8250	-
5.	Vice	weight 120kg	6	8	33600	11200
6.	Tool cabinet	weight 60 kg	22	28	105600	28800
7.	Bench vice	weight 26 kg	26	32	20800	4800
8.	Unit assembly bench	weight 180kg	8	11	56000	21000
9.	Non-standard metal racks	weight 62 kg	14	26	30800	26400
10.	Non-standard stands for coiling of electric motors	weight 185kg	2	4	15000	15000
<u>Totally for other equipment:</u>			<u>86</u>	<u>121</u>	<u>348050</u>	<u>137200</u>

<b>D. HANDLING EQUIPMENT</b>						
1.	Single-beam hoisting crane	5 tons	1	1	272000	-
2.	Mini-bus	10-seater	1	1	240000	-
3.	Motor-car	5-seater	1	1	70000	-
4.	Platform electric truck	2 tons	1	1	60000	-
5.	High-lift electric truck	1t H=3200 m	1	1	95000	-
6.	Rectifier for charging of storage batteries		1	1	12000	-
<u>Totally for handling equipment:</u>			<u>6</u>	<u>6</u>	<u>749000</u>	<u>-</u>

<b>E. MEASURING INSTRUMENTS AND TOOLS</b>						
1.	Vernier depth gauge	125/0,1	20	30	3400	1700
2.	Two-sided jaw slide gauge	250/0,05	16	22	5280	1980
3.	One-sided slide gauge	400/0,1	10	15	12500	6250
4.	Slide gauge	250-710/0,1	3	5	4650	3100
5.	" "	320-1000/0,1	1	2	1980	1980
6.	" "	500-1600/0,1	1	1	2580	2580
7.	Gear tooth gauge	10/0,2	2	3	3620	1810
8.	Vernier depth gauge	400/0,05	2	4	1640	1640
9.	Micrometer	0÷25/0.01	2	3	1260	630
10.	"	25÷50/0.01	3	4	2070	690
11.	"	50÷75/0.01	3	4	2220	740

1	2	3	4	5	6	7
12.	Micrometer	75±100/0.01	2	3	1560	780
13.	"	100±125/0.01	2	3	1760	880
13a	"	125±150/0.01	2	3	1840	920
14.	"	150±175/0.01	2	2	1900	-
15.	"	175±200/0.01	2	2	2640	-
16.	"	200±225/0.01	2	2	2220	-
17.	"	225±250/0.01	1	2	1150	1150
18.	"	250±275/0.01	1	2	1210	1210
19.	"	275±300/0.01	1	2	1300	1300
20.	"	300±400/0.01	1	1	2960	-
21.	"	400±500/0.01	1	1	3420	-
22.	"	500±600/0.01	1	1	3750	-
23.	Steel block gauges	set of 83 gauges	1	1	16750	-
24.	Inside gauge	10/0.1	1	2	2580	2580
25.	"	10-18/0.01	2	2	5240	-
26.	"	18-55/0.01	2	3	5440	2720
27.	"	50-100/0.01	2	2	5800	-
28.	"	100-160/0.01	2	2	6280	-
29.	"	160-250/0.01	2	2	7860	-
30.	"	250-450/0.01	2	2	11140	-
31.	Micrometer depth gauge	100/0.01				
	with changeable tips	10 tips	2	2	2580	-
32.	Check three-sided line	30/320	1	2	680	680
33.	Check laying-out					
	bench	630/1000 class I	1	1	11730	-
34.	Vernier angle tes-					
	ter	0-180° <sub>+</sub> 2 min	1	1	1330	-
35.	Flat templet square	160/250 class I	2	3	1520	760
36.	Wide base fitter's					
	square	400/250 class I	2	3	1520	760
37.	Radius gauge for ex-					
	ternal and internal radii	1±25	3	3	120	-
38.	Screw pitch gauge	metric	3	4	120	400
		inch				

1	2	3	4	5	6	7
39.	Device for checking of the eccentricity between centres	Ømax 200	1	2	3700	3700
40.	Micrometric carpenter's level	max 200/0,1mm	1	1	2700	-
41.	Optical carpenter's level	150/0.01	1	1	4000	-
42.	Device for measuring of the nominal norms for gear wheels	M max=5	1	1	3000	-
43.	Stepmeter	M n max=16	1	1	4120	-
44.	Gear tooth micrometer	M n max=8 Lmax=50	1	1	3000	-
45.	Brinell hardness tester		1	1	10000	-
46.	Rockwell hardness tester		1	1	10000	-
47.	Set of electrical appliances	set	1	1	12000	-
<u>Totally for measuring instruments and tools:</u>					=====200120 38000=====	
Spare parts, cutting tools and appliances for 2 years' operation:					560817 96248 =====	
<u>RECAPITULATION:</u>						
Totally: machines and equipment					9401610 1670640	
for assembly					376064 67186	
incidental and transportation expenses					658113 117575	
spare parts, cutting tools and accessories necessary for 2 years' operation					560817 96248	
Overall for machines and equipment:					10996604 1960649	
Measuring instruments and tools, incl. 4% incidental expenses					208125 39520	
<u>TOTAL AMOUNT TO BE INVESTED:</u>					=====11204729 2000169=====	

Note: The prices of the machines and equipment included in this List are inclusive of the packing and freight to Nicaragua, on basis of deliveries in 1983.

A. KINDS OF REPAIRS

The integrated system for the upkeep of the machines and equipment in the machinebuilding and metallurgical industry in the People's Republic of Bulgaria envisages the following kinds of repair:

- planned preventive check-ups /P/
- current repair /T/
- overhaul /O/
- out-of-plan repairs.

The planned preventive check-up /periodical check-up/ as a rule is being carried out by disassembling of the separate components and units of the machine or equipment.

By the check-up is examined carefully the condition of the following:

- a/ fasteners, especially those bearing dynamic loading: crank mechanisms, bolts, nuts, sleeves, studs, etc.
- b/ adjusting details /wedges, tightening bushes, bearings, screws, etc./ and especially the clearances in them;
- c/ the oil and cooling system, oil-piping, casings, oil pumps, baths, etc.;
- d/ starting devices, transmissions, gear transmissions, belts, chains, friction connections, glands, different gaskets and fittings, the condition of the corroding surfaces, contacts, etc.;
- e/ examination of the condition of insulation of the electrical equipment;
- f/ cleaning of details and surfaces to which no access is possible during normal operation of the machines and equipments;
- g/ examination of control electrical equipment, contact connections, earthing, etc.

The results obtained from the preventive check-up and of the corrections made are entered in the passport of the machine - after example and in the diary, at the same time a list of the defects being drawn up.

The defects discovered in the machine and the operations performed to eliminate them are regularly entered in the diary. By the check-up the machines and equipments are thoroughly cleaned, the oil is being substituted or filled up, lubrication is done.

Current repair /I/ The current repair includes all operations performed by the check-up /P/. Besides, here are carried out a number of additional operations connected with the substitution of the quickly wearing parts, oil change, etc., as well as elimination of defects, connected with disassembly of the machine, taking account of characteristics, measuring and adjustments. By the current repair the following operations are also done:

- regeneration and scraping of bearings, reboring the shaft's necks;
- change of the friction brake belts, ropes, chains;
- change of the gaskets and the fasteners of the glands, etc.;
- repair or substitution of the worn out fittings and pipe lines by new ones, adjustment of the respective pressures;
- cleaning of the coils of the electrical equipment and lacquering, if necessary.
- repair of the heat-exchanging surfaces of the steam generators.

The current repair of a machine or equipment may begin only on condition that all spare parts and units, materials, appliances and instruments are available.

The results obtained and the data on the condition of the machine or equipment are entered in the passport of the machine.

The repaired machines and equipment are accepted by the foreman, by the head<sup>of</sup> department or his substitute.

Overhaul. The overhaul is the largest repair in terms of the volume of the operations carried out by it, by which all components and units

of the machine are disassembled, cleaned and washed, dried up, re-examined thoroughly and a list of the defect is being drawn up. On the basis of this list it is proceeded to the restoration of all components and units which are worn out, so that , after the overhaul, the machine must reach its initial capacity: precision, reliability, output in accordance with the passport of the machine issued by the plant-manufacturer.

With a view to improving the original technical parameters of the machine an updating may be accomplished by the overhaul of the machine. What is most important here is the preliminary preparation for the overhaul, which should cover at least 80% of the total work to be performed.

By the last planned check-up is being drawn up a complete list of the defects and description of the condition of the machine or equipment and on this basis are placed orders for the manufacture of <sup>the</sup> units and components to be changed. They have to be supplied by other factories or imported and only after that it is proceeded to the overhaul.

From an economic point of view the overhaul is most effective if executed in specialized factories on the basis of exchange funds for given type and model of machines. That means that a customer submitting a machine to be repaired can take away a repaired /and updated, if desired by him/ machine of the same type, model and make. The first machine is left to undergo an overhaul and subsequently submitted to another customer.

The overhaul covers:

- operations carried out by the planned preventive check-ups and by the current repair;
- change of all worn out components and units;
- examination of the axes, frames, processing of the working surfaces, close inspection and centering of the machine;
- examination of the base or frame of the machine and if necessary, reinforcement with concrete;

change of the coils of the electrical equipment /if necessary/.

The repaired machine or equipment is tested running idle and under load and is accepted after 72 hours trial. Some machines and equipment have to be tested in accordance with the time stated in their passport.

The execution of overhaul is entered in the passport of the machine. Overhaul of electric motors and generators is carried out only if necessary. By preparing the annual time-schedule is indicated only the number of the electric motors and generators to undergo overhaul. Their repair is being recorded and paid for separately from the other repairs.

Out-of-plan repairs. Such are mainly failure repairs caused by unexpected circumstances, wrong operation etc. etc. In order to reflect the condition of the machine or equipment to the people responsible for the failure, if any, is being drawn up a statement, indicating the losses inflicted, the time necessary for eliminating the failure and the attitude of the management of the establishment.

B. CONTENT /VOLUME/ OF THE REPAIR ACTIVITIES BY PLANNED REPAIRS  
MACHINE TOOLS

Planned preventive check-up

By the planned preventive check-ups are eliminated only those defects of the machine which are an obstruction for the correct operation of it till the next planned repair is done. By the planned check-up is made the following:

1. The covers of the units to be examined are removed and the condition of the mechanisms is checked; the worn out or broken components are changed; the quickly wearing parts and units are examined most carefully.

2. The clearances of the screws and nuts of the supports, carriages, tracers and drive screws are adjusted.

3. The bearings of the spindle are adjusted.

4. The speed and feed levers are checked as to whether switch over correctly.

5. The clutches are adjusted and the brakes are being stretched.

6. The easy movement of the tables, supports, carriages and slides is being adjusted, the wedges of the tables /supports/ and the pressing gibs are being stretched.

7. The condition of the bedways of the bodies, carriages, tracers and the other friction surfaces is being examined; the scratches and scores are being cleaned.

8. The stretching of the springs of the feeding devices is being adjusted.

9. The loosened or worn out fasteners as studs, nuts, screws, etc. are tightened, cleaned or changed.

10. The good working order of the stops, switches and supports is being examined.

11. The chains & belts are cleaned, stretched, restored or changed.

12. The units mentioned in section "Washing" are disassembled and washed away.

13. The oil and hydraulic system and the cooling installation are checked and repaired.

14. The casings are examined and repaired.

15. The details to be changed by the following planned repair are to be specified and entered in the list.



Current repair

By the current repair the following operations are done:

1. The machine is partially disassembled and two or three units subject to quick wearing are examined more closely, the covers are removed for doing an internal check and the rest of the units are washed away.
2. The whole machine is being cleaned, the details of the disassembled units are washed away.
3. The spindle is being disassembled, the spindle's necks are cleaned, the spots under the instruments and the appliance<sup>u</sup> are also cleaned, the spindle is being mounted and the bearings are being adjusted. The spindles of the precise and heavy machines are not dismantled by current repair.
4. The clearances between the shafts and the bushes are checked, the worn out bushes are changed, the rolling bearings are adjusted and the worn out bearings are changed.
5. Discs are added to the clutches, the clutches and brakes are adjusted.
6. The gear wheels are being trimmed, and all gears having broken cogs are changed.
7. The worn out and broken external connecting details by the tool-holders, wedges and gibs are being changed. The remaining connecting details are being cleaned.
8. The adjusting wedges and gibs are scraped.
9. The screws, supports, carriages, tracers, driving screws etc. are cleaned up and the worn out nuts are being changed.
10. The levers for switching off of the straight and reverse move, the levers for switching over speeds and feeds, locking, fixing and safety mechanisms and stops are being adjusted.

11. The worn out details which can not last to the next planned repair are changed.
12. The scratches and scores on the friction surfaces of the bodies, carriages, supports, tracers and columns are being cleaned up.
13. The casings, boxes, fenders, devices for protection of the processed surfaces from chips and abrasive dust are being repaired.
14. Operations connected with the repair of the lubricating system and with the oil changing are executed.
15. The easy movement of the table, supports, carriages, slides is being adjusted and wedges and pressing gibs are tightened up.
16. The stretching of the springs of the worm wheels and of similar mechanisms is being adjusted, the good working order of the stops, switches and supports is being checked.
17. The cooling installation is being examined and repaired, the leakages of the gaskets of the pipe lines are removed, current repair of the pumps and lubricating system's fittings is made.
18. The details to be changed by the following planned repair are specified and entered in the list of defects.
19. The working surfaces of the tables are cleaned up.
20. The precision of the machines is being checked.
21. The machine is being tested running idle at all speeds and feeds, the noise and heating are checked, and by the detail manufactured on it is controlled the precision and smoothness of the processed surface.

By current repair are performed those of the above-mentioned operation which are required by the condition of the repaired machine; the operations in items 19., 20., 21 are performed for all machines.

FORGING AND PRESS MACHINES AND EQUIPMENT -

MECHANICAL PART

Planned preventive check-ups

1. The condition of the quickly wearing mechanisms is being checked, the worn out or broken details are changed; the details to be changed by the following planned repair are specified and entered in the list of defects.

2. The clearances in the basic units of the machine are adjusted and the wedges are tightened up.

3. The friction clutches are adjusted and the brake is tightened up.

4. The condition of the bedways and of the other friction surfaces is being checked, the scratches and scores are cleaned up.

5. The loosened or worn out fasteners, studs, nuts, screws, bolts, etc. are tightened up, cleaned or changed.

6. The good working condition of the stops and supports is being checked.

7. The condition of the safety devices is being checked and repaired.

8. The condition of the lubricating and hydraulic systems is being examined and repair is made.

REMARK: By the check-ups are done only these of the above-mentioned operation which are required by the condition of the machine.

Current repair

1. The machine is partially disassembled, two or three units are dismantled more closely /the units subject to quick wearing and becoming dirty are disassembled/

2. The disassembled units are washed away and the whole machine is being cleaned up.

3. List of the defects is being worked out or specified.
4. The worn out details are repaired or changed, such details being not in a position to last till the next planned repair is executed.
5. The worn out bearings are repaired or changed.
6. Friction discs are added, the tapers are scraped and the friction sleeves and brakes are adjusted.
7. The worn out and broken connecting details are changed.
8. The good operation of the machine is examined and the control, safety and arresting devices are adjusted.
9. The scratches, scores, injuries on the bedways and on the columns of the hydraulic press as well as on the other friction surfaces are cleaned up.
10. The protecting devices are repaired.
11. The lubricating and hydraulic systems are repaired and the oil is changed.
12. The working surface of the table and of the slide are cleaned.
13. The machine is tested running idle and is checked for noise and heating.

ELECTRICAL EQUIPMENT AND DISTRIBUTION LINES  
FOR MACHINE TOOLS

Current repair

1. A check is made of the over-heating, mechanical injuries of the insulation, the good condition of the earthing, reinforcement of the installation and electrical appliances.
2. The contact connections are checked and tightened.
3. The electrical equipment mounted on the machine is being cleaned and blown through.
4. The contacts are cleaned up.
5. The electrical equipment is being repaired and separate details and sections of the insulation of the power installation which are injured are being changed.
6. The insulation resistance of the power installation is being measured.

7. The damaged sections of the electrical installation are changed, same holds good for metal and rubber handles and separate faulty apparatuses.

#### OVERHAUL

The electromotor installation is completely changed and the damaged electrical installations and pipe lines are substituted then tested.

#### ARC WELDING DEVICE

##### Current repair

1. External check up and cleaning of the device and scavenging of the transformer are done.
2. Check-up of the voltage switch and of all starting control lines from the arc-welding device to the panel is made.

##### Overhaul

It covers all operations executed by the current repair; apart of it, the following is done: repair of the transformer - lacquering, drying up and changing of electrodes, repair of the casing, check up and cleaning of the high and low voltage bars, examination of the insulation of the transformer. If necessary, the transformer is being re-wound.

#### ELECTRIC WELDING EQUIPMENT

##### Current repair

1. The cleanness of the contact surfaces, electrodes, intermediate and current-carrying backings is being examined, the range of the rod and the contact connections with the busbar are also examined.
2. The equipment is being cleaned from dirt and flux.
3. The following is checked: the flow in the system of water cooling, the deposit on the contacts of the starting and control

devices, of the relays and of the installations of the secondary commutation, the overheating at the contact connections of the primary and secondary communication, the operation of the electro-pneumatic valves and gates.

4. The gaps of the air-line system are eliminated.

The operations to be performed for the different types of repair of the electrical motors, magnetic starters, contactors and transformers is determined in accordance with their nomenclature in the respective section.

#### Overhaul

It comprises all operations carried out by the current repair, measuring of the resistance, of the secondary commutation and insulation resistance, elimination of the electrical erosions on the contact connections of the secondary closed loop by the means of reboring and scraping.

The worn out details of the current-carrier and busbar of the secondary closed loop are being changed, the electropneumatic valves and gates are measured after being repaired, the electropneumatic valves and gates are adjusted and the water cooling system of the transformer and of the secondary loop are washed away with acis and alkaline solution.

The worn out starting and control devices as well as the electric capturing lines are changed, the operation of the relays is checked, the worn out busbars , current-carrying and intermediary backings are changed.

ANNUAL SCHEDULE

Appendix Nr 4.

for the planned repairs of the metalworking machines in the Metalworking Subsection of COIP,  
Nicaragua, during the first year after the setting up of a Centre for Repair and Maintenance  
of metalworking machines

Nr.	Denomination of machine	Name of the establ. where the machine is mounted	Designation, type, brand	Period in which the machine is due to undergo a re- pair; kind of the repair: P-check-up, T-current repair, O-overhaul;												Stay days	Next plan- ned repair kind after how ma- ny months		
				quarter; month															
				I			II			III			IV						
				I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII				
1.	2.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
<b>I. LATHES</b>																			
1.	Combination lathe	METASA	LODGESH	P	-	-	-	-	T	-	-	-	-	-	-	-	4	P	8
2.	"	"	HERMAN	P	-	-	-	-	T	-	-	-	-	-	-	-	3	P	8
3.	"	"	CINCINATI	P	-	-	-	-	T	-	-	-	-	-	-	-	3	P	9
4.	"	"	EMEMSA	P	-	-	-	-	T	-	-	-	-	-	-	-	5	P	9
5.	"	"	"	P	-	-	-	-	T	-	-	-	-	-	-	-	3	P	8
6.	"	"	"	P	-	-	-	-	T	-	-	-	-	-	-	-	3	P	8
7.	"	"	"	P	-	-	-	-	T	-	-	-	-	-	-	-	3	P	8
8.	"	"	IMPLASA	-	P	-	-	-	-	-	-	-	0	-	-	-	25	P	8
9.	"	"	"	-	P	-	-	-	-	-	T	-	-	-	-	-	3	P	9
10.	"	"	"	-	P	-	-	-	-	-	T	-	-	-	-	-	3	P	9
11.	Monitor lathe	"	JATOR	P	-	-	-	-	-	-	T	-	-	-	-	-	3	0	8

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
12.	Combination lathe	INTERKASA	TAKISAWA	P	-	-	-	-	-	-	-	T	-	-	-	4	P	9
13.	"	"	"	P	-	-	-	-	-	-	-	T	-	-	-	3	P	9
14.	"	"	INCA	TORRENT	P	-	-	-	-	-	-	T	-	-	-	4	P	9
15.	"	"	"	"	-	P	-	-	-	-	-	-	T	-	-	3	P	9
16.	"	"	"	GEMINIS	-	P	-	-	-	-	-	-	T	-	-	5	P	9
17.	"	"	INCA	GEMINIS	-	-	-	-	-	-	-	-	-	-	T	5	P	9
18.	"	"	INCA	GURUZPE	-	P	-	-	-	-	-	-	-	T	-	5	0	8
19.	"	"	"	SOUTHBEND	P	-	-	-	-	-	-	-	-	0	-	30	P	8
20.	"	"	"	"	P	-	-	-	-	-	-	-	-	-	0	30	P	8
21.	"	"	"	ATLAS	-	P	-	-	-	-	-	-	-	T	-	2	0	8
RECAPITULATION: check-ups				13	8	-	-	-	-	-	-	-	-	-	-	21	18	-
current repairs				-	-	-	-	-	3	4	3	3	2	2	1	18	-	-
overhaul				-	-	-	-	-	-	-	-	-	1	1	1	3	3	-

71

## II. MILLING MACHINES

### 1. Universal milling

1.	machine	INTERKASA	ENSHU	P	-	-	-	-	-	-	T	-	-	-	-	3	P	9	
2.	"	"	INCA	JARBE	P	-	-	-	-	-	T	-	-	-	-	3	P	9	
3.	"	"	"	MILWOLEE	-	P	-	-	-	-	-	-	0	-	-	25	P	8	
4.	"	"	"	MILIRITE	-	P	-	-	-	-	-	-	-	0	-	30	P	8	
5.	"	"	MATASA	CINCINATI	-	P	-	-	-	-	-	-	-	-	0	30	P	8	
6.	"	"	"	BROWNSAR	P	-	-	-	-	-	-	0	-	-	-	30	P	8	
RECAPITULATION: check-ups				3	3	-	-	-	-	-	-	-	-	-	-	6	6	-	
current repairs				-	-	-	-	-	-	-	2	-	-	-	-	-	2	-	-
overhaul				-	-	-	-	-	-	-	-	1	1	1	1	4	-	-	



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
<b>III. SHAPING MACHINES</b>																		
1.	Shaping machine	EMEMSA	CINCINATI	P	-	-	-	-	T	-	-	-	-	-	-	3	P	9
2.	"	"	INTERKASA	CHAPER	P	-	-	-	-	T	-	-	-	-	-	2	P	9
3.	"	"	INCA	ROKFORD	-	P	-	-	-	-	-	0	-	-	-	24	P	8
4.	"	"	METASA	CINCINATI	P	-	-	-	-	-	0	-	-	-	-	18	P	8
RECAPITULATION: check-ups				3	1	-	-	-	-	-	-	-	-	-	-	4	4	-
current repairs				-	-	-	-	-	1	1	-	-	-	-	-	2	-	-
overhaul				-	-	-	-	-	-	-	1	1	-	-	-	2	-	-

<b>IV. RADIAL-DRILLING MACHINES</b>																		
1.	Radial-drilling machine	EMEMSA	FODICK	P	-	-	-	T	-	-	-	-	-	-	-	2	P	8
2.	"	"	INCA	TAGO	-	P	-	-	-	0	-	-	-	-	-	18	P	8
3.	"	"	METASA	CINCINATI	P	-	-	-	T	-	-	-	-	-	-	2	P	8
RECAPITULATION: check-ups				2	1	-	-	-	-	-	-	-	-	-	-	3	3	-
current repairs				-	-	-	-	2	-	-	-	-	-	-	-	2	-	-
overhaul				-	-	-	-	-	1	-	-	-	-	-	-	1	-	-

<b>V. PILLAR AND BENCH DRILLING MACHINES</b>																		
1.	Drilling machine	EMEMSA	BUFFALO	P	-	-	T	-	-	-	-	-	-	-	-	2	P	8
2.	"	"	"	"	P	-	-	T	-	-	-	-	-	-	-	2	P	8
3.	"	"	"	P	-	-	T	-	-	-	-	-	-	-	-	2	P	8
4.	"	"	IMPLASA	DARUMA	P	-	-	-	T	-	-	-	-	-	-	2	P	8

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
5.	Drilling m-ne	IMPLASA	ZUDAM	P	-	-	-	T	-	-	-	-	-	-	-	2	P	8
6.	"	INTERKASA	VERMAN	P	-	-	-	T	-	-	-	-	-	-	-	2	P	8
7.	"	FERO ARTE	GENERAL	P	-	-	-	T	-	-	-	-	-	-	-	1	P	9
8.	"	"	DARUMA	-	P	-	-	-	T	-	-	-	-	-	-	1	P	9
9.	"	REDELSA	SRUNGER	P	-	-	-	-	T	-	-	-	-	-	-	1	P	9
10.	"	INCA	GANEDY	P	-	-	-	-	0	-	-	-	-	-	-	17	P	8
11.	"	"	DELTA	-	P	-	-	-	-	0	-	-	-	-	-	15	P	8
12.	"	METASA	SICHERUNG	P	-	-	-	T	-	-	-	-	-	-	-	1	P	9
13.	"	"	S/M	P	-	-	-	-	0	-	-	-	-	-	-	17	P	8
14.	"	"	M/D	-	P	-	-	-	-	T	-	-	-	-	-	2	P	9

RECAPITULATION: check-ups

11 3 - - - - - - - - - - 14 14 -

current repairs

- - - 3 5 2 1 - - - - - 11 - -

overhaul

- - - - - 2 1 - - - - - 3 - -

#### VI. HACK-SAWING MACHINES

1.	Hack-sawing m-ne	EEMSA	emersyn	P	-	-	T	-	-	-	-	-	-	-	-	2	P	9
2.	"	"	EMERSYN	-	P	-	-	T	-	-	-	-	-	-	-	2	P	8
3.	"	IMPLASA	UNIZ	-	-	P	-	-	T	-	-	-	-	-	-	2	P	8
4.	"	"	"	-	-	P	-	-	-	T	-	-	-	-	-	2	P	8
5.	"	INTERKASA	KELLER	-	-	P	-	-	-	-	T	-	-	-	-	2	P	9
6.	"	FERO ARTE	SIERCRAF	-	-	-	P	-	-	-	-	T	-	-	-	2	P	9
7.	"	INCA	SABI	-	-	P	-	-	-	-	-	-	T	-	-	2	P	9
8.	"	METASA	MARBEL	-	P	-	-	-	-	-	-	-	-	-	0	24	P	8

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
9.	Hack-sawing m-ne	METASA	MARBEL	-	P	-	-	-	-	-	-	-	-	0	-	24	P	8
10.	"	IMEP	KASTO	-	P	-	-	-	-	-	-	-	-	T	-	2	P	9
RECAPITULATION: check-ups				1	4	4	1	-	-	-	-	-	-	-	-	10	10	-
current repairs				-	-	-	1	1	1	1	1	1	1	1	-	8	-	-
overhaul				-	-	-	-	-	-	-	-	-	-	1	1	2	-	-

VII. PLANE GRINDING MACHINES

1.	Plane grinding m-ne	INTERKASA	NICCO	-	P	-	-	-	-	T	-	-	-	-	-	4	P	9
2.	"	INCA	HARIG	-	P	-	-	-	-	-	-	-	-	0	-	30	P	8
3.	Grinding m-ne	"	FIRTHUL	-	-	P	-	-	-	-	T	-	-	-	-	4	P	9
4.	"	METASA	ARGET	-	P	-	-	-	-	-	-	-	-	-	0	30	P	8
RECAPITULATION: check-ups				-	3	1	-	-	-	-	-	-	-	-	-	4	4	-
current repairs				-	-	-	-	-	-	1	1	-	-	-	-	2	-	-
overhaul				-	-	-	-	-	-	-	-	-	-	1	1	2	-	-

VIII. HYDRAULIC PRESSES

1.	Hydraulic press	EMEMSA	COLONIAL	P	-	-	T	-	-	-	-	-	-	-	-	2	P	9
2.	"	"	CINCINATI	P	-	-	T	-	-	-	-	-	-	-	-	2	P	9
3.	"	IMPLASA	DAKE	P	-	-	T	-	-	-	-	-	-	-	-	2	P	9
4.	"	"	"	P	-	-	-	T	-	-	-	-	-	-	-	2	P	9
5.	"	"	"	P	-	-	-	T	-	-	-	-	-	-	-	2	P	9

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
6.	Hydraulic press	IMPLASA	ARRIETA	-	P	-	-	-	-	0	-	-	-	-	-	22	P	8
7.	"	INCA	MOROS	-	p	-	-	T	-	-	-	-	-	-	-	2	P	9
8.	"	METASA	CINCINATI	-	P	-	-	-	-	-	0	-	-	-	-	23	P	8
9.	"	"	"	-	P	-	-	-	-	-	-	0	-	-	-	30	P	8
RECAPITULATION: check-ups				5	4	-	-	-	-	-	-	-	-	-	-	9	4	-
current repairs				-	-	-	3	3	-	-	-	-	-	-	-	6	-	-
overhaul				-	-	-	-	-	-	1	1	1	-	-	-	3	-	-

IX. OTHER MACHINES

1.	Cam press	EMEMSA	HST	P	-	T	-	-	-	-	-	-	-	-	-	1	P	9
2.	"	"	A3	P	-	T	-	-	-	-	-	-	-	-	-	1	P	9
3.	"	"	PZGGB	P	-	T	-	-	-	-	-	-	-	-	-	1	P	9
4.	Guillotine	"	HERCULES	P	-	-	T	-	-	-	-	-	-	-	-	2	P	9
5.	Shaping m-ne	IMPLASA	CMZ	P	-	-	T	-	-	-	-	-	-	-	-	2	O	8
6.	Guillotine	"	MAN	P	-	-	T	-	-	-	-	-	-	-	-	2	P	8
7.	"	REDELSA	WYSONG	-	P	-	-	T	-	-	-	-	-	-	-	2	P	9
8.	Comb.press shears	"	WATNEY	-	P	-	-	T	-	-	-	-	-	-	-	2	P	9
9.	Hand edging m-ne	"	"	-	P	-	-	T	-	-	-	-	-	-	-	1	P	9
10.	Hand guillotine	"	CRAFTSMAN	-	P	-	-	-	T	-	-	-	-	-	-	1	O	8
11.	Hand edging m-ne	"	CHICAGO	-	P	-	-	-	T	-	-	-	-	-	-	1	P	9
12.	Hand guillotine	"	LOCKFORME	-	P	-	-	-	T	-	-	-	-	-	-	1	P	9
13.	Shaping machine	INCA	HENDEY	P	-	-	-	-	0	-	-	-	-	-	-	23	P	8

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
14. Slotting machine	INCA		ESPA	-	P	-	-	-	-	T	-	-	-	-	-	2	P	9
15. Hand guillotine	"		FAST	-	P	-	-	-	-	T	-	-	-	-	-	1	P	9
16. Comb.press shears	METASA		TOLEDO	-	P	-	-	-	-	0	-	-	-	-	-	20	P	8
17. Guillotine	METASA		CINCINATI	-	P	-	-	-	-	-	0	-	-	-	-	22	P	8
18. "	"	"	"	-	P	-	-	-	-	T	-	-	-	-	-	2	0	8
19. "	"	"	100t	-	P	-	-	-	-	-	-	0	-	-	-	25	P	8
20. Bending shaft	"		MERCULES	-	P	-	-	-	-	-	-	-	0	-	-	14	P	8
21. "	"	"	LOWN	-	-	P	-	-	-	-	-	-	-	0	-	14	P	8
22. Comb.press shears	"		10t	-	-	P	-	-	-	-	-	-	-	-	0	20	P	8
23. "	"	"	6t	P	-	-	-	0	-	-	-	-	-	-	-	16	P	8
24. "	"	"	15t	P	-	-	0	-	-	-	-	-	-	-	-	20	P	8
25. Hand guillotine	"		TRIUMPH	P	-	-	0	-	-	-	-	-	-	-	-	12	P	8
26. Guillotine	IMEP		CINCINATI	-	-	P	-	-	-	-	T	-	-	-	-	2	P	9
27. Edging machine	"		"	-	-	P	-	-	-	-	-	T	-	-	-	2	P	9
28. Comb.press shears	"		8n	-	-	P	-	-	-	-	-	-	T	-	-	2	P	9
29. "	"	"	10t	-	-	P	-	-	-	-	-	-	-	T	-	2	P	9
30. Bending shaft	"		s/m	-	-	-	P	-	-	-	-	-	-	-	-	0.5	P	9

RECAPITULATION: check-ups	10	13	6	1	-	-	-	-	-	-	-	-	-	-	-	30	28	-
current repairs	-	-	3	3	3	3	3	3	1	1	1	1	1	1	1	19	-	-
overhaul	-	-	-	2	1	1	1	1	1	1	1	1	1	1	1	10	2	-

#### X. WELDING EQUIPMENT

1. Electric weld. device	EMEMSA	27 pcs.	0-3	0-2	0-3	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	135	P	6
--------------------------	--------	---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---	---

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2.	Electr.weld.dev.	IMPLASA	6 pcs.	-	-	-	0	0	0	0	0	0	-	-	-	30	P	6
3.	"	INTERKASA	3 pcs.	-	T	T	T	-	-	-	-	-	-	-	-	3	P	6
4.	"	FERO ARTE	LINCOLN	-	-	-	-	-	-	-	-	-	-	-	0	5	P	6
5.	"	"	8 pcs.	-	T	T	T	T	T	T	T	T	-	-	-	8	P	6
6.	"	REDELSA	3 pcs.	-	0	0	0	-	-	-	-	-	-	-	-	15	P	6
7.	"	"	KW	-	-	-	-	-	-	-	-	-	T	-	-	1	P	6
8.	"	INCA	150A	-	-	-	-	0	-	-	-	-	-	-	-	5	P	6
9.	"	"	3 pcs.	-	-	-	-	-	-	-	-	-	T	T	T	3	P	6
10.	"	METASA	53pcs.	0-5	0-5	0.5	0-5	0-5	0-4	0-4	0-4	0-4	0-4	0-4	0-4	265	P	6
11.	"	"	7pcs.	-	-	-	-	-	0	0	0	0	0	0	0	35	P	6
12.	"	"	MILLER	T	T	T	T	T	T	T	T	-	-	-	-	8	P	6
13.	"	IMEP	19pcs.	T-2	T-2	T-2	T-2	T-2	T-2	T-2	T	T	T	T	T	19	P	6
14.	"	"	TUNDER	-	-	-	-	-	-	-	-	-	0	-	-	5	P	6

RECAPITULATION: check-ups  
current repairs  
overhaul

-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	141	-	-
3	5	5	5	4	4	4	3	2	3	2	2	2	2	2	2	42		
8	9	9	9	9	8	8	8	8	8	8	7	8	8	7	8	99		

TOTAL RECAPITULATION FOR

COIP ONLY:

check-ups  
current repairs  
overhaul

48	40	11	2	-	-	-	-	-	-	-	-	-	-	-	-	101	237	-
3	5	8	15	18	14	15	11	7	7	5	3	111	-	-	-	111	-	-
8	9	9	11	10	12	11	11	12	11	12	13	129	5	-	-	129	5	-

Total

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
																Total			
TOTAL RECAPITULATION FOR THE WHOLE METALWORKING SECTOR OF THE COUNTRY																			
				check-ups	98	82	22	4	-	-	-	-	-	-	-	206	484	-	
				current repairs	6	10	16	31	37	29	31	22	14	14	10	6	228	-	-
				overhaul	16	18	18	22	20	25	22	22	22	22	25	27	262	10	-

The data for the whole metalworking sector are conditional because they are obtained by empiric calculations. It is taken for granted that COIP makes up 49% of the metalworking sector and the remaining part represents the private sector. This has been in such a way owing to the lack of whatsoever data for the machine stock of the private sector.

S T A F F

of the Repair and Maintenance Centre for Metalworking Machines

Nr. 1	Staff by category 2	Qualification and skills requirements 3	Necessary number	
			I stage 4	II stage 5
<b>A. Clerical staff</b>				
1.	Director	higher technical education with experience in the repair and maintenance of metalworking machines	1	1
2.	Deputy director	"	-	1
3.	Book-keeper	Higher economic education, with experience in the industrial book- keeping	1	1
4.	Cashier-accountant	Secondary economic education, with experience in the industrial book-keeping	-	1
5.	Secretary-typist	Experienced typist	1	1
Total number of the clerical staff			3	5
<b>B. Engineering-technical staff</b>				
1.	Department head	Higher technical education, with experience in metalworking ind.	1	1
2.	Designer of spare parts	Higher technical education, with experience in metalworking ind.	1	1
3.	" "	Secondary technical education, with experience in metalworking ind.	-	1
4.	Technologist on the production of spares and on the repair of metalworking machines	Higher technical education. Ex- perience in metalworking and in repair of metalworking machines	1	1
5.	" "	Secondary technical education, with experience in metalworking ind.	1	1
Total number of engineering-technical staff:			4	5



1	2	3	4	5
<b>C. Principal operators</b>				
1. Turners		Very highly-skilled; to be able to work after designs and plans	3	6
2. Milling machine operators		"	1	2
3. Mill-wrights		"	1	1
4. Grinder operators		"	1	1
5. Gear cutting machine operator		"	1	1
6. Gear shaping machine operator		"	1	1
7. Gear shaving machine		"	1	1
8. Slotting machine operator		"	1	1
9. Plano-type surface grinding machine operator		"	1	1
10. Shaping machine operator		"	1	1
11. One pillar drill-layout machine operator		"	1	1
12. Horizontal boring machine operator		"	-	1
13. Fitter for the repair and maintenance of metalworking machines		very highly-skilled, to be able to work after designs; highly-skilled, to be able to work after designs; with medium qualification; with low qualification;	5 3 2 2	7 4 3 3
14. Electric fitter for the repair and maintenance of metalworking machines		Very highly-skilled; Well-trained; With medium qualification;	1 1 -	1 1 1
15. A.C. electric motor; coiler machine operator		Very highly-skilled; Well-trained;	1 1	1 1
16. Electric fitter for repair of equipment for electric welding		Very highly-skilled; Well-trained; With medium qualification;	4 3 2	5 4 3
17. Thermal treatment operator		Very highly-skilled - to know very well the technolo- gy of thermal treatment	1	1
18. Electric & gas welder		Very highly-skilled	1	1
19. Tinsmith		"	1	1

1	2	3	4	5
20. Metalworking machines dyer		Very highly-skilled	1	1
Total number of the principal operators:			41	56
D. Ancillary workers				
1. Cutting-off machine operator		medium qualification	1	1
2. Labourer		Low qualification	1	2
3. Working rooms cleaner		Without qualification	1	2
4. Tool distributor		good qualification	1	1
5. Quality inspector		Very highly-skilled in the metalworking sector	1	1
6. Electric car operator		Very highly-skilled	1	1
7. Driver		"	1	1
Total number of ancillary workers:			7	9
E. Staff not engaged in material production				
1. Distributor of food in the canteen			1	1
2. Dishes washer			1	1
3. Janitor			1	1
4. Armed guard			2	2
Total number of the people not engaged in the material production:			5	5
RECAPITULATION:			60	75
=====			=====	=====

S P E C I F I C A T I O N

of the necessary foreign experts and workers

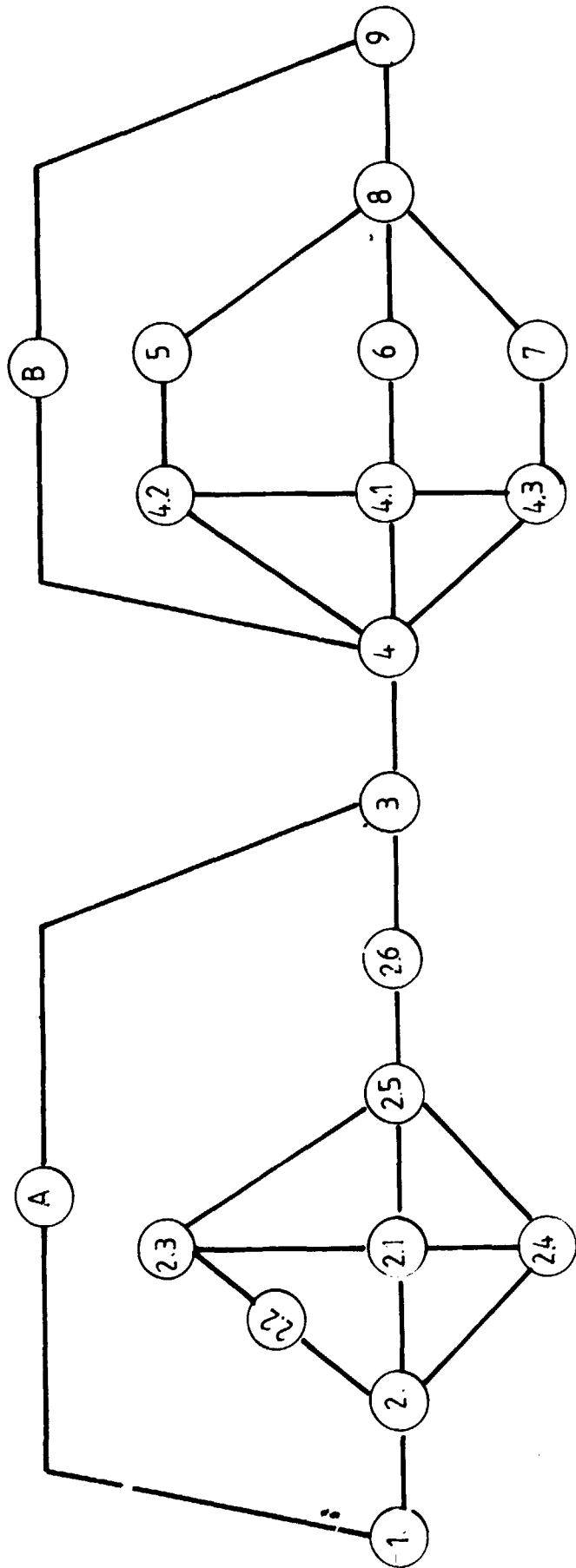
Nr.	Function	Qualification and skills requirements	Necessary number	Period of help rendering /years/
1.	2	3	4	5
1.	Director of the Centre	Higher technical education; experience in setting-up of metalworking establishments, repair and maintenance of metalworking machines.	1	2
2.	Department head	Higher-technical education; experience in repair and maintenance of metalworking machines and manufacture of spares for them.	1	2
3.	Designer of spare parts	Higher technical education; experience in designing of spares for metalworking machines.	1	2
4.	Technologist on the manufacture of spares and on the repair of metalworking machines	Higher technical education; experience in manufacture of spares and repair of metalworking machines.	1	2
5.	Turners	Very highly-skilled; experience in manufacture of spares for metalworking machines.	2	1
6.	Milling machine operator	"	1	1
7.	Machine fitter	"	1	1
8.	Grinder operator	"	1	1
9.	Gear cutting machine operator	"	1	1
10.	Gear shaping machine operator	"	1	1

1	2	3	4	5
11. Gear shaving machine operator		Very highly-skilled; experience in manufacture of spares for metalworking m-nes.	1	1
12. Plano-type surface grinding machine operator		Very highly-skilled; experience in repair of metalworking machines.	1	2
13. One-pillar drill-layout machine operator		Very highly-skilled;	1	2
14. Fitter		Very highly-skilled; experience in the repair and maintenance of metalworking m-nes	2	2
		Highly-skilled; experience in repair and maintenance of metalworking machines.	1	1
15. Electric fitter		Very highly-skilled; experience in repair and maintenance in metalworking machines.	1	2
16. A.C. electric motors coiler machine operator		Very highly-skilled and with experience in this field	1	1
17. Electric fitter for the repair of equipment for electric welding		Very highly-skilled and with experience in this field	1	1
18. Thermal treatment operator		Very highly-skilled and with experience in this field	1	1
<u>RECAPITULATION:</u> Experts with higher technical education:			4	
Skilled workers			17	

WORK SCHEDULE  
for the study, designing, construction of the project and  
putting it into operation

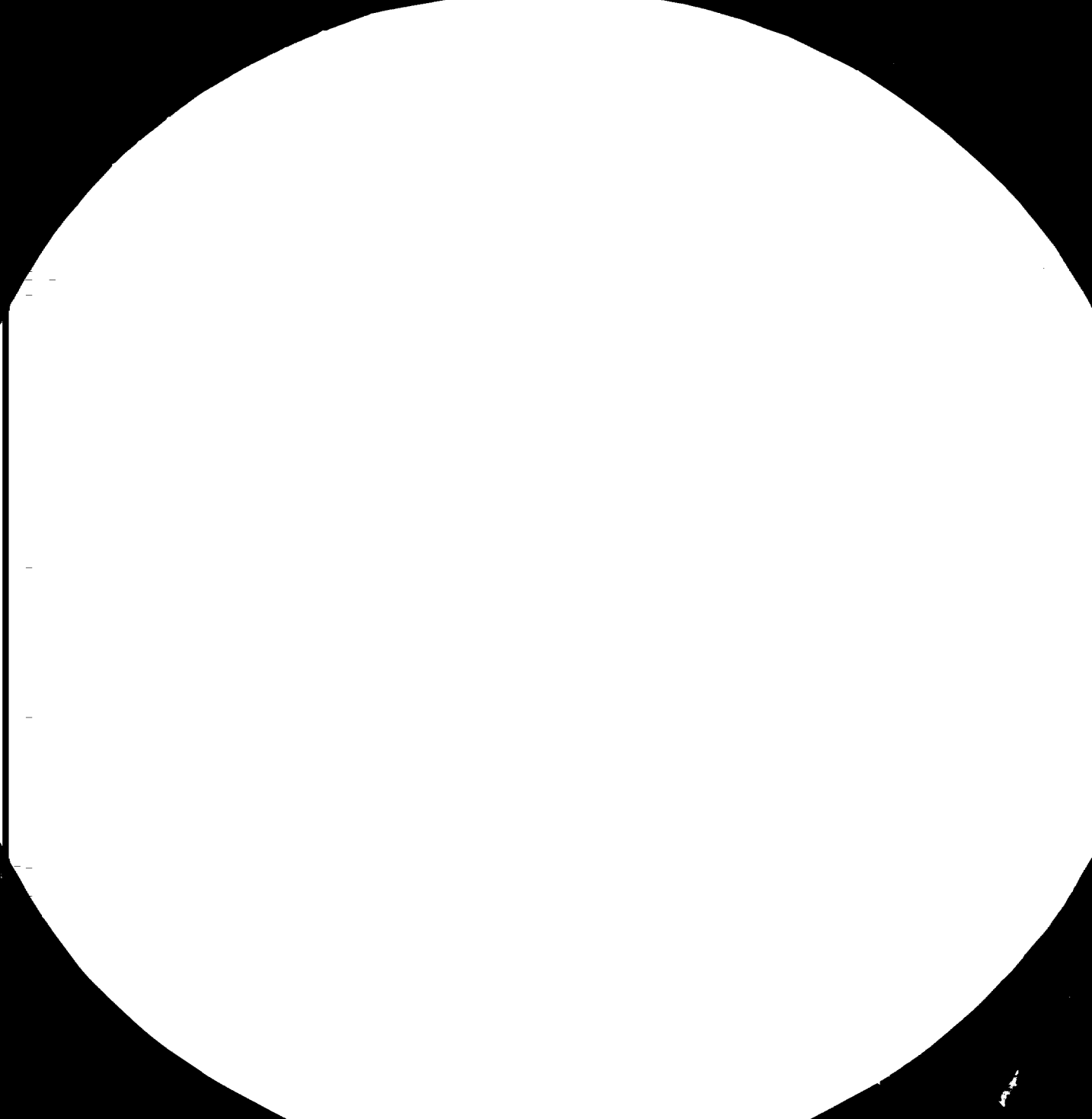
It is shown in Appendix 7a. It has been worked out with a view of maximum shortening the term for erection of the project. The meanings of the letter and of the figures are as follows:

1. Investigation of the possibilities and of the expediency of erection of the project.
2. Investigation and preliminary project.
  - 2.1. Machine engineering; organizational and technological designing, specification of the types and quantities of the machines and equipments.
  - 2.2. Determination of the site and elaboration of general lay-out.
  - 2.3. Development of the architectural and construction part of the project.
  - 2.4. Development of the energetics part of the project - installations /electrical supply, heating and ventilation, water supply and sewerage, weak current and telephone equipment/.
  - 2.5. Calculation of the value of the project.
  - 2.6. Determination of the criteria for techno-economic effectiveness of erection of the project.
3. Co-ordination of the feasibility study with the Buyer.
  - A. Supervision and co-ordination of the investigation
4. Designing
  - 4.1. Machine engineering; specifying of the specification of the machines and equipments.
  - 4.2. Executive architectural and construction part of the project.
  - 4.3. Executive energetics part of the project.
5. Construction.
6. Delivery of the machines and equipments, assembly.
7. Installations assembly.
8. Putting into commissioning and running of tests, training of local staff.



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4. "Guide for designing of machinebuilding factories and workshops", edited by B. I. Aisenburg, volume V, publishing house "Mashinostroene", Moscow, 1975.
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6. Reference and norm materials concerning technological designing of IPP "Mashproject"- Sofia.







MEASUREMENTS MADE WITH THE TEST TARGET  
SHOWN ABOVE ARE SUBJECT TO THE FOLLOWING  
LIMITATIONS:

- 1. The resolution is limited by the quality of the test target.
- 2. The resolution is limited by the quality of the measuring instrument.
- 3. The resolution is limited by the quality of the operator.

SECTION III

R E S U L T S

of the technological calculations for the needs of repair facilities for the metalworking machines of the industrial sector /excluding the metalworking sector/ of the repair and maintenance centre for metalworking machines

1. GENERAL

These calculations are made at our own discretion and they are out of the obligations of the Bulgarian side ensuing from the contract with UNIDO. They are aimed at clearing up the problem for the repair and technical maintenance of the metalworking machines in the whole industrial sector of the economy of Nicaragua. Taking into consideration the existing situation that a large part of the available metalworking machines in COIP /by analogy it is assumed for the whole industrial sector/ are not in the metalworking sector and are used for the repair and technical maintenance of the basic technological equipment in the respective other sectors. The lack of systematic methodological preventive method for their maintenance is a potential threat for the normal and effective exploitation of the production facilities and capabilities in these sectors.

The technological calculations were made after carrying out studies in workshop units in different establishments of COIP and obtaining information by COIP on the metalworking machines available in the corporation.

As in the preceding feasibility study /for the metalworking sector/ we dispose only of data on COIP. The metalworking machines in the private sector are assumed to be a percentage part of the total amount of metalworking machines in the respective sector of industry. The sizing is made by stages /I stage - 1980, II stage - 1985/ on the basis of anticipated capacities. The percentages used are shown in the following table:

Nr.	Denomination of sector	Relative share-%		Growth - % 1985/1980
		priv.sect.	COIP	
1.	Food, wine and tobacco industries	44,0	56,0	30,0
2.	Textile industry	69,0	31,0	35,0
3.	Building materials industry	41,0	59,0	39,0
4.	Chemico-pharmaceutics industry	52,0	48,0	31,0

For the sectors not included in above table the following percentages have been used:

- Clothes and Shoes Industry - same as for Textile Industry
- Wood-processing industry - same as for Building Materials Industry
- Paper industry and Plastics Processing - same as Chemico-pharmaceutics Industry

The results of these calculations are tentative and might be accepted as attempt for technological sizing.

The reason for this is the lack of data on the existing metalworking machines /types and quantities/ in the private sector and on the dynamics of growth of the types of metalworking machines for the second stage /1985/

## 2. PRODUCTION PROGRAMME

Presently the existing metalworking machines in the different sectors of COIP /excluding the metalworking sector/ are as follows:

Denomination of machine	Number of machines by sectors /COIP/								Totally
	Food, wine & tobacco	Text- tile ind.	Clothes & shoes ind.	Build. mater. ind.	wood- proces. ind.	chem.- pharm. ind.	paper ind.	plast. proces. ind.	
2	3	4	5	6	7	8	9	10	11
Lathes	12	15	1	8	1	12	-	17	66
MILLING machines	1	4	-	1	1	3	-	8	18
Shaping machines	1	3	-	-	1	2	-	7	14
Radial-drilling machine	-	2	-	1	-	-	-	-	3
Pillar and bench drilling machines	10	3	1	6	1	5	2	10	38
Hack-sawing machines	2	3	-	2	1	2	-	5	15
Grinding machines	-	1	-	-	1	-	-	2	4
Hudraulic presses	-	-	-	-	-	1	-	3	4
Other machihes	7	4	-	5	3	3	3	2	27
Electric welding equipment	19	11	5	14	3	15	4	13	84
TOTAL NUMBER:	52	46	7	37	12	43	9	67	273

The results of the calculations for determining the quantity of metalworking machines in the industrial sector /without the metalworking sector/, i.e. the programme for the first stage are shown in the following table:

Nr.	Denomination of machine	Quantity of machines by sectors for the first stage - pcs.								Totally	
		Food wine and tobacco ind.	Textile ind.	Clothes & shoes ind.	Build. mater. ind.	wood-proces. ind.	chemico- pharm.ind.	paper ind.	plast. proces.		
1	2	3	4	5	6	7	8	9	10	11	
1.	Lathes	21	48	3	13	2	25	-	35	147	
2.	Milling machines	2	13	-	2	2	6	-	17	42	
3.	Shaping machines	2	10	-	-	2	4	-	14	32	
4.	Radial-drilling machines	-	6	-	2	-	-	-	-	8	
5.	Pillar and bench drilling machines	18	10	3	10	2	10	4	20	77	
6.	rack-sawing machines	3	9	-	3	2	4	-	10	31	
7.	Grinding machines	-	3	-	-	2	-	-	4	9	
8.	Hydraulic presses	-	-	-	-	-	2	-	6	8	
9.	Other machines	12	12	-	8	5	6	6	4	53	
10.	Electric welding equipment	34	33	15	24	5	30	8	26	175	
	TOTALLY:	92	144	21	62	22	87	18	136	582	

Nr.	Denomination of machine	Quantity of machines by sectors for the II stage - pcs.								Totally
		Food wine & tob.	Textile ind.	Clothes & shoes ind.	Build. mater. ind.	Wood-proces. ind.	Chem. pharm. ind.	Paper ind.	Plastics proces. ind.	
1	2	3	4	5	6	7	8	9	10	11
1.	Lathes	27	65	4	18	3	33	-	46	196
2.	Milling machines	3	18	-	3	3	8	-	22	57
3.	Shaping machines	3	13	-	-	3	6	-	19	44
4.	Radial-Drilling machines	-	8	-	3	-	-	-	-	11
5.	Pillar and bench drilling machines	23	14	4	14	3	13	5	26	102
6.	Hack-sawing machines	4	12	-	4	3	5	-	13	41
7.	Grinding machines	-	4	-	-	3	-	-	5	12
8.	Hydraulic presses	-	-	-	-	-	3	-	8	11
9.	Other machines	16	16	-	11	7	8	8	5	71
10.	Electric welding equipm.	44	44	20	33	7	39	10	34	232
TOTALLY:		120	194	28	86	32	115	23	178	776

06

As a result of the above calculations it is possible to draw up a generalized programme for the repair and technical maintenance of the metalworking machines in the industrial sector /excluding the metalworking sector/ and make a comparison with the programme under which has been done the technological sizing of the repair and maintenance centre for metalworking machines in the metalworking sector. This is done in the following table:

Nr.	Stage of study	feasib.	Quantity of machines by which the sizing of the centre is done /pcs/	Quantity of machines in the industrial sector /excl. metalworking sector/ - pcs.	Differenece column 4 as compared to column 3 %
1.	1980		517	582	112,3
2.	1985		725	776	107,0

### 3. TECHNOLOGICAL CALCULATIONS

The analysis of the results of the preceding table shows that it is necessary to double the capacity of the already developed centre to cover the needs of the metalworking sector, in order to create possibilities for repair and maintenance of the metalworking machines in the whole industrial sector of Nicaragua, proceeding from the total number of the different metalworking machines.

But if the quantities of the lathes, milling machines and shaping machines /taken altogether/ of the industrial sector /excl. the metalworking sector/ are compared with those of the metalworking sector, a difference of about 300% is obtained in favour of the industrial sector. Thus the conclusion might be drawn that the capacities of the centre should be tripled.

In connection with these doubts were made precise technological calculations for the sizing of a repair and maintenance centre of the metalworking machines available in COIP / as we have data for these machines only/.

The results of the schedule for repair and maintenance of the metalworking machines available in the metalworking sector, attached thereto, have been also analysed .

Through experts' assessment the conclusion was drawn that there are capabilities to cover the repair and maintenance of a significantly larger number of metalworking machines. In this connection, even by larger quantity of the basic kinds of metalworking machines /lathes, milling machines, shaping machines, etc./ in the industrial sector /without metalworking sector/ as compared with the machines in the metalworking sector, it would be necessary to increase the calculated capacity of the centre by 50% to ensure possibilities for repair and maintenance of the total quantity of metalworking machines in the industrial sector of Nicaragua.



This is the conclusion to be drawn at this stage of the feasibility study, taking in mind that not all data necessary for the calculations is available. At next stage, if the principle of concentration of the repair activities for the metalworking machines in the whole industrial sector of Nicaragua at one centre is accepted, it would be necessary to specify the calculations. It is possible in the future, when using precise data on the existing types and quantities of metalworking machines in the industrial sector of the country and on the dynamics of their growth, that some of the above statements will be confirmed, others - denied. These calculations are tentative and indicative for the next stage of the study.

SECTION IV

R E S U L T S

of the technological calculations for augmenting of the repair capabilities and facilities of the sectors of COIP /excluding the metalworking sector/

1. GENERAL

These calculations are made at the request of the Nicaraguan side and are not part of the obligations proceeding from the contract concluded between Machinoexport and UNIDO. They are aimed at giving information to the management of COIP about the types and quantities of metalworking machines necessary for the reinforcement of the separate sectors with a view to augmenting of their repair capabilities and facilities, creating of pre-requisites and conditions for the spare parts manufacture, decreasing of the spares import, and all things considered, - improving the utilization of the production capacities and increasing of the output.

They have been made after carrying out studies of the workshop units in different establishment of COIP, collecting information about the metalworking machines available. The direct impressions and the analyses of the data collected resulted in the concept for such calculations.

The question was solved jointly with "Technology" Department to the Ministry of Industry. Initially it was decided that the technological calculations would be made on the basis of the needs of the separate sectors of spare parts, judging, by the means of experts' assessment, which of the spares might be manufactured in Nicaragua. After that short technological routes for these spares' manufacture were to be drawn up and the types and quantities of the necessary metalworking machines were to be determined.

For the purposes of the data collection a group of about 30 students from the Technical College in Managua has been formed. They were in-

structured in details about the content and volume of the task and received graphic forms to fill by the visits of the separate establishments. Despite the efforts they made, they failed in the collection of the data needed. This failure is not determined only by their inexperience, but by the lack of preventive system for repair and technical maintenance of the basic technological equipment in the bigger part of the establishments of COIP and by the shortage of personnel to organize such activities.

Instead information has been supplied about the existing in the separate establishments types and quantities of machines and equipment of the basic production. It pertains to only 65% of the establishments of COIP /Appendix Nr. 1/. This information contains only the denominations and quantities of the machines and equipment, without whatsoever technical or size parameters. But having no other alternative, from one part, and taking in mind the short time we had at our disposal, we decided to use it by the calculations. This information was analysed and through experts' assessment have been determined the types and quantities of metalworking machines necessary for the repair and maintenance of the basic technological equipment in the separate sectors of COIP. The results of the calculations are tentative and are subject to specifying. But as the needs for reinforcing of the repair units in the separate sectors are urgent we think that the results of this feasibility study may be used by the management of COIP immediately.

Simultaneously with the delivery of new metalworking machines are to be decided also the matters connected with the repair and maintenance of the existing metalworking machines and shortage of qualified and skilled specialists and workers necessary for the spare parts manufacture and for the repair and maintenance of the basic technological equipment. Initially this can be performed with the help of foreign specialists, creating at the same time possibilities for the training of local staff.

The necessity of overall solution of the question of augmenting the repair capabilities and facilities in the industrial sector of Nicaragua to match the needs, determines the need of carrying out a more detailed and closer study. It has to be carried out on national level, covering the entire industrial sector. Furthermore, a solution should be sought of the question of the blanks' manufacture - ferrous and non-ferrous castings, alloys castings and forgings. For the spare parts manufacture cannot be secured without adequate capacities for blanks manufacture.

## 2. CALCULATIONS BY SECTORS

### 2.1. FOOD, WINE AND TOBACCO INDUSTRIES

At the time of the development of the feasibility study we disposed of data about 64% of the establishments.

The total number of the machines and equipment in this sector are as follows:

- denomination /types/	72
- quantity /pcs./	278

The average repair complexity of the mechanical part is 5, and of the electrical - 2.

The calculated machine-consumption is 50560 Machine/hours.

The calculated number of metalworking machines by FDM = 1600machine/hours/annually and utilization of the equipment - 80%, is 50 pcs.

Taking into consideration that only 64% of the establishments are being examined, the number of the assumed machines is increased to 59 pcs.

Their distribution is as follows:

Nr.	Denomination of m-ne	Quantity - pcs.		
		existing fit	necces. number of assumed	to be delivered
1	2	3	4	5
1.	Lathes	12	14	2

1	2	3	4	5
2.	Milling machines	1	2	1
3.	Shaping machines	1	2	1
4.	Radial-drilling machines	-	1	1
5.	Pillar and bench drilling machines	10	10	-
6.	Hack-sawing machines	2	3	1
7.	Grinding machines	-	2	2
8.	Hydraulic presses	-	2	2
9.	Slotting machine	-	1	1
10.	Guillotine - 6,3 mm	-	1	1
11.	Edging machine - 100 tons	-	1	1
12.	Electric welding equipment	19	19	-
<u>TOTALLY:</u>		45	59	13

## 2.2. TEXTILE INDUSTRY

By the time of starting the feasibility study we availed of data about 78% of the establishments. The total number of the machines and equipments in the basic manufacture is

	1061 pcs.
incl. looms	844 pcs.
carding machines	76 pcs.
spinning machines	70 pcs.

The looms and the carding machines are assumed to be reliable by the sizing of the units for repair and maintenance of the equipment in the sector.

a/ at supposed average repair complexity of a loom

P mech.= 12 and P elect= 2

and structure of the repair

$$\eta_{OCH} = 30\%, \text{ and } \eta_{TEK} = 70\% \quad OCH = \text{overhaul}; \quad TEK = \text{current}$$

is obtained the overall machine consumption:

$$M_{u1} = 59202 \text{ machine/hours} \quad M_{u1} = \text{Calculated machine-consumpt.}$$

b/ at supposed average repair complexity of a carding machine

$P_{\text{Mechanic}} = 4$  and  $P_{\text{electr}} = 1$   
and repair structure

$$\eta_{\text{overhaul}} = 50\% \quad \text{and} \quad \eta_{\text{curr.}} = 50\%$$

is obtained the following overall machine-consumption:

$$CMC_2 = 2441 \text{ machine/hours} \quad CMC = \text{calculated machine-consumpt.}$$

The total machine-consumptions is 61643 machine/hours

The calculated number of machines for repair and maintenance of the basic equipment by actual annual fund of working hours 1600 machine/hours per year and utilization of the machines - 80% is:

$$\eta_{CMC} \frac{61643}{1600 \cdot 0,8} = 43 \quad \eta_{CMC} = 48$$

The distribution of the machines by establishments in this sector was possible because of the relatively greater amount of data over the basic technological equipment .

Some of the machines are duplicated in the two main establishments TEXNCSA and FABRITEX , and in other establishments there are machines technologically required. For this reason the total number of the accepted metalworking machines in this sector is higher than the calculated and amounts to 56 basic machines.

Maximum utilization of the metalworking machines is envisaged. 8 lathes only are not taken into consideration as they are physically worn out and are to be rejected.

Cooperation between the separate establishments in the sector, as concerning the spare parts manufacture, is also envisaged, taking into consideration the zone in which they are located.

T A B L E

for the metalworking machines for the basic establishments of the Textile industry, necessary for the organization of planned-preventive repairs and technical maintenance of the machines and equipment in the sector

Nr.	Denomination of machine	Existing machines		Necessary m-nes	
		fit to be used	morally & physic. worn out	m-nes	to be delivered
1	2	3	4	5	6
I. FABRITEX					
1.	Combination lathe, $\varnothing_{max} = 800$ , L between centers = 3000 /Lbc/	-	-	1	-
2.	Combination lathe, $\varnothing_{max} = 420$ , Lbc = 100	-	-	1	1
3.	Combination lathe, $\varnothing_{max} = 310$ Lbc = 3000	1	-	1	-
4.	Combination lathe $\varnothing_{max} = 150$ , Lbc = 1000	1	-	1	-
5.	Combination lathe $\varnothing_{max} = 170$ Lbc = 1000	-	1	-	1
6.	Combination lathe $\varnothing_{max} = 80$ , Lbc = 610	1	-	1	-
7.	Combination lathe $\varnothing_{max} = 560$ , Lbc = 2000	-	-	1	1
TOTALLY FOR LATHES:		3	1	6	3

1	2	3	4	5	6
1.	Milling machine universal 200/1000	1	-	1	-
2.	Milling machine universal 320/330	-	-	1	1
Totally for milling machines:		1	-	2	1
1.	Universal circular grinding machines $\varnothing_{max} = 320$	-	-	1	1
2.	Face grinding machine 200/630	-	-	1	1
Totally for grinding machines:		-	-	2	2
	Universal shaping machine Hmax=640	1	-	1	-
	Radial-drilling machine $\varnothing 55$	-	-	1	1
	" $\varnothing 3/4''$	1	-	1	-
	Hack-sawing machine $\varnothing_{max}=200$	1	-	1	-
	" $\varnothing 400$	-	-	1	-
	Hydraulic press 160 t	-	-	1	1
	Electric welding equipment 250a	2	-	2	-
	Gear-cutting machine m =6	-	-	1	1
	Jig-boring machine 400/730	-	-	1	1
	Slotting machine Hmax=200	-	-	1	1
Totally:		8	1	21	12
II. TEXNCSA					
1.	Combination lathe $\varnothing_{max}=300$ Lbc=3000	2	-	2	-
2.	Combination lathe $\varnothing_{max}=280$ Lbc=2500	1	-	1	-



1	2	3	4	5	6
3.	Combination lathe $\varnothing_{\max}=115$ , Lbc = 800	1	-	1	-
4.	Combination lathe $\varnothing_{\max}=250$ Lbc = 1500; 2200	-	2	-	-
5.	Combination lathe $\varnothing_{\max}=560$ Lbc = 2000	-	-	1	1
Totally for lathes:		4	2	5	1
1.	Universal milling machine 200/1000	1	-	1	-
2.	Universal milling machine 320/1370	-	-	1	1
Milling machines - totally:		1	-	2	1
1.	Shaping machine universal Hmax = 11'' /280mm/	1	-	1	-
2.	Shaping machine universal Hmax = 7'' /178 mm/	1	-	1	-
Shaping machines - totally:		2	-	2	-
	Radial-drilling machine $\varnothing_{\max}=55$	-	-	1	1
	Radial-drilling machine $\varnothing_{\max}=3/4'' \neq \varnothing 19/$	1	-	1	
	Pillar drilling machine $\varnothing_{\max}=1/2'' / \varnothing 13 /$	2	-	2	
	Pillar drilling machine $\varnothing_{\max}=3/4'' / \varnothing 19/$	1	-	1	
	Hack-sawing machine $\varnothing_{\max}=355$	1	-	1	

1	2	3	4	5	6
Grinding machines		cooperated with FABRITEX			
Gear-cutting machine		"		"	
Jig-boring machine		"		"	
Slotting machine		"		"	
Hydraulic press 160 t			-	1	1
Electric welding device		6	-	6	
Totally:		16	2	22	4

III. NICARAO

1. Combination lathe $\varnothing_{max}=250$ Lbc = 800	1	-	1	-
2. Combination lathe $\varnothing_{max} 560$ Lbc=2000	-	-	1	1
Totally for lathes:	1	-	2	1

Universal milling machine 320/1280	-	-	1	1
Radial-drilling machine $\varnothing_{max}=55$	-	-	1	1
Hydraulic saw $\varnothing_{max}=400$	-	-	1	1
Hydraulic press 100 t	-	-	1	1
Electric welding device 400a gear-cutting m-ne, grinding, jig-boring, slotting m-nes	-	-	1	1
Totally:	1	-	7	6

IV. NICATEX

Combination lathe $\varnothing_{max}=150$ Lbc=800	1	-	1	-
Electric welding device 180a	1	-	1	-

1	2	3	4	5	6
Pillar drilling machine $\varnothing_{max}=4$ grinding, gear-cutting, jig-boring, slotting, milling and shaping operation		-	-	1	1
		cooperation with FABRITEX and TEXNCSA			
Totally:		2	-	4	2
V. CASA DE SEDINA					
Combination lathe $\varnothing_{max}=350$ Lbc=1500		1	-	1	-
Universal Milling Machine 200/1100		1	-	1	-
Pillar drilling machine $\varnothing_{max}=40$		-	-	1	1
Electric welding device 400a		1	-	1	-
Grinding, gear-cutting, jig-boring, slotting and shaping operations		cooperation with FABRITEX and TEXNCSA			
Totally:		3	-	4	1
VI. ILANICA					
		No metalworking machines; at this stage to cooperate with FABRITEX and TEXNCSA			
VII. TRICOTEXTIL					
VIII. AGROTEX					
IX. TELASA					
Combination lathe $\varnothing_{max}=300$ Lbc =2850		1	-	1	-
Pillar drilling machine $\varnothing_{max}=1/2''$		2	-	2	-
Electric welding device 230a		1	-	1	-
Grinders universal		1	-	1	-
Other operations		cooperation with the remaining establishments in the sector			
Totally:		5	-	5	-

1	2	3	4	5	6
RECAPITULATION:		38	3	62	24
incl.: lathes		14	3	16	5
milling machines		3	-	6	3
grinding machines		-	-	2	2
shaping machines		3	-	3	-
radial-drilling machines		2	-	5	3
pillar drilling machines		5	-	7	2
hack-sawing machines		2	-	4	2
electric welding devices		11	-	12	1
gear-cutting machine		-	-	1	1
Jig-boring machine		-	-	1	1
slotting machine		-	-	1	1
universal grinder /sharpening d./		1	-	1	-

### 2.3. CLOTHES AND SHOES

By the time of starting the feasibility study we availed of data about 60% of the establishments.

The total number of the machines and equipment in the sector is:

-denomination /types/ 9

-quantity /pcs./ 316

incl. sewing machines 264

The following metalworking machines are envisaged through experts' assessment, without taking into consideration the spare parts manufacture:

Nr.	Denomination of machine	Quantity - pcs.		
		existing fir for use	accepted necess. m-nes	to be delivered
1.	Lathes	1	3	2
2.	Milling machines	-	2	2
3.	Bench drilling machines	1	2	1

1	2	3	4	5
4.	Universal grinders /sharpening device/	-	3	3
5.	Electric welding device	5	5	-
	Totally:	7	15	8

#### 2.4. BUILDING MATERIALS

By the time of starting this feasibility study we disposed of data for all the establishments in the sector.

The total number of the machines and equipment is as follows:

- denomination /type/	69
- quantity /pcs/	455

The diversity of types and quantities of machines in this sector is very large, at the same time the greater part of them being not characterised by high repair complexity. The calculations made and the accepted experts' assessment for availability of a set of metalworking machines in the establishments in this sector showed that the following machines are needed:

Nr.	Denomination of machine	Quantity - pcs.		
		existing m-nes fit for use	accepted necessary m-nes	machines to be supplied
1	2	3	4	5
1.	Lathes	8	8	-
2.	Milling machines	1	3	2
3.	Hack-sawing machines	2	6	4
4.	Electric welding devices	14	14	-
5.	Combined press shears	2	2	-
6.	Hydraulic presses	1	3	2
7.	Grinding machines	-	2	2
8.	Shaping machines	-	1	1

1	2	3	4	5
9. Universal grinders /sharpening device/		-	4	4
10. Slotting machine		-	1	1
11. Radial-drilling machine		1	2	7
12. Pillar drilling machine		3	5	2
13. Portable angle-grinding machine /hand grinder/		-	6	6
<b>Totally:</b>		<b>32</b>	<b>63</b>	<b>31</b>

### 2.5. WOODWORKING

By the time of starting this feasibility study we had data about 43% of the establishments.

The total number of the machines and equipment is as follows:

-denomination /type/	24
-quantity /pcs.	61

By the technological sizing was obtained a small number of metal working machines. This is determined by the simple structure of the basic machines, characterised by low repairability, proceeding to the necessity of having one set of metalworking machines in this sector /furthermore, we dispose of data on 43% of the establishments/, the following equipment is envisaged:

Nr.	Denomination of machine	Quantity - pcs.		
		existing	adopted	quantity of machines delivered for pcs.
1	2	3	4	5
1.	Lathes			
2.	Milling machines			
3.	Shaping machines			

1	2	3	4	5
4. Pillar drilling machines		1	3	2
5. Hand hack-saws		1	3	2
6. Universal grinder /sharpening device/		3	6	3
7. Electric welding device		3	6	3
Totally:		11	24	13

## 2.6. CHEMICO-PHARMACEUTICS INDUSTRY

By the time of starting this feasibility study we had data about 69% of the total number of the establishments.

The total number of the machines and equipment is as follows:

- denomination /types/ 26
- quantity /pcs/ 254

The calculated machine-consumption is 46080 machine/hours. The calculated number of metalworking machines at FDM = 1600 machine/hours per year and utilization of the equipment 80% - 36.

Nr.	Denomination of machine	Quantity - pcs.		
		existing m-nes fit for use	accepted necessary machines	machines to be supplied
1.	Lathes	12	12	-
2.	Milling machines	3	3	-
3.	Shaping machines	3	3	3
4.	Pillar drilling machines	5	5	-
5.	Radial drilling machines	-	1	1
6.	Grinding machines	-	2	2
7.	Hydraulic press	1	1	-
8.	Combined press shears	1	1	-
9.	Hack-sawing machine Ømax=400	-	2	2
10.	Edging machine	1	1	-
11.	Electric welding device	15	9	6
12.	Slotting machine	-	1	1
	Totally:	40	41	7

## 2.7. PAPER INDUSTRY

By the time of starting the feasibility study we disposed of data for 60% of the establishments.

The total number of the machines and equipment is as follows:

- denomination /type/ 15
- quantity /pcs/ 36

Increase of the existing metalworking machines is not envisaged.

The metalworking machines are as follows:

- drilling machines 2
- electric welding devices 4
- hand edging machine 1
- hand shears 1
- combined press shears 1

If necessary, the sector may cooperate with other sectors.

## 2.8. PLASTICS PROCESSING

By the time of starting the feasibility study we disposed of data for 54% of the total number of establishments.

The total number of the machines and equipment is as follows:

- denomination /type/ 42
- quantity /pcs/ 257
- inc. spray equipment 9

The spray equipments are authoritative for the technological sizing. Their repair complexity is as follows:

P mechanical = 14    P electrical = 6

By determining of the total machine-consumption it is taken in mind that in this sector the manufacture of toolong /spray forms/ is of great significance.

Calculated machine-consumption - 58360 machine/hours

Calculated number of basic machines at FDM = 1600/machine/hours per year and the utilization of the equipment 80% - 60.

The distribution of the machines is shown in the following table:



Nr.	Denomination of machine	Quantity - pcs.		
		Existing fir for use	Accepted machines /necessary/	Machines to be supplied
1.	Lathes	17	17	-
2.	Milling machines	8	8	-
3.	Shaping machines	7	7	-
4.	Pillar and bench drilling machines	10	10	-
5.	Hack-sawing machines	5	5	-
6.	Grinding machines	1	2	1
7.	Hydraulic press	1	1	-
8.	Slotting machine	-	1	1
9.	Guillotine 6,3 mm	-	1	1
10.	Combined press shears	1	1	-
11.	Electric welding device	13	13	-
12.	Jig-boring machine	-	-	1
13.	Electro-erosion CNC machine	-	1	1
14.	Mould-and-die copying machine	-	1	1
Totally:		63	67	6

3. RECAPITULATION OF THE NECESSITIES FOR NEW METALWORKING MACHINES . It is shown in the following table for the different sectors of COIP

Nr.	Denomination of machine, technical parameters	Needed new machines by sectors							Total'y	
		Food, wine & tobacco	textile ind.	Clothes &shoes ind.	Build. mater. ind.	Woodw. ind.	chemic. pharm. ind.	Paper ind.		Plastics process. ind
1.	COMBINATION LATHES	2	5	2	-	1	-	-	-	10
1.1.	∅max=800; Lbc=3000	1	1	-	-	-	-	-	-	2
1.2.	∅max=420;Lbc=1000	1	1	-	-	-	-	-	-	2
1.3	∅max=460;Lbc=1500	-	-	-	-	1	-	-	-	1
1.4.	∅max=100; Lbc_400	-	-	2	-	-	-	-	-	2
1.5	∅max=560; Lbc=2000	-	3	-	-	-	-	-	-	3
2.	INIVERSAL MILLING MACHINES & OTHERS	1	4	2	2	2	-	-	-	10
2.1.	B/L 320/1370	1	3	-	1	-	-	-	-	5
2.2.	B/L 250/1120	-	-	-	-	1	-	-	-	1
2.3.	B/L 125/500	-	-	2	-	-	-	-	-	2
4.	HORIZONTAL BORING MACHINE ∅max=100	-	-	-	1	-	-	-	-	1
2.5.	GEAR-CUTTING MACHINE m= 8	-	1	-	-	-	-	-	-	1
3.	RADIAL-DRILLING MACHINE ∅max=55	1	3	-	7	-	1	-	-	12
4.	PILLAR DRILLING MACHINE ∅max=40	-	2	-	2	2	-	-	-	6
5.	BENCH DRILLING MACHINE ∅max=20	-	-	1	-	-	-	-	-	1

1	2	3
6.	SHAPING MACHINE H=630	1
7.	HACK-SAWING MACHINE $\varnothing_{max}=400$	1
8.	HYDRAULIC PRESS 160 t	2
9.	ELECTRIC WELDING DEVICE 400a	-
10.	JIG-BORING MACHINE B/L 400/630	-
11.	UNIVERSAL GRINDING MACHINE $\varnothing_{max}=320$	1
12.	FACE-GRINDING MACHINE B/L 200/630	1
13.	SLOTING MACHINE $H_{max}=200$	1
14.	GUILLOTINE 6,3 mm	1
15.	EDGING MACHINE 100 tons	1
16.	ELECTRO-EROSION CNC MACHINE B/L320/320	-
17.	MOULD-AND-DIE COPYING MACHINE B/L540/950-	
18.	UNIVERSAL GRINDER /SHARPENING DEVICE $\varnothing_{max}=400$	-
19.	HAND ANGLE-GRINDING MACHINE /HAND GRINDER/ $\varnothing_{max}=200$	-
<u>TOTALLY :</u>		13

4	5	6	7	8	9	10	11
-	-	1	1	1	-	-	4
2	-	4	2	2	-	-	11
3	-	2	-	-	-	-	7
1	-	-	3	-	-	-	4
1	-	-	-	-	-	1	2
1	-	1	-	-	-	1	4
1	-	1	-	-	-	-	3
1	-	1	-	1	-	1	5
-	-	-	-	-	-	1	2
-	-	-	-	-	-	-	1
-	-	-	-	-	-	1	1
-	-	-	-	-	-	1	1
-	3	4	3	-	-	-	10
-	-	6	-	-	-	-	6
24	8	31	13	5	-	6	100

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C O N C L U S I O N S

As a result of the study carried out the following has been established:

1. In the metalworking sector of COIP as well as in the other sectors of the state industrial branch of Nicaragua there are no facilities for the repair and technical maintenance of metalworking machines and for spare parts manufacture. The private industrial branch also is lacking such facilities.

2. No preventive repair activities of metalworking machines are carried out in Nicaragua systematically.

3. In connection with the above-mentioned it is necessary to proceed to the erection of facilities for repair and maintenance of metalworking machines and spare parts manufacture.

4. It is advisable that the repair and maintenance of the metalworking machines in the industrial sector of the country's economy, as well as in other sectors, be concentrated in a specialized centre. It is determined by the specific features of the country, by the not large number of the metalworking machines, by the lack of local specialists and workers to carry out these activities requiring high qualification and skills.

5. With a view to reducing the period for setting-up this centre it is necessary that a study should be made and a preliminary design of the project be worked out.

6. It is advisable that the help of a country having experience in the field of the centralized preventive repair activities - in the directions below stated, should be used:

- carrying out of studies and working out preliminary designs;
- making available technologies for repair and maintenance of metalworking machines and spare parts manufacture, suitable for the conditions in Nicaragua;

-making available of technical assistance by specialists and workers from such country to erect and put into operation of repair facilities and training of local specialists and workers;

- delivery of the necessary machines and equipments, measuring instruments and tools.

7. Simultaneously with the study and the working out of preliminary design for the proposed centre, it is recommended that the studies for erection of facilities for repair and maintenance and spare parts manufacture to cover the needs of the basic equipments in the remaining sectors of the industrial branch of the country should start.

8. It is necessary, together with the studies and working out of a preliminary design for the erection of the centre, to study the capabilities for manufacture of ferrous, non-ferrous and alloy castings and forgings, and if necessary, the project should envisage the erection of such facilities with a view to meeting the demand of blanks needed for the manufacture of spare parts.



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