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ECONOMIC ASPECTS AND SIGNIFICANCE OF THE UTILIZATION OF NON-FERROUS SCRAP IN DEVELOPING AND DEVELOPED COUNTRIES 1/

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Contents

I. Introduction

1/ Extensive development of chemization and use of artificial materials have made a remarkable step forward, especially in our century. However, an important role was been played also by the old servants of man - non ferrous metals. In many cases, the trend of their use and consumption are almost comparable with the trend of use of artificial materials.

2/ However, there [illegible] essential difference which must one take it into serious consideration. While the basic raw materials for the production of artificial materials - mostly based on organic base - are at the disposal almost in unlimited extent, the situation of the raw material base for the production of non-ferrous metals is substantially worse. These metals, on which economic development as well as living standard depend, are extracted from relatively small and specific geological sources in which a dispersed metal has been concentrating for very long geological periods. The earth's crust, for example, contains more aluminium than iron, but aluminium is dispersed or impured by other elements and, owing to this fact, only a small part could be yielded and processed to metal in an economical way.

/See table 1./

Table 1.

Content of metals in the upper 15 km of the earth's crust. /Reffered to 100 units of the content of lead/.

Silicium	1 364 000	Tin	0,5
Aluminium	400 000	Arsenic	0,5
Ferrum	248 000	Molybdenum	0,5
Magnesium	104 000	Mercury	0,05
Titanium	32 000	Cadmium	0,05
Manganese	4 900	Antimony	0,05
Chromium	1 800	Silver	0,005
Zircon	1 300	Bismuth	0,005
Nickel	1 000	Gold	0,0005
Vanadium	500	Platinum	0,0005
Copper	480	Thalium	0,0005
Uranium	400	Cesium	0,00005
Wolfram	240	Indium	0,00005
Zinc	200	Tantalum	0,00005
Lithium	200	Iridium	0,00005
Lead	100	Palladium	0,00005
Beryllium	46	Radium	0,0000005
Cobalt	40		

The length of geological periods necessary for the formation of a local accumulation of metals into deposits, is a limiting factor. Thus, the sources of metals accessible at present are not unlimited [illegible].

3./ The production of non-ferrous metals and their utilization are still of an increasing tendency. Parallelly with the intensive increase in the number of people over the world the use of these metals is also increasing [illegible] a head. All this creates an unavoidable necessity of maximal saving with non-ferrous metals all over the world.

4./ Development of economy of extraction of the non-ferrous metals is also noteworthy. The time is gone when the ore of these metals was obtained from rich or superficial deposits with minimal expenses, when treating was almost not necessary and the proper extraction process was quite simple. And spite of the fact that the range of men's knowledge has intensified since, and, beyond doubt technology has made further increased twice from [illegible] till 1967 steps forward, [illegible] deposits have been found in recent years: at least none such which would cause a significant improvement of circumstances.

5./ Few exceptions, [illegible] example, deposits of lead ores in Clark National Forest Region, Missouri, U.S.A., with supposed reserves [illegible] tons, were discovered in the last years. These findings [illegible] owner to build there the most modern plant [illegible] only [illegible] 1968/69. But [illegible] belongs to [illegible] Co. as well as other firms, only confirm the general situation mentioned above.

6./ The object of metallurgical processing are consistently becoming more complicated raw materials which contain not only relatively less amount of metals which are the aim of extraction, but also such accompanying metals which are very important from the aspect of production. On the other hand, the total effect of metallurgical plants is [illegible] improved by the presence of some accompanying metals and a change in the production technology, aimed to their parallel extraction makes it worth while. Hydrometallurgy is of a significant importance in this case. New technology results in the total increase in direct output of individual metals from ore, to metallurgic product. This enables renewal

work in abandoned deposits, or, eventually, go back to old mining and metallurgic dumps, use them for further extraction of metals and thus to increase the total useable capacity of reserves for the production of primary non-ferrous metals together with discovery of new deposits.

To these reserves nowadays are also taken into consideration the amount of non-ferrous metals occurring in sea waters. These waters cover the majority of the earth's surface. 1 km^2 of sea water contains approximately 1.400 000 t Mg, 200 t Al, 200 t Zn, 30 t Ag, 1 t Au and almost all known elements are presented in it. New technologies are developing in order to extract them; one of the first successfully extracted metals from sea water is magnesium.

./ In this situation, efforts are made to substitute the deficiency in metals. Much endevour is carried out to replace these deficit of metals by substituting them by other metals, which are easier accessible, or, replacing them completely by other materials. A well known example is replacing of copper in electrotechnique by aluminium. However, this interchange presented also some failure in similar experiments. Practice has proved that this replacing cannot be absolute, aluminium can be used only in a limited range, e.g. for air high voltage conductors, aluminium cables, etc. There were also varied results in the case of replacing metals by plastics, where, for example, aluminium was not successfully replaced with polyvinil chloride /PVC/ in the packaging cosmetic cream.

II. Statistical data.

9 ./ In order to illustrate the above mentioned conclusions we present a few statistical data concerning the production and utilization of non-ferrous metals from the first and second smelting, as well as their share held in the world.

/See table 2. and 3.

Table 2.

World Output of NON-FERROUS METALS in 1930-1966 /in thousands of tons/

Production	Al[1/]	Cu[1/]	Pb[1/]	Cu[1/]	Sn[1/]
1930	27[illegible]	1[illegible]50	1660	1[illegible]90	179,7
1931	2[illegible]0	13[illegible]0	1370	9[illegible]0	153,[illegible]
1932	1[illegible]0	[illegible]00	1[illegible]50	7[illegible]0	105,4
1933	140	[illegible]90	1150	970	98,6
1934	160	1[illegible]60	129[illegible]	1150	117,[illegible]
1935	[illegible]30	1[illegible]50	1350	1290	141,9
1936	340	1630	1440	1400	17[illegible],3
1937	[illegible]50	[illegible]240	1610	1[illegible]50	204,6
1938	540	1[illegible]20	15[illegible]0	1[illegible]00	164,7
1939	630	[illegible]040	1[illegible]00	1[illegible]90	176,1
1940	71[illegible]	2330	1560	1[illegible]60	[illegible]0,[illegible]
1941	9[illegible]0	2[illegible]70	1610	1[illegible]60	[illegible]20,[illegible]
1942	1320	[illegible]700	1560	1720	107,5
1943	[illegible]00	2[illegible]70	1[illegible]00	1[illegible]50	[illegible]11,[illegible]
1944	1[illegible]00	[illegible]400	1230	1540	[illegible]5,2
[illegible]	7[illegible]0	[illegible]0[illegible]			[illegible],[illegible]
1946	[illegible]90	1[illegible]70	[illegible]02[illegible]	13[illegible]	1[illegible]0,9
1947	[illegible]10	[illegible]90	1[illegible]90	1[illegible]80	1[illegible],[illegible]
1948	1[illegible]2[illegible]	2[illegible]2[illegible]	13[illegible]0	17[illegible]0	16[illegible],[illegible]
1949	[illegible]2[illegible]0	[illegible]207	[illegible]430	170[illegible]	171,1
1950	13[illegible]0	[illegible]2[illegible]1	[illegible]770	1[illegible]8[illegible]	17[illegible],1
1951	1[illegible]90[illegible]	[illegible]300	1[illegible]90	1[illegible]4[illegible]	150,4
1952	[illegible]0[illegible]0	[illegible]4[illegible]0	[illegible]630	2[illegible]0[illegible]	171,[illegible]
1953	[illegible]19[illegible]	2[illegible]70	[illegible]9[illegible]0	20[illegible]0	[illegible]0[illegible],1
1954	[illegible]1[illegible]0	[illegible]1[illegible]0	17[illegible]0	[illegible]150	1[illegible]7,7
1955	[illegible]710	[illegible]7[illegible]0	17[illegible]0	[illegible]3[illegible]0	1[illegible]5,3
1956	[illegible]910	[illegible]9[illegible]0	1[illegible]70	[illegible]4[illegible]0	1[illegible]9,4
1957	2[illegible]60	[illegible]0[illegible]0	[illegible]970	[illegible]540	177,4
1958	[illegible]040	[illegible]9[illegible]0	1[illegible]90	[illegible]070	141,9
1959	[illegible]31[illegible]	[illegible]640	17[illegible]	[illegible]30[illegible]	1[illegible],8
1960	[illegible]700	[illegible]4[illegible]0	[illegible]050	[illegible]490	14[illegible],2
1961	[illegible]62[illegible]	[illegible]0[illegible]0	1910	[illegible]040	[illegible]8[illegible],7
1962	[illegible]96[illegible]	[illegible]440	19[illegible]0	[illegible]760	147,0
1963	[illegible]0[illegible]0	[illegible]4[illegible]0	19[illegible]0	[illegible]030	149,3
1964	[illegible]90[illegible]	[illegible]6[illegible]0	[illegible]040	3050	144,7
1965	[illegible]20[illegible]	[illegible]27[illegible]	[illegible]97[illegible]	[illegible]40[illegible]	[illegible]51,[illegible]
1966	[illegible]5[illegible]0	[illegible]5[illegible]0	[illegible]1[illegible]0	[illegible]5[illegible]0	[illegible]6[illegible],[illegible]

The years 1930-48 without the U.S.A. and only primary metal
" 1949-53 without the U.S.S.R. and China and only primary metal at Al, Cu, Pb and Zn. In the case of Sn without the U.S.S.R.
" 1954 at Al without China and the U.S.S.R., at Cu, Pb and Zn without China, Korea and the U.S.S.R., but also the metal from the secondary melting. At Pb without China, Czechoslovakia, German Democratic Republic, Korea, the U.S.S.R., Romania, Turkey and primary metal. At Zn without China, Czechoslovakia, Korea, the U.S.S.R., German Democratic Republic and Romania only primary metals. At Sn without China, Czechoslovakia, German Democratic Republic, Vietnam and the U.S.S.R.

Table 3.

The World production of primary non-ferrous metals in comparison with the year 1963 = 100 %

1956	80 %	1961	94 %
1957	82 %	1962	99 %
1958	77 %	1963	100 %
1959	82 %	1964	105 %
1960	92 %	1965	108 %
		1966	114 %

10 / The development of the utilization of non-ferrous metals can be marked by the data of two metals: Sn - the utilization of which is limited by limited sources of raw material, and Al - the source of which is at present particularly great.
Balance reserves amount to ca 5 mld tons of bauxite. Al represents unambiguously the metal with the greatest trend of production as well as utilization.

Table 4.

Consumption of Sn in 1947-1963 expressed in thousands of tons.

1947	129,0	1957	157,0

1948	133,0	1958	150,5
1949	116,0	1959	152,6
1950	154,5	1960	170,2
1951	142,0	1961	167,0
1952	134,0	1962	163,4
1953	135,0	1963	165,3
1954	144,5	1964	171,0
1955	137,0	1965	167,7
1956	162,0	1966	169,4

The years 1947-1958 without the U.S.S.R.
" 1958-1962 without Bulgaria, China, Czechoslovakia,
the year 1962 without German Democratic Republic, Hungary, Vietnam, Poland, Romania and the U.S.S.R.

1) As we presume that the statistic data concerning Al or subject of another request at the conference we will abstain from putting forward but we will mention only the following with its utilisation in the western countries recorded in 1946-67 ... early increase of 2,6 % p.a. in 1957-67 2,6 % and its increase in 1965 ... with the year 1967 was 10 ...
It is supposed that Al... growth will reach the amount of 10 mil. ... in 1975.

2) Considering the growth in the number of inhabitants over the world according to the statistics of UNESCO and U.N.O.

Year	thousands of inhabitants
...	2.07... 000
...	2.29... 0...
...	2.51... 0...
...	2.69... 0...
...	3.0... 5 000
...	3.29... 000
...	3.3... 0...
...	3.4... 0...

The yearly increase amounted in ...60-6... by 1,9 % yearly, while the world population has grown in 196...-67 by 1... %.

Thus, the yearly increase in the production of Al over the whole world exceeds the growth of people /expressed in %/ and its utilization per head has increased from 1,1[illegible] kg /1955/ to 3,71 kg in 1966.

13./ Although the cited data do not give a complete picture about the production and utilization of non-ferrous metals, they mark a very distinct and quite quickly raising trend of introduction of the non-ferrous metals and metals in general, into the sphere of man's utilization. The fund of metals has reached a volume of milliards of tons in the present time.

14./ In spite of a great effort of geologists and metallurgical workers, discovery of further reserves of ores and findings of new technological methods, which are capable of treating very complicated ores, as well as ores containing a low amount of metals, [illegible] relatively slowly and as already mentioned, have absolutely limited possibilities.

15./ The present situation is characterized distinctly by a reduction of the possibilities in the production of primary metals and, on the other hand, by a raise in the metal fund, as a base for the production of secondary metals. Basic [illegible] determined for the production of secondary metals are as follows:

- Scraps from the metallurgic production of non-ferrous metals
- Scraps from the treatment of non-ferrous metals
- Metallic products unsuitable for further use, such a constructions and various equipment. Under the term "scrap" mostly the last two [illegible] are being taken into consideration.

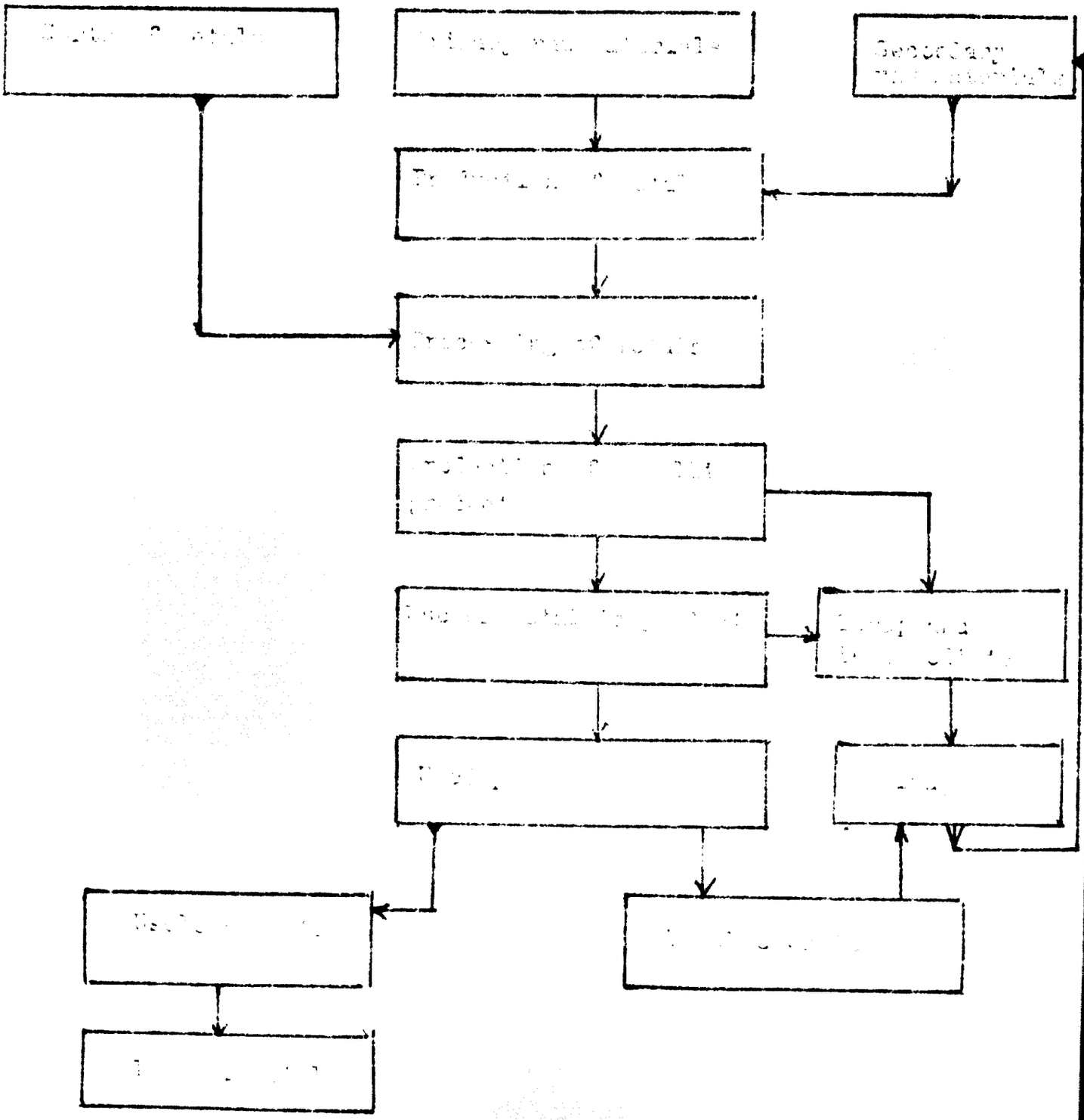
As to the liveliness of metal in [illegible] constructions, the range of organization of salvage of metal for metallurgic production, their treatment and the technology of their metallurgic [illegible] can bring about a rather high restitution in secondary form.

The circulation of metals, to which it comes, is given in a simplified scheme./ see [illegible]/.

The scraps of non-ferrous metals remain, therefore, an important factor [illegible] economy of these metals.

16./ Theoretical possibilities of restitution of metals are, first of all, limited [illegible] metal, caused chiefly [illegible] extent dispersion, for example: by loss due to abrasive wear of the moving parts of machines, losses during manipulation, frict[illegible]

Simple circulation of non-ferrous metals.



etc. However, according to the opinions of experts these losses are relatively small, they reach about 2 - 5 % and, therefore, there exists a theoretic possibility of restitution of 95 - 98 % of metal. The amount of the metal which is actually returned, is, however, rather lower due to imperfect salvage and classification. Thus, Istrin supposes the restitution coefficient for aluminium in the U.S.S.R. 75 % and many other authors are in agreement that the coefficients for the individual metals are within the range of 60 - 85 %.

Restitution of about 50 % means an absolute doubling of amount of metal that is at the disposal for further utilization during the course of three years.

17./ At the same time there is an important fact to remember the secondary source of metal becomes exclusively the material with a distinct contents of its own metal very often exceeding the concentration of the metal in ores.

The technology of remaking it to usable metal is a simple one. It does not require capital investments and it requires only a low consumption of auxiliary materials and manpower. Usually, the total expenses for remaking reach only about 10 - 25% of the expenses necessary for recovery of the primary non-ferrous metals.

III. Economic comparison and situation in developing countries.

18./ Therefore let us start off for further consideration under the assumption that the scraps of non-ferrous metals are valuable sources of metals meant for re-utilization economy throughout the world. We are going to [illegible] some technical- economic aspects of its utilization in the countries with well - developed industry, as well as in the countries which are less developed from the aspect of economy.

From the point of view of economising with non-ferrous metals it is possible to point out industrially highly developed countries as those with an existing distinct fund of metals, whose task remains to extend this fund according to the demands of their industry.

On the other hand, there are the countries with their industries still developing and their task is to face the creation of their own fund of metals and ensure its further development.

Due to these differences the problem of scraps of non-ferrous metals plays a different role in the economy of both named groups of countries.

19 / Countries with well developed industry have at their disposal a great metallurgic capacity for the production of primary non-ferrous metals, they have a well - developed industry for processing these metals and at the same time a high demand for assortment of their products on the home market. While the production of primary metals often depends on the base of imported raw materials /e.g. the production of Al in Western Germany, Norway and Czechoslovakia, as well as in further countries without sources of bauxites, base sources of scraps enable an intensive development of the production of secondary metals.

20./ The situation in the developing countries is quite different. In spite of the fact that they often possess quite extensive reserves of metals, their metallurgic production of primary metals is remarkably low, or even non-existing. Here, actions of building their own industry are limited chiefly by insufficient investment sources. Owing to the import of the products of the metal-processing industry in the well - developed countries, there

exist even in these countries funds of metals created almost by 100 % of metals in utilisation and of scraps of amortized products. The developing possibilities of domestic metal-processing industry are thus given - apart from other factors - by absolute possibilities of extraction of further metal for the consumption of the home industry, which is a common problem for the well - developed countries, as well. The share with which the metall - processing industry of developing countries participate in the total volume of industry, are rather low, although still raising. The materials of U.N.O. from 1966 present the following data:

/See the statistic table 5./

Table [illegible].

Distribution of investments into industry in 1938 - 1961.

Country	Group of industry	1938	1946	1953	1961
World, inclusive the U.S.S.R and Western Europe	1./light industry	[illegible],4	44,3	39,3	37,[illegible]
	2./production of metallic products	24,1	30,1	35,2	34,7
	3./heavy industry	23,5	25,6	25,5	27,5
Countries with well-developed industry	1./light industry	50,[illegible]	42,2	37,5	35,9
	2./production of metallic products	25,5	31,9	35,0	36,6
	3./heavy industry	23,7	25,9	25,5	27,5
Countries with [illegible] industry	1./light industry	[illegible],9	67,2	63,1	55,7
	2./production of metallic products	9,7	10,7	11,9	16,3
	3./heavy industry	21,4	22,1	25,0	28,0

[illegible] 2./ includes the groups ISIC
35 [illegible]
36 [illegible] powerstations
37 [illegible] of electric [illegible]
38 production of transport equipment

2./ With regard to the [illegible] mentioned low investment demands for [illegible], it is possible [illegible] that the [illegible] of some [illegible] of great interest to the developing countries from the [illegible] aspect, in the [illegible] to the further [illegible] into the developing industry. Cheap [illegible] labour enables [illegible] in comparison with the well-developed countries, [illegible] better [illegible], [illegible] expensive [illegible], to increase the productivity of work. The main [illegible] possible [illegible] of workers. [illegible]

fact is that already a small re-making capacity is able to work with profits. We present two examples.

-2./ The salvage of domestic vessels [illegible] tin and copper in the [illegible], after [illegible] visual classification, when re-melted, sufficient material [illegible] the industrial production of these vessels.

-3./ The number of running cars [illegible] supposition for the [illegible] vage of [illegible] scraps. Usable [illegible] be obtained only by careful classification or by remelting it [illegible] cylinder [illegible] be [illegible] with a minimal refinement.

-4./ Of course, the problem of increasing the metal funds can be also solved by import of primary metal or by change in capital investments.

I[illegible] of [illegible] is quite expensive. In the [illegible] [illegible] remains the [illegible] the production [illegible] possible, [illegible] this process, [illegible].

-5./ [illegible] of metallurgical [illegible] from which the most [illegible] for the developing country is export of the produced primary [illegible].

-6./ Thus, [illegible] of scraps [illegible] - for a [illegible] - industry - the most [illegible] non-ferrous metals, although in a [illegible] industry, [illegible] in 192[illegible], [illegible].

-7./ The technological [illegible] aspects concerning scraps [illegible] non-ferrous metals [illegible] for [illegible] countries. It refers [illegible] classification and the actual treatment of [illegible] to the specific conditions of both [illegible] far as the technical equipment and volume capacity [illegible] concerned.

No doubt, the problems concerning the scraps from the metal treatment are of a different character from the problems in the treatment of mentioned scraps.

ad / In the case of cuttings, chips, metal shavings etc. the situation is relatively simple. The return into the reproduction cycle is possible to realize in the following ways:
- treatment in one's own plant
- direct delivery from the place of occurrence into the processing plant
- delivery into the processing plant through a salvage organization

The decisive factor in this case is the correct standardization for output procedure and the prices in the country inquestion. There are two diametrical, opposed facing each other factors: interest of the scrap producer who tries to reach the highest price for scraps and offer is whose interest it is the payment of the lowest possible price for the scraps used, thus, to increase of the profusion of scraps to improve his own economic balance. It lies mostly with the central, governmental or regional authorities to find a compromise concerning the necessary quality of scraps, as well as adequate prices, which could have a certain stimulating effect for both sides.

ad / For instance in the German Democratic Republic in 1966-67 the price of non-alloyed steel bearing cuttings Ma5c was 2.460 MDN/T and the alloyed ones 4.730 MDN/T. The price of cast steel RgS, non-classified, was 2.460 MDN/t and the classified 6.640 MDN/t. The price of the scraps is in this case not only a means for the stimulation of the owner, as well as of the scrap processing, but also it ensures sufficient clearances which guarantee the possible shortest cycle of the restitution into the workable metal.

As a matter of fact, consequences of wrong treatment are not seldom possible. For example, 40 kg of cast metal RgS can contaminate 1 ton of brass cuttings Ms5c to such an extent that it can

be used only for casting copper. The question of purity does not influence only the direct expenses for the restitution of scraps, but often it effects even the absolute possibilities of its use; e.g. devaluation of steel scraps with insufficiently classified non-ferrous metals. It is especially copper that causes that such scrap can be then used only for the production of steels of lower qualities.

Of a far important role is played by the speed of delivery of scraps for remelting and its careful storage which protects the scraps from oxidation and corrosion. This is the worst thing that can happen to Al and Mg. For example, the content of Al in the Al cuttings is decreasing by 0,3 % within a month in a sheltered store with 4 % moisture. In an unsheltered store by 1 %. When the moisture is 14 % a decrease in the sheltered store is 2,7 % and in an unsheltered one 3,9 %. The presence of iron speeds up the oxidation.

Table 6.

Loss of Al by oxidation of cuttings at moisture 4 % and storage within a month (expressed in %).

% Fe	Sheltered store	Unsheltered store
2,5	3,2	3,8
6	3,5	4,8
10	5,5	7

The technology of processing of oxydized cuttings is more difficult and requires increased expenses.

Losses of metal are being increased by storing it in open yards. Having liquidated a sheltered store for copper scraps without flooring in a yard of a metallurgical plant, we discovered these facts: Up to a depth of 10 cm the soil contained 11 % Cu in the form of $CuSO_4$, to a depth of 10 - 20 cm 5 % Cu, and in the depth of 30 - 40 cm still 2.5 % Cu.

31 / The problem in the case of amortized scraps lies in the actual salvage, itself. In the countries with developed industry this scrap is treated in specialized plants, which are very often of a immense capacity. There exist also specialized plants in which treatment of scraps proceeds before the actual processing. For example, in the U.S.S.R. exist such plants projects of which treat scraps and they have a capacity of 400, 600, 1200, 3000, 5500 to 10.000 t ns per year.
Specialization enables to achieve a high productivity of work. A plant with 200 employees engaged in the salvage and treatment of scraps classified in the year 196[illegible] 12.200 tons of scraps for further processing, achieved the following presentation of individual containing metals. /See page 18-A/.
The technology of these plants enables processing of many different materials containing the most required metals. For example, in the plants for remelting copper these metals are as follows: copper, brass, bronze, red metal and other sorts of alloys; they appear in the following forms: copper in pieces, copper cables, windings of electric motors, cuttings, brass ashes. The object of treatment can be also some chemical compounds /e.g. lead zinc, sodium antimonate /V/, oxides and sulphates of lead, etc.
Thus, the salvage is aimed to the most different sorts of metallic material.

32 / Contrary to this, the salvage of scraps of non-ferrous metals in the developing countries, where no special plants for its treatment exist, the salvage is differentially [illegible] the same content of [illegible], the remelting of which the plant can obtain the required metals, essential for the production of their final products. This is often the only way how to get to an accessible source of the necessary and a relatively cheap metal.
We would like to support the above mentioned as critical that the remelting of scraps in optimal cases, requires only about 10-25 % of expenses /usually 25-30 %/ necessary for the production of primary metal; the data for this support are chosen by chance from an operation practice lowering consumption of some significant items from the aspect of production expenses, resp. by comparison with the consumption of production of primary metals.

25,5 % - steel scraps
10,9 % - cast iron scraps
25,0 % - copper - base alloy and scraps for re-making to casting copper
10,4 % - Al and Al-base alloy
12,5 % - Pb scraps
1,0 % - other non-ferrous metals
14,6 % - this part was represented by non-metallic scraps and melting losses

At the same time we presume that the economical advantage of treating scraps of most common non-ferrous metals will be brought up in further reports at this conference dedicated to the problems of individual metals.

33 / A copper plant on an average technical level in Central Europe, with a yearly capacity of about 6.000 tons of electrolytic copper, on the basis of primary raw materials, and 7.000 tons of secondary electrolytic copper, requires for the production of 1 ton of electrolytic copper from Cu concentrate 14 working hours. The production of 1 ton of electrolytic copper from very heterogenic scraps /impure cuttings, etc./ requires only 4h working hours. The technological process in the first case includes the following parts: shaft furnace, converter, anode furnace, electrolysis. In the case of secondary raw materials refining is added.

34 / About 17.000 kWh of electrical energy is required for the production of 1 ton aluminium, obtained by electrolytical process. When using oil-fired Al-scrap, the required amount of electrical energy in an induction furnace is only 550 - 650 kWh/t. In the case of an other energy being used, e.g. gas, as in one plant in the German Democratic Republic, the melting loss is also favourable melting from steel - aluminium scrap requires 120 kg of oil per one ton, at the output of 70 - 85 % of metal.

35 / A short rotary furnace, type Kohlmeyer - Lungi /KTC/, is an extremely suitable equipment for remelting of many types of scraps of non-ferrous metals /zinc dusty scraps, copper scraps, Pb-Sn-Zn containing scraps, mixed scraps, etc./ when taking into consideration the low investment expenses and rapid heat transfer to the material involved, as well as further technological performances.

From a long - termed operation practice we can present the following result: when remelting accumulator scrap with an average content of Pb 72 - 84 %, Sb 3 - 4 %, Sn 2,5 - 3 %, antifrictional materials 3,5 / 4,5 % CuO with Sb 6 - 8 %, Sn 0,15 - 0,3 %, As 0,03 - 0,05 %, Cu 0,55 - 0,7 %, Fe 0,005 - 0,03 %, Ag 20 - 50 g/t the direct output was about 91 % of Pb, - when the short cylindric furnace Lungi Ø 3 m, operated by three workers, was used, with a daily charge of 17 - 26 t.

The consumption of electrical energy was 80 - 107 KWh per 1 ton of produced lead. The consumption of heating oil was 6 - 10 per weight of charge and consumption of auxiliary materials as follows: 1,5 % of spent sulphite liquors, 6 % of coke, 5 % of crushed material ores, 3 % soda, 0,6 % borax, 0,4 % CaF_2, 3 % of coke crushed material per weight of charge.

IV. Conclusions and recommendations.

36./ Concluding from these reports, statistics and analysis of problems, it can be realized that the developing countries are faced with the role of increasing their [illegible] of metals in an organized, tenacious and [illegible] way. The decisive role should be played by the production of metals, with respect to further development of the whole industrial basis. The most advantageous of the two existing possibilities seems to be the production of secondary metals, based on the domestic salvage of scraps, especially in the case of non-ferrous metals, chiefly when compared with the primary production based on concentrates or other home reserves of ores. Especially, the height of investment [illegible] seems to be the most decisive factor in this case /inclusive the evolved investments in both the production and tertiary sphere/.

37./ Investment seems sufficient to secure the production of secondary metal, and far from enough to cover the production of primary metal and hardly cover expenses connected with the basic geological investigations, and the starting off of extraction. The expensive construction of the [illegible] complex and auxiliary equipment remain still [illegible].

38./ As to the sphere of consumption the developing countries are [illegible] approaching the countries with developed industry, especially where the structure of goods consumption is concerned. [illegible] distinct life [illegible] in the [illegible] level, the interests of the inhabitants [illegible] in their households, [illegible] etc/. Therefore, the [illegible] turned to those non-ferrous metals which take the first place in the economy of well-developed countries: aluminium, copper, lead, zinc and tin.

39./ With regard to the smaller volume of metal-working industry [illegible] the scraps of non-ferrous metals prevail in the form of [illegible]. The [illegible] concerning the salvage of these scraps have the same [illegible] in both types of countries. The difference [illegible] plants which treat the scraps, or in the fact if the plants were constructed to treat the salvage of non-ferrous metals in general, or [illegible] to treat only certain metals and their [illegible]s.

40./ As a result of analysis realized by a number of experts of different countries the decisive factors of the amount of metals to be re-made for utilization, as well as for the economical effect, are:

a./ technical factors
b./ organizatory factors

a./ Salvage and classification of scraps at the place of occurrence or at least nearest possible to it.
Storing of classified scraps in sheltered stores with flooring, for hte shortest possible periods, - eventually direct deliveries to the smelting plants.
Treatment of classified scraps for the production of usable metal by means of shortest metallurgical process.

b./ Legalization of qualitative standards and prices supporting the keeping of terms of the above mentioned technical conditions.
Taking control of economical management of scraps by state authorities.

41./ The original idea of the strong countries about the form how to help the developing countries is always changing, according to the changed capital interests of both groups of countries. The investment of capital into the developing countries based on the assumption of [illegible] "coming back" in the extraction of non-ferrous metals, [illegible] of payment with [illegible] of concentrates, [illegible] the phase of smelting the metals themselves. The "coming back" of the investments in connection with [illegible] level [illegible] of energy and [illegible] use of [illegible] of the [illegible] countries in the markets of well-developed countries. Thus, it is getting a character of indirect "coming back". Revenue of the well-developed countries is rising rapidly and [illegible] nowadays 1.000-4.000 US $ per head while the situation in the developing countries is worsening, chiefly due to the expansion of the population and its revenue does not exceed [illegible] US $ per head a year.

4./ From what has been stated so far it would be possible to put down, on behalf of the developing countries, these technical-organizatory recommendations.

General recommendations:
To regard salvage and treatment of scraps of non-ferrous metals as the most important and most advantageous way of creating home metal fund, as a base for futher development of industry from here to more.

Techn.and - organizatory recommendations:
1./ Forming of a state organ or institution, or any kind of authority, to be in charge of assuming the maximal re-utilization of metal regained from scraps of non-ferrous metals.
2./ The chief task of this authority being:
- regulation of state standards for scraps of non-ferrous metals in accordance with those existing in economically developed countries.
- carrying out of control of prices of scraps from the interest of the state, whose primary aim is maximal mobilization of metal.
- instructive activity and its realization.
3./ The problem of scraps of non-ferrous metals to be introduced into the teaching plans of secondary schools and Universities, - from the point of view of trade, economy, metallurgy and engineering.
4./ To enable experts to gain experience in organization and technology of processing by participation on study trips to the capitalist and socialist countries, especially with regard to scraps of Al, Zn, Pb and Sn.
5./ To make plans for actual evaluation of the present state and the working out of needs and plans for further steps, in accordance with conditions of the individual country.
6./ To organize immediately, even before the actual recommendations 1./,-5./, for the salvage and treatment of scraps of non-ferrous metals would be put down, arranging of sorting of plants, concerned with the collecting and processing the factual situation in the sphere of the most important non-ferrous metal scraps: Al, Zn, Pb, Cu, Sn, - with regard to their occurrence, treatment and utilization.

g./ Following recommendations under f./, to put stress on:
Optimal salvage and classification.
Shortening of storing periods.
Simplified treatment for gaining useable metals.

V. Summary.

a) Conclusive brief summary:

We have pointed out the importance of scraps of non-ferrous metals as a source for production of secondary metals in general by a confrontation of the contemporary situation in the reserves of primary metals with development of their production and consumption. Our conclusions are supported by a few numerical data.

b) In the further part of this report we have analysed some technical-economical problems in connection with the problems in the scraps of non-ferrous metals in the well developed countries and in the countries with developing industry. We have come to the conclusion that the most reasonable way how to create in our national fund as a base for the further development of industry in the developing countries is just re-making of non-ferrous metallic scraps.

c) On behalf of gained experience and studies we have come to the conclusion of suggesting the following recommendations for the developing countries:

Main recommendations:

a) To regard selective acid treatment of scraps of non-ferrous metals as the most important way for creating home metal fund, as a base for further development of industry from home sources.

Technical - organizatory recommendations:

a) Forming of a state organ or institution, or any other kind of authority, to be in charge of securing the required re-utilization of metal, regained from scraps of non-ferrous metals.
b) The chief task of this authority being:
   Legislation of state standards for scraps of non-ferrous metals in accordance with those existing in economically developed countries.
   Carrying out of control of prices of scraps from the interest of the state whose primary aim is maximal restitution of metal. Contracting activity and its realization.
c) The problem of scraps of non-ferrous metals to be introduced into the teaching plan of Trnavan schools and Universities,- from the point of view of trade, economy, metallurgy and engineering.

d/ To enable experts to gain experience in organization and technology of processing by participation on study trips to the capitalist and socialist countries, especially with regard to scraps of : Al, Cu, Zn and Sn.

e/ To ask UNIDO for expert evaluation of the present state and the working out of recommendations for further steps, in accordance of conditions of the respective country.

f/ To organize in advance, even before the actual recommendations d.,-e., for the salvage and treatment of scraps of non-ferrous metals would be put down, arranging of meeting of plants, concerned with the aim of discussing the factual situation in the sphere of the most important non-ferrous metal scraps: Al, Cu, Pb, Zn, Sn, - with regard to their occurence, treatment and utilization.

g/ Following recommendations under f/, to put stress on:
Optimal salvage and classification.
Shortening of storing period.
Simplified treatment for gaining useable metals.

46./ At last, we discussed the still increasing difference between the revenue of both mentioned groups of countries and we have come to the conclusion /recommendation/ how to help the developing countries in their problems of formation of their own capital funds. The answer is the idea of capital help, motivated solely by humanity and without any enforced unilateral obligations. The great role that UNIDO should play in this field of endeavour is beyond any doubt.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