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PERSPECTIVES OF LEAD AND ZINC INDUSTRY

FOR THE NEXT TEN YEARS ^{1/}

by

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Summary

The most precise methods of estimating the future demand for lead and zinc can be efficiently adopted for developed highly industrialized countries. For some developing countries the correlation between lead/zinc consumption and Gross National Product was not found. Considering the current trends of metals consumption growth in 1960-1968 and many projections for the period 1970-1980 the forecast of lead/zinc consumption and production can be made. The lead/zinc consumption in the developing countries has increased since 1960 more considerably than in the remainder of the world, the mine and metals production, however, showed only a slight increase. To meet the projected consumption of lead and zinc in 1980 new mine capacities and smelter facilities should be adopted. In many developing countries there are possibilities of increasing both mine and metal production which could improve the economy and ameliorate the standard of living. In Argentina, India and Korea the increase in metals production could meet the growing consumption. In Mexico, Peru, Congo, Morocco, Algeria, Tunisia, Honduras and Bolivia conditions are favourable to develop zinc/lead production and to export metals instead of concentrates. There are still many trade barriers which restrain the developing countries from expanding their metals production. The stabilization of the metals consumption/production balance and of metals prices is the target of the International Lead and Zinc Study Group. The further expansion of the lead and zinc industry in developing countries demands an extensive technical and organizational assistance of the United Nations in programming the expansion, in the evaluation of technically best solutions and in training specialists in the required fields.

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I. Projections of demand for zinc and lead

1. The projections of demand can be most generally divided into a/ short-term and b/ long-term ones. The second type of projections is the object of our interest.

2. The aim of these projections is to assess the future demand for metals with a view to accurate programming the development of these industries. Investment cycles in mining are relatively long, within the limits of 10 years, thus involving the necessity of appropriate anticipating the future demand. The projection of that kind should therefore cover the period of at least 10-15 years. Moreover, the long projections have another aim, they provide opportunity for the confrontation of demand with reserves being at the disposal. Assuming that the economic development might result in the increase of demand for metals, outlook for meeting future demands is being examined and questions cast into view which might claim for solution. The conclusions drawn from that kind of examinations are of significant importance for the raw materials policy of a particular country, of a group of countries or of world economy as a whole.

3. The classic example of the examinations of that kind are such studies as "Resources for Freedom" and "Resources in America's Future". The objective of the authors was to examine the situation of the United States in raw materials: the first refers to the years 1950-1975 and the second to the years 1960-2000. It should be borne in mind that although that study is relevant to the United States the authors examined the situation in raw materials of the world as a whole too.

That object of the examinations is to be emphasized particularly from the point of view of these countries which are or may be potential producers of lead and zinc chiefly for export.

The look forward into the raw materials situation in the world may be a valuable criterion for taking decisions with regard to the extent of use of domestic potential possibilities for the development of the production.

4. The most precise method to estimate the future demand for metals is the method of end uses. It consists in:

- a/ determining main uses for metals,
- b/ determining the relationship between the consumption of metals for a particular end-use and the changes in the output of this use in time
- c/ approximate estimating the future metals consumption according to the projected level of output

5. This method was applied in both above mentioned studies and among others by I.S.Shishko in his paper "U.S.Demand for Selected Non-Ferrous Metals End Use Projections to 1975". I.S.Shishko employs the following classification of end uses:

Lead	Zinc
Storage Batteries	Die Casting
Antiknock Compounds	Galvanizing
Cable Covering	Brass
Sheet, Pipe, Traps and Bends	Rolled Zinc
Pigments	Zinc Oxides
Solder, Type Metal and Bearing Metal	Miscellaneous
Calking	Total
Miscellaneous	
Total	

The above classification may be of course either more des-aggregated or aggregated according to statistic data available.

6. Once the end uses have been determined it is to choose what branch of production is of decisive importance. In the case of use of lead for storage batteries for instance vehicle industry is of decisive importance, and steel production in the case of use of zinc for galvanizing. It should be cleared off however that leading branches are to be determined according to the economy of a particular country. It may easily happen that in the country X a different branch of end uses production is decisive for a given end use from that in the country Y.

7. The next point is to determine the relationship between the production of a leading branch and the consumption of metal in this branch. It is determined by virtue of econometric methods based on observation over a representative period of time. In "Resources in America's Future" for instance the observation of the 10 years period 1950-1960 was applied and I.S.Shishko has determined respective relationship over the years 1947-1965. The relationship assessed between the consumption of metal for a given use and the production of the leading branch cannot be recognized as steady - unchanged. It is usually assumed that the technical progress and substitution would result in the decline of the consumption per one unit of end use production. It obviously refers only to the metals which to some greater extent are not substitutes to other metals or plastics. To take these tendencies into consideration not only reliable statistics are required but also a good knowledge of the tendencies prevailing in technical development and its further lines. On the other hand it should be noted that the use of the relationship discussed becomes clearly speculative in particular with reference to long term periods for which technical conditions and economic ones in the production are very difficult to be forecast.

8. The method of end uses can be characterized as follows:

- a/ it is no doubt the most precise method of estimating demand but very risky too, especially when there are no available data reliable enough;
- b/ it requires available data comprising the period sufficiently long for extrapolation of trends for the future;
- c/ it requires a concept of economic development in such a disaggregation as could make possible the assessment of the dynamics of particular leading branches in the production.

The above study implies that this method can be applied solely to individual countries and is quite useless in the case of groups of countries or world economy as a whole. It should be noted also that only a few highly industrialized countries possess conditions for its practical use.

9. In view of substantial difficulties in practical use of the end use method in projecting demand for metals, a method simplified, aggregated, which ties the consumption of metals to the development of the industrial production can be employed. This method rests on finding far reaching correlation between the consumption of metals and the development of the industrial production.

Subsequently to pertinent examinations for the years 1950-1965 J.Dembowski obtained the following results:

Country	Correlation coefficient R	
	Lead	Zinc
World /excluding centrally planned economies	0.980	0.970
Europe /OECD/	0.979	0.977
United Kingdom	0.902	0.827
France	0.744	0.894
Federal Republic of Germany	0.975	0.971
Italy	0.956	0.988
Austria	0.837	0.980
Sweden	0.927	0.773
Japan	0.861	0.732
United States	0.861	0.732

The correlation is quite clear here and close to straight functional relationship. Furthermore from the calculations made it has been inferred that in the world scale by the years 1950-1964 each one per cent in the development of industrial production resulted in the increase of lead consumption by 0.628 per cent and in the case of zinc by 0.747 per cent. The author mentioned above resting on obtained equations of regression curve

for lead $y = 30,716 + 0.628x$

for zinc $y = 16,262 + 0.747x$

and assuming that the growth of the industrial production in the years 1965-1985 would average to 5.1 per cent per year, estimated the percentage rate of growth

for lead 3,5 on the average per year
for zinc 4.0 on the average per year

10. I.S. Shishko also obtained interesting results: apart from end uses methods for the United States he estimated the annual average percentage rate of growth in consumption of metals:

	End Uses Method	Aggregated Method
Lead	2.0	1.7
Zinc	3.0	2.6

The innovation here was his introducing into the aggregated method the dependence of metal consumption not on industrial production in general, but on the production of durables. The differences in the results obtained by help of both methods are slight as a matter of fact and in the 10 years scale they are in the margin of error.

11. The advantage of the aggregated estimation methods of metal consumption is that they can be applied not only to one country but also to groups of countries and to the whole world. The imperfection of the aforesaid method is, however, that it is of no avail in estimation of demands in developing countries as a whole. Differences in level of the industrial development arising in these countries are so great and the structure of the industrial production is varying so widely /lack of versatility/ that the estimation of future demands for metals in that group of countries with their changing industrial structure is practically not feasible. In the case of considering the world as a whole the result obtained will be more accurate but it should be borne in mind that more than 90 per cent of the actual consumption of metal is accounted for highly industrialized countries.

12. The aggregated method can be also referred not to industrial production but to Gross National Product /GNP/. It was applied by the experts of the Economist Intelligence Unit to the projection for the years 1970-1980 and following annual average percentage rates were obtained:

Region	Lead	Zinc
World	2.4 - 3.5	3.6 - 5.1
Africa	6.4	22
Asia	6.8 - 8.6	10.8
Latin America	4.9 - 7.2	5.2 - 7.3

It should be pointed out that satisfactory correlation for lead in Africa and for zinc in Africa and in Asia was not found here, consequently the projection was based on simple extrapolation of trends in last years. The discussed method is to be sure notably less precise than that based on the industrial production. It is because of the relationship between GNP and metal consumption more indirect than in the case of the industrial production. That is referred to developing countries in particular where the big share in GNP is accounted for the agriculture the development of which has not such an immediate effect on the increase in demand for metals.

13. From the review of basic methods used in projections of demand for metals it is inferred that they cannot be applied to groups of developed countries approached as a whole. The fact that these countries are so much differentiated in the degree of economic development and in actual as in postulated economic structure, provides no opportunities both for applying the aforesaid methods and for obtaining reliable results. It does not mean however that respective estimates with regard to individual developing countries could not be made. On the contrary, it is not only feasible, but it is advisable, however the individual approaching of particular countries with regard to their peculiar features will be necessary. UNIDO may be here of substantial assistance in financing works which could be carried out by international experts.

14. The above mentioned difficulties do not eliminate general estimations of future demand for metals. In the literature there are many studies of that kind the results of which deserve to be presented.

Source	Dates	Projection for the years	Annual Average Percentage Rate of Growth
Resources in America's Future	1960	1960-2000	world
zinc			2.5 - 4.0
lead			2.5 - 3.0
UNCTAD	1967	1964-1975	world
zinc			4.1
lead			3.3
J.Dembowski	1967	1965-1967	
zinc			4.0
lead			3.5
The Economist			
International Unit	1968	1970-1980	
zinc			3.8 - 5.1
lead			2.4 - 2.5

There are some differences in particular estimates inferred from different methods and different periods related to. On the other hand the significant convergence of the results should be emphasized which falls within the limits

2.0 - 3.5 per cent for lead
3.0 - 5.0 per cent for zinc

15. As it has been pointed out it is very difficult to separate groups of developing countries. It is known however that the potential rate of growth in consumption of metals will be in all likelihood higher than in developed countries.

II. Consumption of lead and zinc in 1960-1968

16. Most of the above discussed projections of lead and zinc consumption refers to the years 1960-1975-1980. The eight years period can be regarded as representative enough to check if the assumptions adopted in the forecasts were plausible. That period covers the years marked with small rises in consumption or even

With its decline and years of strong rises in consumption. Covering half of the period 1960-1975 it is the period sufficiently long too. The comparison of the actual trends of growth in lead and zinc consumption during that period with the forecasts set forth in mentioned above Chapter I may prove to be very useful in adopting its most likely projections for 1970-1975-1980.

17. Table 1 shows the increase in consumption of refined lead between 1960 and 1968. Consumption showed an increase of 719,000 tons - 31 per cent from which in developed countries of 575,000 - 28 per cent and in developing countries of 144,000 tons - 101 per cent. In spite of the marked increase in consumption shown by developing countries their share in world consumption is still very poor; it rose from 6.4 per cent in 1960 to 9.8 per cent in 1968. The relatively sharp rise in consumption of lead between 1960-1968 was not steady however, the prices in particular years fluctuated widely due to the disturbed balance between production and consumption.

18. The consumption of lead in the United States over the same period amounted to: /in thousand tons/

1960	1965	1966	1967	1968 ^{x/}
809	989	1076	1031	1066

^{x/} Estimated

Source: International Lead and Zinc Study Group, Monthly Bulletins of Statistics. For 1967-1968. Report of Statistical Committee. Twelfth Session, Geneva, November 1968.

19. Table 2 gives the picture of the increased consumption of zinc; it showed an increase of 1,295,000 tons - 52 per cent, with an increase of 1,107,000 tons - 48.5 per cent in developed countries and in developing countries of 188,000 tons - 108 per cent. Similarly, as in case of

lead the share of developing countries in global consumption of zinc is poor and over the years 1960-1968 rose only from 5 per cent to 9.6 per cent.

20. The consumption of zinc in the United States over the same period amounted to: /in thousand tons/

1960	1965	1966	1967	1968
790	1,256 ^x	1,273 ^x	1,125 ^x	1,275 ^x

^x/ Apparent

Source: International Lead and Zinc Study Group.

Average annual percentage rate of growth in lead and zinc consumption, by regions

21. Actual average annual percentage rates of growth in consumption of lead and zinc over the period under consideration in the world, in the United States, in developed countries and in developing countries are summarized as follows:

	1953-1955 to 1966-1968	1960 1968	1963-1965 to 1966-1968
World	3.6	3.7	2.6
United States	1.9	3.4	3.2
Developed countries	3.3	3.1	2.2
Developing countries	8.5	9.2	5.6

22. Actual average annual percentage rates of growth in consumption of zinc over the period under consideration amounted relatively:

	1953-1955 1966-1968	1960 1968	1963-1965 1966-1968
World	4.4	5.5	3.5
United States	2.3	6.1	3.6
Developed countries	3.9	5.0	3.2
Developing countries	11.3	9.7	5.4

23. The figures shown above indicate that despite various short term fluctuations, the first half of the period comprised in the long term forecast /1960-1975/, indicated that the projections for the United States as well for the whole world have been carried out and obtained picture is even more optimistic. The period 1963-1965 shows the rates of lead and zinc consumption growth lower than those for longer period 1960-1968 both with regard to zinc and lead, to short however for the conclusions referring to long term trends to be drawn.

24. Since 1960 a number of reasons emerged which allow to believe that the world lead and zinc market and the steady rise in consumption of both metals would be gradually stabilized.

25. In 1960 the International Lead and Zinc Study Group was established. Thirty countries are now members of that group: Algeria, Australia, Austria, Belgium, Bulgaria, Canada, Czechoslovakia, Denmark, Finland, Germany Federal Republic of, Hungarian Peoples' Republic, India, Italy, Japan, Mexico, Morocco, Netherlands, Norway, Peru, Polish Peoples' Republic, South Africa, Republic of Spain, Sweden, Tunisia, Union of Soviet Socialist Republics, United Kingdom, United States of America, Yugoslavia and Zambia. The Study Group provides opportunities for inter-governmental consultations on international trade in zinc and lead and for studies of the market situation in zinc and lead with particular reference to the desirability of providing continuous and accurate information regarding the supply and demand position and its probable development. Through its Special Working Group, comprising twelve member Governments a number of studies have been initiated. These include studies of production, consumption, international economic policies, scrap and secondary metal, forward estimates of mine and metal production and metal consumption, a study of pricing mechanisms in major markets. The Study Group's activity seems clearly to influence the stability of world lead and zinc market.

26. Another significant factor having effects on the buoyancy of the growth rate in consumption of metals, particularly of zinc, are research works on the introduction of new uses for lead and zinc and on the improvement of former ones. The achievements in that field of the International Lead and Zinc Research Organisation comprising a number of Research Institutes in developed countries are very important. The works on die casting zinc alloys are to be pointed out here especially. That application for zinc besides galvanizing shows the widest development and owing to new investigations the improved properties of die casting and the quality of their surface are secured. It is also possible to maintain the competitive position of zinc die casting to aluminium and plastics. The recently issued informations in United Kingdom on new superplastic zinc-aluminium alloy PRESTAL should be here mentioned too. Sheets from that alloy have been introduced by firms Leyland Motor, RTZ and Delta Metal into fabricating of cars and for other purposes. The alloys marked with superplasticity behave at the determined temperatures as thermoplastics; they can be treated in usual methods proper to plastics, at normal temperatures however they keep the characteristics of metal.

The growth in consumption of lead and zinc in developing countries

27. Another factor beginning to gain more ground in the world market of zinc and lead is the sharply rising consumption of these metals in developing countries. Besides the growth in consumption of lead and zinc in these countries, where they have been used for years, the processing of lead and zinc was started after 1965 in a number of countries not using these metals previously. The table bellow illustrates the increase in number of countries specified in the Statistics of International Lead and Zinc Study Group.

Number of developing countries by consumption of zinc and lead within ranges: 1,000 - 5,000, 5,000 - 10,000 and above 10,000 tons per year

year	Lead			Zinc		
	1,000 - 5,000	5,000 - 10,000	above 10,000	1,000 - 5,000	5,000 - 10,000	above 10,000
1960	2	-	4	1	-	4
1965	2	1	4	1	-	4
1968	7	4	4	3	2	9

28. In 1968 the consumption of lead exceeded 10,000 tons per year in following developing countries: Argentina 29,000 tons, Brazil 26,000 tons, Mexico 68,000 tons and India 60,000 tons.

29. The consumption of zinc exceeded 10,000 tons per year in following developing countries: Argentina 24,000 ton, Brazil 45,000 tons, Mexico 36,000 tons, India 80,000 tons, Pakistan 18,000 ton, Korea Rep. of 15,000 ton, Philippines 24,000 tons Taiwan 12,000 tons and Thailand 18,000 tons.

The comparison of the trends in 1960-1968 and the forecasts for the future

30. The comparison of the forecast increase in lead and zinc consumption in the United States made on the basis of the end uses method to the actual annual average rate of growth over the years 1960-1968 is presented as follows:

Source	Period	Consumption of lead			Consumption of zinc		
		Low	Medium	High	Low	Medium	High
H.M.Landsberg	1960-1970	-0.2	2.2	4.1	1.3	3.9	6.5
	1960-1980	-0.14	1.9	3.8	1.3	3.6	5.4
I.Shishko	1965-1975		2.0			3.0	
Actual	1960-1968		3.4			6.1	
	1963-65 - 1966-68		3.2			3.4	

As it can be noted the actual trend of increase in consumption of lead and zinc in the United States fall within the limits of the forecasts close to the estimate High.

30. Similar comparison for the forecast trends of increase in consumption of lead and zinc in the world is as follows:

Source	Period	Consumption of lead		Consumption of zinc	
		Low	High	Low	High
H.H.Landsberg	1960-2000	2.5	3.0	2.5	4.0
U.N.Projections	1964-1975		3.3		4.1
J.Dembowski	1965-1985	2.5	3.5	3.0	4.0
Economist Intelligence Unit	1965-1980	2.4	3.5	3.6	5.1
Actual	1954-1967		3.6		4.4
	1960-1968		3.7		5.5
	1964-1967		2.6		3.5

Actual rates of growth are in general within the limits of the forecasts, whilst the increase in the zinc consumption over long periods is approaching the upper limit of the forecast. The adoption of the following assumption referring to the increase in lead and zinc consumption in the world seems fully justified:

Lead:	Low 2.5 per cent	High 3.5 per cent
Zinc:	Low 4.0 per cent	High 5.0 per cent

31. In view of the afore discussed difficulties scarce projections of growth in consumption of lead and zinc were made for the developing countries. Only for some more industrialized developing countries it was possible to determine the correlation between the consumption of these metals and the growth of GNP. That refers to the countries of Latin America and to India. In African countries and other countries of Asia such a correlation was not found. The comparison of the forecast for the developing countries with the actual rate of growth in

consumption is shown as follows:

Regions	Consumption of lead			Consumption of zinc		
	Projection		Actual	Projection		Actual
	Low	High	1966-68	Low	High	1960-68
Latin America	4.9	7.2	6.4	5.3	7.6	7.2
Asia	6.0	8.6	13.4	10.8		9.8
Africa		6.4	17.0	22.0		33.3
All developing areas	5.4	7.6	9.2	9.4	10.0	9.6

32. The above comparison implies that actual results for the countries of Latin America are within the projected limits and can be adopted for lead in the limits 4.9 per cent to 7.2 per cent and for zinc 5.3 per cent to 7.6 per cent.

The consumption of lead and zinc in Asiatic and African countries has been climbing in recent two years so quickly that it became necessary to correct the long-term projection. Although any projection in that case is very risky it seems that for Asiatic countries the rates of growth in consumption of lead within the limits 7.0 per cent to 9.0 per cent and for African countries 8 per cent to 10 per cent can be adopted with a high degree of likelihood. The average rate of growth in consumption of zinc in Asia's developing countries can be assumed within the limits 8 per cent to 10 per cent, in Africa up to 1975 within the limits 15 per cent to 20 per cent, but by the years 1975-1980 when the consumption reaches notable level it will probably drop to the limits 8 per cent to 10 per cent, similarly to the asiatic countries, the average rate would then in the years 1968-1980 amount from 13 per cent to 16 per cent.

33. Table 3 shows the estimates of lead and zinc consumption by regions for the years 1970-1975 and 1980 made on the basis of the above mentioned projections. These estimates may seem very optimistic for developing countries, but the figures

given above indicate how surprisingly rapid is the growth in consumption in these countries in last years. Considering the per capita consumption in the developing countries which in Latin America is only 10 per cent and in Asia and Africa only about 1 per cent of that in developed countries, we can see a great potential possibility of expansion in the demand in these areas.

The factors affecting consumption in developing countries

34. The end use patterns in the developing countries are different and depend on levels of industrialization. In the countries using lead and zinc largely like Argentina, Mexico Brazil and India a good deal of uses known in highly developed countries exists. In other countries, however, where the metals consumption started in recent time, the major use of zinc is galvanizing, lead is used for batteries, sheets and pipes. Many galvanizing plants with rather primitive equipment produce durable finish like buckets, troughs, barrows, fenceposts and other farm equipment. There were many simple sheet galvanizing plants in most of developing countries using zinc and in Argentina, Mexico and India continuous strip galvanizing plants are operating. The galvanized sheets are widely employed in building throughout tropical areas for roofing and siding, water storage tanks and stormwater conduits. Galvanized roofs provide a very long life in clean atmosphere, are easy to lay, and give possibility to collect rainwater for domestic use without running the risk of its contamination. In some of developing countries galvanized wire used for fencing and galvanized tubes for water distribution are produced. In several countries zinc is used for dry battery cans and in some of them for zinc oxide.

35. The most modern uses for zinc like die casting are in developing countries not yet established. The production of expensive dies for short production runs is not economical. But in some countries of Latin America and India, where the local assembly of imported cars and other equipment has been

established on a scale big enough there are good conditions for zinc die casting production and there are some die casters in operation.

36. The main use of lead in developing countries is acid batteries production and battery works are widely established in these countries. There is still demand for lead sheets and pipes for building applications but it is rather unlikely that these uses would be developed on a large scale. The developing countries will tend to adopt new technologies and new, more economical materials. The cable industry exists in developing countries rather on a small scale but there are some cable plants in Latin America and Sout-East Asia.

37. The rapid growth in consumption of lead and zinc in developing countries will depend on general development of industrialization, overcoming of difficulties in foreign trade balances of these countries and connected herewith currency restrictions and on technical assistance. The interest in the industrial advancement of developing countries is general as a consequence of the desirability to ameliorate the standard of living. Due to currency restrictions the consumption of lead and zinc in many developing countries is narrow if it depends on import of these metals. In many cases lead and zinc are substituted by other less adequate domestic materials with a view to avoiding the import of these metals. In many developing countries there are good conditions to initiate the production of lead and zinc which could substantially influence the quick development of applications for these metals and of their consumption. That question will be discussed in further part of the present paper.

38. Technical assistance and necessary technical information including educational material, provided to developing countries may play an important part in appropriate and efficient use of lead and zinc in these countries. This action was initiated in recent years by Zinc Development Association and Lead

Development Association in London. These Associations derive much of their income from producers in main exporting countries who encouraged them to pay increasing attention to stimulating lead and zinc consumption in developing countries. As Director General of ZDA and LDA Mr. R.L.Stubbs stated at the joint Annual General Meetings of ZDA and LDA in Chicago in 1967 these associations for a number of years and in growing scope have been supplying to the interested Governments authorities, Universities, technical schools and the fabricators in developing countries with the Zinc and Lead Abstracts Bulletins and other latest publications and educational material. There was set up the Indian Lead and Zinc Information Centre in Calcutta in 1962.

39. The experience of Information Centre in India led the Zinc Development Association and Lead Development Association to establish an Overseas Development Fund. The object of this Fund is to provide the basic finance for the Indian office and to meet the cost of survey in other developing countries. The activity of the Associations basing on the above mentioned Fund outside of distribution of technical litterature consists in regular visits of technical experts to developing countries and in cooperation with plants processing lead and zinc. It is predicted to establish another Information Centre in Africa. The countries of South-East Asia are serviced by the Australian associations and in South America by experts from the United States and London. Training of future specialists from developing countries and providing them opportunities for acquiring experience in modern plants in developed countries is also a notable form of assistance. Technical assistance for lead and zinc consumers seems to be in right hands and should be expected to contribute to the predicted rapid growth in consumption of both metals, which is a matter of concern to developing countries as to lead and zinc producers as well.

III. Lead and zinc production

Production of lead and zinc ores and concentrates

40. Table 4 shows the lead mine production over the periods 1953-1955 and 1960-1968 in the world excluding centrally planned economies; the developed and the developing countries have been reviewed separately. During the last eight years period world mine production of lead ores showed an increase of 407,000 tons i.e. 22.5 per cent. The major part of this increase, however, was achieved in developed countries 393,000 tons - 32 per cent. The increase in the production of developing countries was slight: 14,000 tons - 2.3 per cent only. The production expanded mostly in developing countries of Latin America /34,000 - 8.7 per cent/ whilst in the developing countries Africa's, Morocco and Congo, the production declined. Total share of developing countries in world production of lead ores and concentrates declined from 33 per cent in 1960 to 27 per cent in 1968.

41. Over the same period the production of zinc ores and concentrates /Table 5/ expanded by 1,461,000 tons - 57 per cent; most of that increase of 1,194,000 tons i.e. 64 per cent is in this case also accounted for developed countries. In developing countries the production showed an increase of 268,000 tons - 38 per cent; the production was expanding most rapidly in India Iran and South Korea, Asia and Far East countries reflected an increase of 63,000 tons - 315 per cent. Total share of developing countries in world production of zinc ores moved downward, however, from 27 per cent in 1960 to 24 per cent in 1968.

Production of lead and zinc

42. The development of lead production over the years 1960-1968 is shown in the table 6. The production showed an increase of 608,000 tons i.e. 25 per cent which corresponds to the percentage increase over total period 1938-1960. This total increase

in the production is accounted for developed countries where it amounted to 602,000 tons, which corresponds to the increase by 31 per cent. In developing countries of Asia and Africa the production of lead declined by 16,000 tons/excluding Zambia/ and in Latin America /excluding Mexico/ rose slightly by 12,000 tons - 4.3 per cent. The share of developing countries in the production of lead moved downward from 16.3 per cent to 13 per cent in 1966.

43. Table 7 shows changes in the production of zinc. The production of zinc in the course of the period 1960-1968 showed an increase of 1,074,000 tons i.e. 42 per cent in relation to the growth by 84 per cent over the years 1938-1960. The zinc production in developed countries showed an increase of 959,000 tons i.e. 40 per cent, in developing countries of 115,000 tons i.e. 61 per cent. The production of zinc expanded in all developing countries where zinc is being produced: Congo /Congo Dom.Rep.or/ by 17 per cent, Zambia by 50 per cent, Argentina by 18 per cent, Mexico by 53 per cent, Peru by 100 per cent; moreover, zinc production was started in India /25,000 tons/ in 1968 and in Korea /Rep.of/ /6,000 tons in 1968/. The share of developing countries rose from 7.3 per cent in 1960 to 9.1 per cent of total world production in 1968.

44. Changes in the share of developing countries in mine and metal production and consumption of lead in relation to world quantities are summarized as follows:

Shares of developing countries in total lead
production and consumption

	Average a/ 1935-1938		Average 1953-1955		1960		1968 b/	
	thou sand metr. tons	per cent	thou sand metr tons	per cent	thou sand metr tons	per cent	thou sand metr tons	per cent
Mine production	424	28.2	561	32.0	598	33.0	612	27.0
Metal production	337	22.1	370	19.0	374	16.3	380	13
Metal consumption	41	2.7	90	5.0	142	6.4	286	9.8

a/ Minerais et Metaux, Statistiques 1958

b/ Estimated

As can be seen from the above table the share of developing countries in the consumption of lead moved upward from the period 1935-1968 3.5 times, the share in mine production remained at the unchanged level with the tendency for decline during last eight years, on the other hand, the share in metal production fell nearly by about a half with the steady tendency for decline.

45. Similar changes in the production of zinc and in its consumption are as follows:

Shares of developing countries in total
zinc production and consumption

	Average ^a 1935-1938		Average 1953-1955		1960		1968	
	thou sand metr tons	per cent	thou sand metr tons	per cent	thou sand metr tons	per cent	thou sand metr tons	per cent
Mine production	332	20.4	653	25.0	699	27.0	697	24.0
Metal production	54	4.0	185	7.6	189	7.3	304	9.1
Metal consumption	40	3.0	79	3.9	174	7.0	361	9.6

a/ Minéraux et Métaux. Statistiques 1958

b/ Estimated

In this case the share of developing countries in mine production, metal production and in its consumption rose, reflecting some tendency for decline in recent years.

46. It is characteristic for the cases both of lead and zinc that the share of the raw materials production in developing countries is high, with the relatively poor share in metal production and its consumption. Almost one third of the lead mine production and one fourth of the zinc mine production is accounted for the developing countries, the share in metal production reaching respectively 13 per cent and 9.1 per cent.

**Balances of Metals production and consumption
in the years 1960-1968**

47. In the balances of production and consumption of lead and zinc trade with socialist countries and changes in non commercial stocks in the United States are to be taken into account. These factors are of some importance for the situation in the world market of lead and zinc and are to be considered in examining the forward production. Changes in demand and supply for lead over the period 1960-1968 can be shown in general as follows:

/thousand metric tons/

Year	Metal Production	Net import from centrally planned economies	Net changes in non commercial stocks	Total Metal new supplies	Metal Consumption	Balance	Changes in producers stocks
1960	2,303	33	- 2	2,338	2,217	+ 121	+ 80
1961	2,371	50	+25	2,396	2,300	+ 96	+ 18
1962	2,320	32	+25	2,327	2,399	- 72	- 64
1963	2,457	27	- 8	2,492	2,505	- 13	- 95
1964	2,568	25	-45	2,638	2,696	- 58	- 45
1965	2,621	45	-34	2,700	2,737	- 37	+ 12
1966	2,742	22	-58	2,822	2,792	+ 30	+ 10
1967	2,765	26	-25	2,816	2,782	+ 34	- 17
1968 ^a	2,911	- 19	-26	2,918	2,936	- 18	

a/ Estimated

Source: as in Table 1

48. With the surpluses in supplies in 1960-1961 the prices of lead on the LME fell from L 79.10 s. in April 1960 to L 51.2 s. in August 1962. The surplus in production in 1966 and 1967 resulted in considerably slighter changes of prices of lead. As a consequence of the long period of low prices small enterprises operating with lesser efficiency, particularly mines in developing countries, have been affected most substantially. The output of lead ores in Congo and

Tanganyika stopped in 1960-1961 and was not resumed subsequently. Large producers can easier stand the recession period restraining the production and storing the surpluses. During the period of shortage in supply the increased demand is being met from producer stocks; there are also releases from non-commercial stocks.

49. Export of lead from socialist countries prevailing in the years 1960-1967 at the annual average of 33,000 tons changed to import due to increased import into Chinese Peoples' Republic in 1968. In 1969 it is also predicted that this tendency would continue and result in net trade with socialist countries amounting to 19,000 tons.

50. Since 1963 the tendency has been prevailing in the United States for curtailing non commercial stocks of lead. Over last six years these stocks were curtailed by 196,000 tons i.e. about 33,000 tons per year were released from them on the average.

51. The balance of supply and demand for zinc during 1960-1968 including export from centrally planned economies and releases from non-commercial stocks is shown as follows:

/thousand metric tons/

Year	Metal Production	Net import from centrally planned economies	Net changes in non-commercial stocks	Total new supplies	Metal consumption	Balance	Changes in producers stocks
1960	2,439	73	- 33	2,545	2,472	+ 73	- 37
1961	2,570	90	- 14	2,674	2,622	+ 52	+ 16
1962	2,653	116	- 9	2,778	2,726	+ 52	+ 18
1963	2,742	90	- 1	2,833	2,958	-125	-129
1964	2,959	143	- 68	3,170	3,243	- 73	- 39
1965	3,124	147	-201	3,472	3,390	+ 82	+ 23
1966	3,301	127	- 91	3,519	3,431	+ 88	+ 51
1967	3,291	119	-113	3,423	3,427	- 4	+ 21
1968	3,644	72	- 28	3,744	3,767	- 23	

a/ Estimated

Source: AI in the Table 1

52. The surpluses in supply of zinc over demand during the years 1960-1968 resulted in the marked fall of prices of zinc on the LME from L 95 in January 1960 to L 64 per ton in September 1962. The consumption growing since 1963 resulted in further expansion of the production and in rise of prices up to L 140 in July 1964. The main zinc producers fearing that too high a price will encourage the consumers to substitute zinc by other metals have established the uniform producer price of L 125 per ton. That price which was modified in next years within L 98 - L 114 contributed to lower quotation on the LME and stabilization of prices. The balance almost static between supply and demand was prevailing over the period 1965-1968. There are reasons to believe that International Zinc and Lead Study Group with its works makes in some measure contribution to that, and it may be expected that this situation would be maintained also for the future.

53. The net import from socialist countries was wavering in the years 1960-1968 within 73,000 - 147,000 tons. In 1968 due to considerably expanded purchases made by Chinese Peoples' Republic it dropped to 72,000 tons. In the years 1961-1967 it averaged about 100,000 tons per year.

54. During the whole period 1960-1968 the government of the United States was releasing zinc from non-commercial stocks. The largest volume of zinc 201,000 tons was released in 1965. The annual average release was 51,000 tons.

New projected capacities up to 1971

55. The Sub-Committee on Forward Estimates of Production of IZLSG prepares each year the Report with the list of reported additions to mine capacities and smelter facilities. The Committee stresses that the timing of initial production and the rate at which projects will be brought to ultimate capacity are influenced by many factors like the market outlook, availability of finance, government policies etc. These informations can be therefore recognized as very approximate the mere

56. As some mines actually producing will be closed and some existing smelter facilities shut down when new projects come to fruition.

56. In the table 8 are shown the reported in 1967 and 1968 additions to lead/zinc mine capacities and smelter facilities to be put into operation up to 1971. Even if assumed that this assessment is very approximate, does not comprise complete data and that some of new capacities would be put into operation after 1971, in developed countries the tendency for more rapid expansion of the production than in developing ones is obvious.

57. New mine capacities of the zinc/lead ores are reported only in Argentina, Bolivia and Iran, and their slight expansion in Peru and Korea. Up to the present time no new lead smelter facilities are reported in developing countries; in zinc smelters only in Algeria, India and its slight expansion in Mexico.

Approximate estimation of lead and zinc
ore reserves

58. It is difficult to assess exactly the world reserves of lead/zinc in ores. Data concerning newly discovered deposits have been issued unsystematically and their respective classification has been made according to various criterions. Various sources suggest that the measured and indicated reserves of lead in ore can be assessed approximately at 50,000,000 tons and of zinc in ore at 75,000,000 tons.

Following reserves can be estimated according to regions:

	Lead		Zinc	
	million tons	%	million tons	%
North America	16.7	33.4	29.0	38.6
Europe	14.0	28.0	12.5	16.7
Australia	10.7	21.4	12.0	16.0
Latin America	2.7	5.4	10.5	14.0
Africa	3.6	7.2	4.0	5.3
Asia	2.3	4.6	7.0	9.4
Total	50.0	100.0	75.0	100.0

59. Under the United States Bureau of Mines estimation in recent years the additions to lead reserves in the world by new discoveries or by extension of existing deposits exceeded the rate at which the metal was being extracted. The inferred reserves of lead are at least as large as measured and indicated ones. The reserves secure the production for at least 20 years.
60. The reserves of zinc secure the forecast production for many years too. Due to the technical improvements the efficient use of old dumps of mine and smelter residues containing lead and zinc is feasible, increasing total volume of metals being at the disposal of industry.
61. Nevertheless in view of the forecasts relating to lead and zinc consumption up to the year 2000, many authors draw the attention to the insufficient exploration works pursued on new deposits so far. Assuming the annual rate of growth in production of lead and zinc up to the year 2000 only of 2.5 per cent the cumulative demand up to that year would reach about 160,000,000 tons of lead and 200,000,000 tons of zinc which sets the task to secure reserves for farther future at right time.
62. With a view to securing reserves of raw materials for the future production of lead and zinc the exploration of new deposits was initiated on a larger scale in recent years. Japanese association "Overseas Mineral Resources Development Organisation", financed in 50 per cent by the government and in 50 per cent by the producers exhibits a particular activity. That association is pursuing large scale works in more than 40 countries all over the world.
63. Similar activity is shown by French Bureau de Recherches Geologiques et Minières, American Geological Survey and Bureau of Mines, English Overseas Development Corporation, and recently also by firms of Federal Republic of Germany, Socialist countries are also offering to many developing countries their assistance in pursuing prospect works,

mine constructing and providing them with equipment.

64. The exploration of new deposits being pursued by the mentioned associations and firms in many developing countries may be a good chance for further expansion of mine and metal production of lead and zinc in them. It could bring about general industrial advancement in these countries on the condition, however, that in the agreements concluded with foreign companies the interests of nations and those of developing countries as right owners of their natural resources are secured.

The forecast of net trade with centrally planned economies

65. Lead and zinc production in socialist countries is developing very quickly. Over the period 1960-1967 the output of lead ores in these countries rose by 41 per cent as compared to 20 per cent of the output in the world, metal production by 63 per cent as compared to 20 per cent of the production in the world. The expansion of zinc ores output by 47 per cent was slightly smaller than that in the remainder of the world /52 per cent/ whereas the production of metallic zinc rose by 39 per cent as compared to that of 28 per cent in the world.

66. The quick increase in consumption of both metals in quickly developing machinery industry and in building keeps pace, however, to that rapidly expanding production. The growing demand absorbs total increases in the production of lead and zinc so that surpluses designed for export remain over longer periods at the unchanged level.

67. Allowing for large reserves of zinc and lead ores in China /mainland/ and initiated works on the construction of Imperial Smelting Furnace in that country it should be expected that in next future local production would meet the growing demand for lead and zinc.

68. This suggests the forecast that net export from socialist countries in the years 1970-1980 would most likely be kept at the level of the period 1961-1967. It may be assumed that

export of metallic lead from these countries would amount to 30,000 tons per year and that of zinc to 100,000 tons per year.

The estimation of new capacities up to 1980
to meet the consumption

69. In view of the projected consumption of lead and zinc in the years 1970-1980, the production of metals in 1968, the increase in lead and zinc smelter capacities, already projected, and the forecast export from socialist countries in these years it is possible to assess approximate magnitudes of the new capacities necessary to meet the predicted demand.

70. For lead the approximate balance is shown below:

	1968 ^a	/thousand metric tons/					
		1970		1975		1980	
Actual production	2,911	2,911		2,911		2,911	
Reported additions to smelter capacities	-	292		292		292	
Net trade with centrally planned economies	-19	-		30		30	
Net changes in non-commercial stocks	-26	-		-		-	
Total supply possibilities up to 1971	2,918	3,203		3,233		3,233	
		Low	High	Low	High	Low	High
Projections of consumption	2,936	3,000	3,100	3,380	3,600	3,860	4,320
Balance							
New necessary capacities /-/	-18	+203	+103	-147	-367	-627	-1,087

a/ Estimated.

71. Similar balance for zinc is as follows:

/thousand metric tons/

	1968 Esti- mated	1970		1975		1980	
Actual production	3,644	3,644		3,644		3,644	
Reported additions to smelter capacities	-	600		600		600	
Net trade with centrally planned economies	72	90		100		100	
Net changes in non commercial stocks	-28	-		-		-	
Total supply possibilities up to 1971	3,744	4,334		4,344		4,344	
Projections of consumption	3,767	Low	High	Low	High	Low	High
		4,000	4,100	4,900	5,200	5,900	6,600
BALANCE New necessary capacities	- 23	+ 334	+ 234	- 556	- 856	-1556	-2256

72. The above balances were drawn up on the assumption that production and consumption would be fully offset.

73. From the volume of the metals zinc and lead production in the years 1970-1980 the demand for the mine production of these metals is inferred. To assess its volume the average relationship in 1958-1967 was adopted, for lead 128 per cent and for zinc 93 per cent. The production capacities in mines and in enrichment plants in 1970-1980 compared to the actual and forecast ones for next years can be laid down as in table 9.

74. New mine capacities and smelter facilities should be recognized as very approximate. It is evident that in such a long period a number of less modern plants will be shut down and subsequently they will have to be replaced with additional new capacities. For the same reason and also due to later commissioning of new plants, surpluses of production upon consumption assessed for 1970 will probably prove lower or will not arise

at all. The above assessment was made to illustrate a general approximate picture of the expansion of mine and smelter production over the years 1970-1980 with a view to analysing the outlook for possible participation of developing countries in that expansion.

Outlook for expansion of lead and zinc production
in developing countries

75. It is difficult to forecast the growth in consumption of lead and zinc in developing countries but it is almost impossible to evaluate more accurately the expansion of the lead and zinc metals production in these countries up to 1980. Resting on statistical data related to the last 15 years and extrapolating solely on that basis the development of the production up to 1980 the result obtained will be a very pessimistic one. The consumption of lead and zinc in developing countries is rising at a considerably faster pace than in the remainder of the world, but the expansion of lead mine and smelter production is slower in these countries than in developed ones and in Asia and Africa even its decline was pronounced. The output of zinc ores in developing countries is expanding more slowly than in the remainder of the world and only the production of that metal is rising at a more or less the same rate as in the whole world.

76. There are many reasons as lack of political stabilization on one hand and tendencies for promoting the economic independence of the developing countries on the other, which encourage large producer companies to expand raw materials basis, and smelter facilities rather in highly developed countries without being involved in larger investments in developing countries.

77. The developing countries generally have not adequate means to undertake expensive investments particularly in mining which need a long time for construction works to be carried out and which freeze the capital. Moreover, experts are lacking who could choose the best expansion programmes of lead and zinc industry and appreciate their economic efficiency. It seems that

for further expansion of lead and zinc industry in developing countries in the future and for overcoming the current stagnation common actions of governments of developing countries, of international aid organizations and of major lead and zinc companies should be undertaken.

78. In actual conditions it is difficult to predict how the production of lead and zinc would be developed. It is possible to determine in what countries there are potential possibilities to expand the production or to start it. From that point of view the developing countries can be divided into three groups.

79. Within the first group fall countries where metal consumption is well established but its further expansion narrow due to foreign trade difficulties. The increase in consumption can be achieved through the development of local production. The example is India where the marked consumption of zinc in 1963-1964 amounting to 90,000 tons went downward in later years but due to the local production put into operation begins to recover despite the fact that it satisfies only about 30 per cent of the requirements. The production of zinc in India seems to continue its expansion to meet in part the growing consumption. It would be advisable to examine the outlook for the expansion of mine output in that country because the actual production of zinc in India is based almost solely on imported concentrates. The possibilities for lead production in India are also not fully taken advantage of, which implies that only about 3 per cent of the consumption is satisfied by local production.

80. Almost fully sufficient with regard to lead and zinc production is Argentina, where mine and metals production meet the consumption of metals. In that case further expansion of mine and metals production to match the growing local requirements can be also predicted.

81. Republic of Korea satisfies only about 30 per cent of zinc consumption with local production despite the export of zinc

concentrates. It can be predicted that the attempts will continue to expand the smelter production initiated there to smelt the concentrates. Similar situation is in Brazil in production and consumption of lead.

82. The second group of developing countries enjoying potential possibilities for the expansion of lead and zinc smelting is represented by countries exporting at present the concentrates of these metals. Since a long time ago many of these countries were endeavouring to expand smelting facilities and to export metal instead of concentrates which from one side would stimulate industrialization and from the other would contribute to the increased value of export. To the countries with the mine production of lead markedly exceeding the metal production or where there is production of concentrates without processing them belong: Morocco, Tunisia, Bolivia, Honduras and Peru. In the case of zinc following countries fall into that group: Algeria, Congo, Morocco, Bolivia, Mexico, Peru, Burma and Iran.

83. The third group comprises developing countries where the concentrates or metals up to the present time are not produced but which possess the deposits of lead and zinc ores and are interested in gradually commencing their production on a small scale, to cover the requirements, still not significant.

84. Even if all those potential possibilities for the expansion of metals production in developing countries would be realized in the years 1970-1980, which is hardly likely, the increase in the production of lead in these countries could be estimated at about 270,000 tons and in that of zinc at about 700,000 tons. This would suggest that the share of developing countries in general addition to new capacities in the world with the projection High would amount for lead to about 25 per cent and for zinc to about 31 per cent.

85. The expansion of metals production would be of major importance for Morocco exporting at present about 70,000 tons

of lead and 50,000 tons of zinc in concentrates, for Peru exporting about 75,000 tons of lead and 240,000 tons of zinc in concentrates and for Mexico with its export of about 160,000 tons of zinc in concentrates. Nonetheless it should be pointed out that in mine production of lead and zinc in Mexico and in Peru notable investments have been made by the United States and Japan and that is the reason for the large volume of concentrates import from its sources to these countries.

Export of lead zinc concentrates and metals
in the economy of developing countries

86. Export of lead ores and concentrates accounted for less than 4 per cent of the export earning of any developing country with the exception of Morocco where it accounted for about 6 per cent. The United States imported predominantly from Latin America and Canada, Japan took about half her imports from Australia and Asian countries but also imported from Latin America where Japan has investments; EEC sources of import were mainly Europe and Latin America, United Kingdom imported mainly from Australia and Canada.

87. About one quarter of total import of lead metal into the developed countries in 1966 came from developing countries, mainly from Mexico and Peru to the United States and EEC, from Morocco and Tunisia to France and from Zambia to United Kingdom. In none of these countries the value of lead metal export exceeds 4 per cent of its total export earnings.

88. The pattern of trade in zinc ores and concentrates and zinc metal is almost the same as that in lead. In these cases the value of zinc ores and concentrates export exceeds 5 per cent of total export earnings in none of the developing countries.

89. In 1964 the value of exports of lead and zinc ores and metals from developing countries reached \$ 227 million which is 1.6 per cent of total export earning of non-agricultural commodities in all developing countries.

Tariff barriers and trade liberalization

90. The further advancement in the liberalization of international trade in lead and zinc may play an important role in the expansion of smelting in developing countries. In last years due to the elimination of the quota system by the United States and the removal of the import duty on lead in the United Kingdom some liberalization of trade in these metals was pronounced. There are still many barriers which restrain the developing countries from expanding their trade in metals.

91. There are no tariffs on imports of lead and zinc ores and concentrates, nor on imports of lead ashes and residues to the EEC, Japan or United Kingdom. The current tariff on imports of lead concentrates into United States is 0.75 cents per lb on the lead content, which amounts to an ad valorem duty of about 5 per cent. The rate of duty on imports of zinc concentrates is 67 cents per lb on the zinc content. If the entire amount of duty on imports of lead/zinc ores and concentrates into the United States in 1966 were to accrue to the developing exporters, it would amount in total to about \$ 3.25 million.

92. Tariffs on imports of unwrought lead exist in most developed countries. The imports duty of lead into the EEC is 4.5 per cent and into the U.S. about 7 per cent ad valorem. Japanese duties are 5 per cent on both lead metal and scrap. The duty on unwrought zinc in the United Kingdom is equivalent to about 2 per cent ad valorem and in Japan about 12 per cent.

93. In some EEC countries is still existing the quota system. There are some assumptions, that the United States might reimpose a quota system. It should be expected, however, that the activity of the GATT Kennedy Round and of UNCTAD would let the trade in lead and zinc go on stabilizing gradually in the future and would lead to entire removal of the quota systems and to lower tariff duties.

United Nations assistance in Lead and Zinc Industry
Progress in Developing Countries

94. As the above considerations suggest there is good outlook for quick expansion of lead and zinc industry in the years 1970-1980. The securing of the share of developing countries within this expansion, which would correspond to their reserves in ores and would meet their needs of industrial and social progress, would require however some efforts from the organisations of United Nations devoted to that aim and from Governments of both developing and developed countries.

95. The basic condition of the lead and zinc expansion in the whole world, first of all in the developing countries, is the stabilization of the metals consumption/production balance and metals prices on the adequate but competitive to the substitutes level. This is the main target of the International Lead and Zinc Study Group and its activity with the cooperation of the member Governments in particular of the United States with respect to non-commercial stocks releases policy is likely to secure such stabilization within suitable limits.

96. Further liberalization of trade, removal of quota systems and lowering of import duties are additional factors having substantial effects on the production of metals in developing countries. These are problems which UNCTAD and a number of other international organisations are dealing with.

97. In developing countries specialists in zinc and lead industry are generally not available. That is an obstacle in laying down the best economic and technical programmes of the expansion of that industry based on the reserves of these countries. The assistance of the experts of the United Nations in preparing such programmes in individual countries or in individual state enterprises in developing countries may be very useful. "Survey of Lead and Zinc Mining and Smelting in Burma" made in 1966 within the United Nations Development Programme is an example of that aid.

98. In addition to the long-term projections, the right evaluation of offers for construction of complete mines and smelters is a difficulty the governments of developing countries come across occasionally. An objective evaluation of these offers made by United Nations independent advisers can suggest the best choice. In the countries possessing zinc and lead ores the possibly application of the Imperial Smelting Processes method for instance, may be more expensive in investment but ensuring a markedly lower cost of production at adequate scale, requires a keen analysis.

99. The expansion of lead and zinc industry in developing countries demands training of local staff. The gradual Zambianization of Broken Hill plant at Kabwe proves that the most sophisticated technology can be mastered by local staff. It would be desirable, however, to train the specialists and the staff before a new plant enters the production and here the assistance of the United Nations for developing countries can be of great service.

100. To some of the management posts in enterprises taken over by developing countries or in new ones local specialists can not be at once appointed since they are not available there. Experienced administration officers to supervise enterprises of lead and zinc industry or other forms of managing the industry often lack in developing countries. Until local specialists acquire appropriate professional qualifications United Nations advisory service in assigning these posts to its experts is necessary.

101. Technical schools and Universities in these countries which are enjoying opportunities for the expansion of lead and zinc industry should ensure the suitable education to the future specialists in these fields. An essential form of the United Nations assistance for developing countries is providing them lecturers with educational qualifications if they

lack on the spot which is often the case.

102. In many developing countries the expansion of lead and zinc industry is tied to problems concerning foreign trade policy. The specific feature of foreign trade in lead and zinc concentrates and metals requires also special experience. Until foreign trade officers in some of developing countries acquire necessary routine the assistance of experts United Nations sent there on request of the interested governments seems advisable.

103. In all above mentioned cases the assistance of United Nations experts should be temporary. Education and training of local specialists involve long term stays in highly developed countries as an opportunity to gain practical experience. Such trainings organized by United Nations could be of great assistance for developing countries.

Table 1

Consumption of refined lead by regions

/thousand metric tons/

	Average 1953-1955	1960	1965	1966	1967	1968 ^c
World^a	1,785	2,217	2,733	2,785	2,782	2,936
<u>Developed countries</u>	1,695	2,075	2,491	2,560	2,516	2,650
North America	766	846	1,043	1,134	1,090	1,127
Western Europe ^b	830	1,064	1,207	1,186	1,178	1,247
Oceania and South Africa	56	66	84	90	85	93
Japan	43	100	157	150	163	183
<u>Developing countries</u>	90	142	242	225	266	286
Latin America	64	98	149	150	153	161
Asia and Far East	19	38	78	59	93	104
Africa	7	6	15	16	20	21
Share of developing countries in total consumption /per cent/	5	6.4	8.9	8.1	9.4	9.8

a. Excluding the centrally-planned economies

b. Including Yugoslavia

c. Estimated

Source: For the periods 1953 - 1955, 1960, 1965 - Submission by the Secretariat of the International Lead and Zinc Study Group to UNCTAD COMMODITY SURVEY 1966 /PART II A/
For 1966 - International Lead and Zinc Study Group, Monthly Bulletin of Statistics. November 1968
For 1967 - 1968 International Lead and Zinc Study Group. Report of the Statistical Committee. Twelfth Session, Geneva November 1968.

Table 2

Consumption of slab zinc by regions

/thousand metric tons/

	Average 1953-1955	1960	1965	1966	1967	1968 ^c
World^a	2,032	2,472	3,390	3,431	3,427	3,767
<u>Developed countries</u>	1,953	2,298	3,110	3,182	3,093	3,405
North America	948	860	1,362	1,370	1,223	1,384
Western Europe ^b	827	1,127	1,289	1,295	1,255	1,348
Oceania and South Africa	79	123	147	134	157	150
Japan	99	189	312	383	458	523
<u>Developing countries</u>	79	174	280	249	334	362
Latin America	46	81	144	135	132	141
Asia and Far East	31	90	130	106	174	191
Africa	1	3	6	8	28	30
Share of developing countries in total consumption /per cent/	3.9	7	8.3	7.3	9.7	9.6

a. Excluding the centrally-planned economies

b. Including Yugoslavia

c. Estimated

Source: As in the Table 1

Table 3

**Approximately estimation of lead and zinc consumption
in 1970's by regions.**

/thousand metric tons/

	Average rate of growth		1970		1975		1980	
	Low	High	Low	High	Low	High	Low	High
<u>Lead</u>								
<u>World^x</u>	2.5	3.5	3,000	3,100	3,380	3,600	3,860	4,320
<u>Developed countries</u>	1.9	2.8	2,686	2,770	2,960	3,124	3,300	3,597
<u>Developing countries</u>	6.6	8.9	314	330	420	476	560	723
Latin America	4.9	7.2	170	178	218	250	276	368
Asia and Far East	7.0	9.0	120	125	166	188	230	290
Africa	8.0	10.0	24	27	36	38	54	65
Share of Developing countries in total consumption per cent			10.5	10.8	12.4	13.3	14.5	16.7
<u>Zinc</u>								
<u>World^x</u>	4.0	5.0	4,000	4,100	4,900	5,200	5,900	6,600
<u>Developed countries</u>	3.3	4.0	3,587	3,663	4,295	4,484	5,030	5,486
<u>Developing countries</u>	7.6	9.9	413	437	605	716	870	1,114
Latin America	5.3	7.6	152	160	195	228	255	332
Asia and Far East	8.0	10.0	222	234	330	378	485	605
Africa	13.0	16.0	39	43	80	110	130	177
Share of Developing countries in total consumption			10.3	10.6	12.3	14.2	14.8	16.8

x Excluding centrally planned economies

Table 4

Production of lead ores and concentrates by regions
/thousand metric tons of metal content/

	Average 1953-1955	1960	1965	1966	1967	1968^c
World^a	1,753	1,810	2,033	2,129	2,179	2,217
<u>Developed countries</u>	1,192	1,212	1,423	1,544	1,687	1,605
North America	490	420	552	603	617	631
Western Europe ^b	320	379	366	426	463	470
Oceania and South Africa	359	373	450	452	443	442
Japan	23	40	55	63	64	62
<u>Developing countries</u>	561	598	610	585	592	612
Latin America	387	393	415	410	415	427
Asia and Far East	34	46	49	46	49	53
Africa	140	159	146	129	128	132
Share of developing countries in total production /per cent/	32	33	30	27.5	27.3	27

a. Excluding the centrally-planned economies

b. Including Yugoslavia

c. Estimated

Source: As in the Table 1

Table 5

Production of zinc ores and concentrates by regions
/thousand metric tons of metal content/

	Average 1953-1955	1960	1965	1966	1967	1968 ^c
World ^a	2,399	2,563	3,478	3,572	3,895	4,025
<u>Developed countries</u>	1,686	1,864	2,553	2,737	2,968	3,058
North America	831	824	1,434	1,520	1,677	1,690
Western Europe ^b	477	574	545	595	631	693
Oceania and South Africa	273	309	353	369	397	409
Japan	105	157	221	253	263	266
<u>Developing countries</u>	653	699	925	835	927	967
Latin America	445	474	596	558	623	641
Asia and Far East	11	20	43	56	75	83
Africa	197	205	286	221	229	243
Share of developing countries in total production /per cent/	27	27	26.5	23.5	24	24

a. Excluding the centrally - planned economies

b. Including Yugoslavia

c. Estimated

Source: As in the Table

Table 6

Production of refined lead by regions
/thousand metric tons/

	Average 1953-1955	1960	1965	1966	1967	1968 ^c
world^a	1,995	2,303	2,621	2,742	2,765	2,911
<u>Developed countries</u>	1,625	1,929	2,227	2,346	2,402	2,531
North America	728	788	902	959	907	967
Western Europe ^b	668	858	934	972	1,059	1,133
Oceania and South Africa	198	209	282	297	286	259
Japan	31	74	109	118	150	172
<u>Developing countries</u>	370	374	394	396	363	380
Latin America	286	281	309	323	289	303
Asia and Far East	15	29	30	19	18	18
Africa	69	64	55	54	56	59
Share of developing countries in total production /per cent/	19	16.3	14	14	13	13

a. Excluding the centrally - planned economies

b. Including Yugoslavia

c. Estimated

Source: As in the Table

Table 7

Slab zinc production by regions
/thousand metric tons/

	Average 1953-1955	1960	1965	1966	1967	1968 ^c
World^a	2,439	2,570	3,124	3,301	3,291	3,644
<u>Developed countries</u>	2,254	2,381	2,878	3,040	3,010	3,340
North America	1,028	1,061	1,303	1,352	1,286	1,348
Western Europe ^b	923	967	1,006	1,047	1,018	1,181
Oceania and South Africa	122	141	202	197	198	210
Japan	181	212	367	444	516	601
<u>Developing countries</u>	185	189	246	261	273	304
Latin America	103	101	144	158	160	166
Africa	82	88	102	103	106	107
Asia and Far East	-	-	-	-	7	31
Share of developing countries in total production in %	7.6	7.3	7.9	7.9	9.0	9.1

a. Excluding centrally - planned economies

b. Including Yugoslavia

c. Estimated

Source: As in the Table 1

Table 8

**Estimated additions in mine and smelter capacities after
1968 reported to ILZSG**

/thousand metric tons/

	Mines /metals content/		Smelters	
	Lead	Zinc	Lead	Zinc
World^a	363	545	292	600
<u>Developed Countries</u>	330	438	292	548
North America	230	210	150	25
Western Europe ^b	30	104	115	325
Oceania and South Africa	65	50	-	73
Japan	6	38	27	125
<u>Developing countries</u>	33	107	-	52
Latin America	27	72	-	4
Asia and Far East	6	34	-	13
Africa	-	-	-	35
Share of developing countries in total additions of capacities.	9,1 %	19,5 %	0,0 %	8,7 %
Share of developing countries in total production in 1968	27,0 %	24,0 %	13,0 %	9,1 %

a. Excluding centrally - planned economies

b. Including Yugoslavia

Table 9

Approximately estimation of necessary new capacities
in Lead and Zinc mine production in 1970-1980.

/thousand metric tons/

	1970		1975		1980	
	Low	High	Low	High	Low	High
Lead						
Forecasts of metal consumption	3,000	3,100	3,580	3,600	3,860	4,320
Mine production /Ratio 100:128/	2,320	2,420	2,640	2,820	3,020	3,380
Actual mine production	2,217	2,217	2,217	2,217	2,217	2,217
Reported additions in capacities	363	363	363	363	363	363
Total supply to 1971	2,580	2,580	2,580	2,580	2,580	2,580
BALANCE						
New necessary capacities /-/	+ 260	+ 160	- 60	- 240	- 440	- 800
Zinc						
Forecasts of metal consumption	4,000	4,100	4,900	5,200	5,900	6,600
Mine production /Ratio 93:100/	4,300	4,440	5,270	5,580	6,350	7,100
Actual mine production	4,025	4,025	4,025	4,025	4,025	4,025
Reported additions in capacities	545	545	545	545	545	545
Total supply to 1971	4,570	4,570	4,570	4,570	4,570	4,570
BALANCE						
New necessary capacities /-/	+ 270	+ 130	- 700	-1,010	-1,780	-2,530



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