VATT-TUTKIMUKSIA

24

VATT-RESEARCH REPORTS

Gonzalo Oroza

THE CIS MINING INDUSTRY IN A TRANSITION PERIOD

with special reference to Finnish mining prospects

VALTION TALOUDELLINEN TUTKIMUSKESKUS

Government Institute for Economic Research

Helsinki 1994

ISBN 951-561-109-1
ISSN 0788-5008

Valtion taloudellinen tutkimuskeskus
Government Institute for Economic Research
Hämeentie 3, 00530 Helsinki, Finland

J-Paino Ky
Helsinki 1994

GONZALO OROZA: THE CIS MINING INDUSTRY IN A TRANSITION PERIOD with special reference to Finnish mining prospects. Helsinki: VATT, Valtion taloudellinen tutkimuskeskus, Government Institute for Economic Research, 1994. (B, ISSN 0788-5008, No 24) ISBN 951-561-109-1.

TIIVISTELMÄ: Itsenäisten Valtioiden Yhteisön (IVY) kaivosteollisuuden rakenteellisilla muutoksilla on kauaskantoiset seuraukset jäsenvaltioiden lisäksi myös koko kansainvälisille metallimarkkinoille. Poliittinen epävakaisuus sekä yksityiskohtaisen ja nykyaikaisen kaivoslainsäädännön puute vaikeuttaa IVY:n jäsenmaiden yhteisen kaivosteollisuuden kehitysstrategian luomista. Nopea ja kattava, länsimaisen modernin kaivosteknologian leviäminen sekä merkittävä investoiminen IVY-maiden kaivosteollisuuteen ennen vuotta 2000 on näillä näkymin epätodennäköistä. Vertailtaessa IVY-maiden ja kehitysmaiden kaivosteollisuuden ongelmia, IVY-maiden nykytilanne muistuttaa jälkimmäisten tilannetta 1960- ja 1970-luvulla. Suomen yleistavoitteena IVY:n kaivossektorin kanssa käytävässä yhteistyössä tulisi olla tarkoituksenmukaisen tasapainon takaaminen mineraaliraaka-aineiden saatavuudessa. Erityisesti tämä yhteistyö edesauttaa Suomen kaivosteollisuuden teknologista kehitystä, kun sen on otettava huomioon IVY-maiden kaivosalan erityisolot. Suomen näkökulmasta katsottuna erityisen kiinnostavia ovat seuraavat kaksi kohdetta: Karjala ja Venäjän luoteisosa. Suomen yhteistyö IVY-maiden kaivosteollisuuden kanssa on osa teollista yhteistyötä, jolla on myönteinen vaikutus Suomen kansalliseen turvallisuuteen ja taloudelliseen hyvinvointiin.

Asiasanat: kaivos- ja perusmetallliteollisuus, sulatus, jalostus, investointi, joint-venture, kehitysnäkymät, yhteistyö.

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ABSTRACT: The structural changes of the CIS mining industry have far-reaching consequences not only for the national economies of the member states but for the entire international metal market. Political instability and absence of a detailed and modern mining legislation make difficult a coordinated strategy for the development of the mining sector. Over the next years up to the year 2000, an accelerated and widespread diffusion of western modern mining technology and big investment into the CIS mining industry seems to be improbable. A comparative view on the common problems of the mining industry on the CIS and in developing countries resembles the latters situation during the 1960's and 1970's. The general objective of Finland's cooperation with the CIS mining sector should be to secure appropriate balance of supply of mineral raw materials. In particular, this will permit further technological development of the mining industry in Finland regarding the specific conditions of the CIS mining sector. Two regions are of particular interest from the Finnish perspective: Karelia and the north-west region of Russia. Cooperation with the CIS mining industry is essential to the long-term security and economic health of Finland.

Keywords: mining, smelting, refining, investment, joint-venture, prospects, cooperation.

ESIPUHE

Raaka-ainekysymykset ovat olleet Gonzalo Orozan selvityskohteena jo useita vuosia, aluksi Taloudellisessa suunnittelukeskuksessa (TASKU) ja nyt Valtion taloudellisessa tutkimuskeskuksessa (VATT). Globaaliset ja Suomea koskevat mineraalituotanto-, kysyntä-, markkina- ja teknologiaennusteet sekä alan investointianalyysit ovat osoittautuneet hyödyllisiksi sekä kasvupolitiikan suunnittelijoille että kansallisen kaivostalouden päättäjille. Kansainvälinen kaivosteollisuus elää tänään nopeiden muutosten aikaa entisen Neuvostoliiton taloudellisen ja poliittisen hajoamisen seurauksena. Tämän tutkimuksen kohteena ovat IVY-maiden kaivosteollisuuden kehitysnäkymät vuoteen 2000.

Tärkeimpien mineraalien varantoja ja metallituotantoa on tarkasteltu maittain ja alueittain. Yksityiskohtainen tieto on koottu ottaen huomioon viimeisimmät ja merkittävimmät tapahtumat, jotka vaikuttavat IVY-maiden kaivosteollisuuden kehitysnäkymiin tällä vuosikymmenellä.

Erityistä huomiota on kiinnitetty Suomen ja IVY-maiden yhteistyömahdollisuuksien arvioimiseen mineraali- ja metallialoilla. Lukuisat taloudelliset ja poliittiset tekijät jarruttavat ulkomaisten kaivosyhtiöiden investoimista IVY-maihin. Venäjän sekä muiden IVY-maiden kaivosteollisuus tarvitsee kuitenkin yhä suuremmassa määrin rahallista apua ja teknistä yhteistyötä malminetsintä-, louhinta- ja jalostusmenetelmien kehittämisessä sekä ennen kaikkea nykyisten tuotantolaitosten päästöjen vähentämisessä ja tuotantomenetelmien nykyaikaistamisessa. Suomen rooli IVY-maiden kaivosteollisuuden uudistamisessa voi olla merkittävä.

Valtion taloudellisen tutkimuskeskuksen puolesta lausun parhaat kiitokset Gonzalo Orozalle tämän merkittävän tutkimuksen valmistumisesta. Olen vakuuttunut, että tutkimus herättää mielenkiintoa paitsi alan kotimaisten, myös kansainvälisten asiantuntijoiden piirissä. Esitän myös kiitokset johtaja Tapani Erlingille, ylijohtaja Veikko Lappalaiselle, erikoistutkija Kalle Laaksoselle, tutkimuspäällikkö Antti Romppaselle sekä akateemikko A.D. Shchegloville tutkimuksen kuluessa annetusta tuesta.

Marraskuussa 1994

Seppo Leppänen

FOREWORD

Research on raw materials has been carried out for several years, first at the Economic Planning Centre and now at the Government Institute for Economic Research. Global and Finnish forecasts on mineral production, demand, markets, technology as well as analysis of investments in the sector have proved to be useful for decision makers in the domestic mining industry.

The international mining industry is, at present, facing a period of rapid changes as a result of the economic and political disintegration of the Soviet Union. The present study focuses on developments in the Commonwealth of Independent States' mining industry up to the year 2000. The data collected includes iron and steel as well as major base metals by country and geographical region, and has been analyzed in a comprehensive review bringing together the most recent and important features to estimate medium-term prospects.

Special reference has been made to the potential issues and main problems of the cooperation between Finland and the CIS. A number of economic and political factors are making foreign mining companies remain cautious about investing in the CIS. In the medium-term, however, Russian and other CIS Republics mining sectors will require increasing amounts of financial and technical cooperation in mineral exploration, mining, processing and, above all, cleaning and modernization of existing facilities. Finland should play a special role in the restructure of the CIS mining industry.

November 1994

Seppo Leppänen

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1. INTRODUCTION

The mineral sector played a very important role in the Russian economy long before the Communist Revolution. The knowledge and technology for mining exploitation had spread from Western Europe to Russia in the late eighteenth century. Tsarist Russia became one of the largest pig-iron producers and the largest exporter in the world. Russia and other Eastern European countries adopted the advanced mining and metallurgical technology of the West parallel to the development of their own technology. During the Soviet Union period, Russia rapidly laid the foundations of a gigantic metal industry.

The first five year plans of the Soviet Union system emphasized the expansion of the iron and steel industry. The Second World War found the Soviet Union with an unfavourable geopolitical distribution of base metal industries. Shortages in a number of mineral raw materials were also experienced. The Third Five Year Plan (1938-1942) started a clear tendency to shift metals production and heavy industry towards the East. Most of the iron and steel, coal, nickel and aluminium production was located in the Ukraine and central and northern Russia, which were vulnerable in the defence plans. New projects were initiated particularly in Siberia and Kazakhstan, and priority was given to the war industry.

The Fourth Five Year Plan, between 1946 and 1950, was dedicated to the reconstruction of the country after the war. The plan succeeded not only in reconstructing the Soviet Union metal industry, however, but also in surpassing the pre-war levels. The non-ferrous industry, in particular, benefited from more efficient and modern technology. The Fifth and Sixth Five Year Plans, 1951-1960, (1) were programmed as great qualitative and quantitative advances.

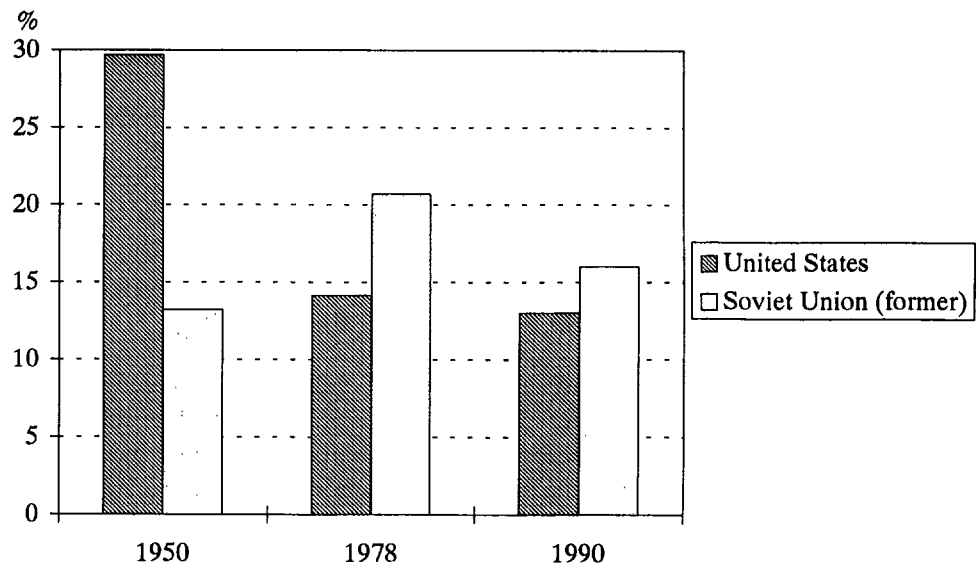
During the Khruschev government, the metal industry of the Soviet Union was prepared for a decisive step to seize supremacy in world leadership from the United States. However, planned goals were not achieved and only very modest advances were obtained. The ambitious production growth rates and targets were far above the existing resources of the Soviet Union. In 1965, Soviet Union iron and steel industry production represented some 70 per cent of that of the United States and non-ferrous metals output was around one half of the same in the United States (2).

In 1965 the Soviet Union gross national product was USD 460 billion as compared with USD 685 billion of the United States. Although this high figure was clearly artificial because of an unrealistic rate of exchange set for the rouble (1 Rouble = USD 1,11), the Soviet Union economy was evidently the second largest in the world, before Japan, Germany and France (3).

The Seventh and Eighth Five Year Plans brought the Soviet Union mining industry closer to the United States. Large investments to diversify the metal

sector were made and although there were delays and unsuccessful projects, considerable progress was made in non-ferrous, rare and precious metals production. In the 1970's the Soviet Union became the largest mining country in the world, with regard to the value of its production.

Figure 1. USA and Soviet Union Share of the Value of World Mineral Production [1]



1 Mineral production covers 45 non-fuel, metallic and non-metallic mineral commodities.

Sources: F. Callot: Annales des Mines, Novembre-Decembre, 1980, Paris;
Raw Materials Group, Stockholm;
UNCTAD secretariat: TD/B/CN.1/16, Geneve, 1993; and own estimates.

The mineral and metal sector of Russia and the rest of the CIS (4) is facing a challenging period that started at the end of the 1980's. The CIS has been facing a generalized decline of minerals and metals consumption and production over the 1989-1994 period. However, the area still remains, one of the five largest world producers of iron ore, crude steel, aluminium, copper, nickel, lead, zinc, chrome ore, manganese, molybdenum, vanadium, antimony, cadmium, gold and platinum.

The profound changes of the CIS metal sector have far-reaching consequences not only for the national economies of the member states, but also for the

international metal market. A slow and very difficult restructuring of Soviet Union mineral practices has been occurring since 1989-1990. Continuous attempts are being made to apply the basic principles of market economy and to introduce mechanisms of managerial responsibility and some degree of operational autonomy in the minerals and metals sector.

One of the most difficult but necessary adjustments to make the transition effective concerns pricing. In the centrally planned economy of the Soviet Union, differences in mining and smelting costs were neutralized by a redistribution of funds from profitable to unprofitable operations in order to maintain the flow of production. A large number of mines and smelters operated to planned deficits and were reimbursed with subsidies. Mineral policies were based on costs of the worst operations, with the lower costs producers making payments to the state (5).

In the market economy countries, metal and mineral prices reflect mostly the situation of supply and demand related to the costs of production of a particular mineral industry. A mineral deposit is of economic importance if it can be mined and transported to the market at a profit. The cost of mining, concentration, smelting and transport must be lower than the world price by a reasonable profit margin. In minerals producing countries which are primarily export-oriented, such as in developing countries and now in the CIS countries, only deposits rich enough to give a profit should be worked. This is not the case in the CIS area, where, due to a number of considerations, marginal deposits are still being exploited.

The initial and sometimes controversial reforms due to specific regional conditions of the CIS mining industry, have resulted in an unpredictable period characterized by depressed levels of output, productivity and investments. Although the transition problems affect the whole CIS economy, it is especially complex in mining, concentration and smelting activities, where quality and location of the ore deposits, physical and infrasructural conditions, methods of smelting and environmental aspects vary much more widely than production conditions in manufacturing. The restructuring of the CIS mining industry is obviously far from completion. Efforts to modernize and increase the productivity and international competitiveness of the Russian and other mines of the area, as well as of the metallurgical plants, have proved to be insufficient. Making projections on the development of metals production and consumption in the region is a very hazardous task and depends on the continuation and intensity of the reforms.

Very roughly, it might be estimated that within 2 to 5 years, efforts will be made to maintain average production levels of the 1992-1993 period for minerals and metals at whatever cost. Perhaps the strongest considerations will be the need for western currency and the possibility of rapid profits for influential local groups.

In the longer term, however, economic and geological, including environmental, legal and political considerations may restrict mining operations and significant cutbacks of capacity seem inevitable.

At present even the reduced volume of production, compared with the 1980's average is sufficient to satisfy a local demand for metals that has practically slumped. The international metal market has felt the impact of these changes in the form of large volumes of CIS exports followed by strongly unstable price levels. The mineral sector,worldwide, is facing a challenging period of changes and obligatory restructuring as a result of the economic and political disintegration of the Soviet Union.

2. MINERAL POTENTIAL OF THE CIS REGION

The Russian Federation covers more than three quarters (76%) of the CIS territory. Kazakhstan (12%) and the Ukraine (3%) are the second and the third largest areas. Some of the dominant characteristics as a human habitat of what now forms the CIS area are:

1) Its isolation from the rest of the world; from ancient times, this territory of more than 22.2 million km^2 remained isolated from close contact with western civilizations. The large interior of Siberia has not been easily accessible to the outside world.

2) Most of the territory is not well suited for agriculture. The fertile lands are in the west and the south. However, the greater part of the region is either too arid, too mountainous or too cold for a competitive agriculture;

3) As a result of the geological diversity of the vast region, the area contains the world's largest variety of mineral resources.

Figure 2. Mineral Resources in the CIS Area

Sources: R. Crockett: Metal within the changing Soviet Union system;
Metal Bulletin Monthly, December 1991; and several sources.

Not all the countries of the CIS, however, are abundant in mineral resources. Russia is, by far, the richest territory in minerals followed by Kazakhstan, the Ukraine and Uzbekistan.

The Russian Federation occupies around one sixth of the world's territory outside the ice caps, being by far the largest country on earth. Its pattern of geological structure suggests a basically favourable mineral endowment. It possesses such important mineral regions as the shield of Baltica, shared with Fenno-Scandia, the Urals, Caucasus, Altai, and that immense shield of Eastern Siberia. To the south, the Central Asian countries, particularly Kazakhstan, constitute a rich area for minerals.

2.1. Geological exploration in the Soviet Union

The most important objective of the mining industry in the Soviet Union was to fulfill the domestic demand for raw materials and the central government's foreign trade obligations with other centrally planned economies. Special legislation was adopted to make possible a "systematic and rational exploitation of mineral resources, beginning with their geological study and projection of mining undertakings, and ending with the extraction and processing of the minerals" (6).

The Soviet Union geological prospecting, exploration and mapping was mainly the responsibility of the Ministry of Geology. In practice, geological work was carried out by ten different ministries, a large number of institutes and academies of sciences and by unions of geologists. The Ministry of Geology alone employed near 700,000 geological workers. More than 350 universities and technical schools prepared professionals in geology and related matters (7).

The geological prospecting work was planned according to standard periods for the minimum life of the reserves:

- at least 40 years for reserves of iron ore and other materials for the iron and steel industry,
- 30 to 40 years for copper, lead, zinc, nickel and bauxite reserves,
- 20 to 30 years of reserves for mining tungsten, tin, molybdenum and mercury,
- 15 to 20 years for gold mines, and
- 5 to 10 of reserves for mining certain rare metals (8).

The planning and evaluation of geological prospecting and exploration were done under five-year plans. The results of the operations were estimated according to common norms of the central government and served as a basis for the projected volume of money necessary to carry out the next plan of geological activities. As

a rule, bigger assignments were approved in response to more spectacular results reported by the State Commission for Mineral Reserves under the USSR Council of Ministers.

Geological research was one of the most dynamic sectors of Soviet Union cooperation with foreign countries. Before the collapse of the system, the Soviet Union had hundreds of mineral prospecting projects not only with the CMEA countries, but also in Africa, Asia and Latin America. In 1988, more than 5,000 Soviet Union geologists were employed in technical assistance projects to foreign geological services in Ethiopia, Algeria, Guinea, Ghana, Mozambique, Benin, Mongolia, South Yemen, Afghanistan, Cuba, Nicaragua, Peru and Bolivia.

Exploration and geology - both in the Soviet Union and abroad - had been for years the pride of the system. Money or technical equipment were never a problem for this activity. During the last three years of the Soviet Union system, the central government concluded contracts with a number of industrialised countries, such as Australia for cooperation in cartography, and with the Federal Republic of Germany in remote sensing.the Soviet Union Cosmos system for high- resolution satellite imagery was world renowned. Certain technology for studying the earth's depths was also highly appreciated throughout the world. Seabed prospecting, in cooperation with Finland and Great Britain was one of the most advanced of that time (9).

Economic and technological cooperation in the fields of geology, mining and metallurgy was an important way for the Soviet Union to maintain and strengthen economic and political ties with developing countries. Projects were based on inter-governmental agreements and were long-term and diversified. Soviet Union organisations surveyed and carried out research and development, supplied equipment, sent specialists, shared experiences, etc.

Apart from political considerations, the Soviet Union's economic and technological cooperation with developing countries was of considerable importance for the entire development of the Soviet Union mineral sector itself. It greatly increased output of industrial export goods and, at the same time, helped the research and development of new exploration, mining and metallurgical techniques and, to a lesser degree, secured the import of mineral raw materials needed for the growing requirements of the Soviet Union industries.

The basic principle of Soviet Union cooperation in the mineral sector was "to bring peoples closer to a much higher stage than ordinary promotion of trade" (10). The principle was, however, largerly theoretical, because in practice, copperational conditions were as demanding as those between industrialized and developing countries, plus the political ingredient (11). Soviet Union cooperation in the mineral sector was at its highest during the 1980-1986 period. At present,

practically all former Soviet Union economic and technical cooperation with developing countries in the mining sector has collapsed.

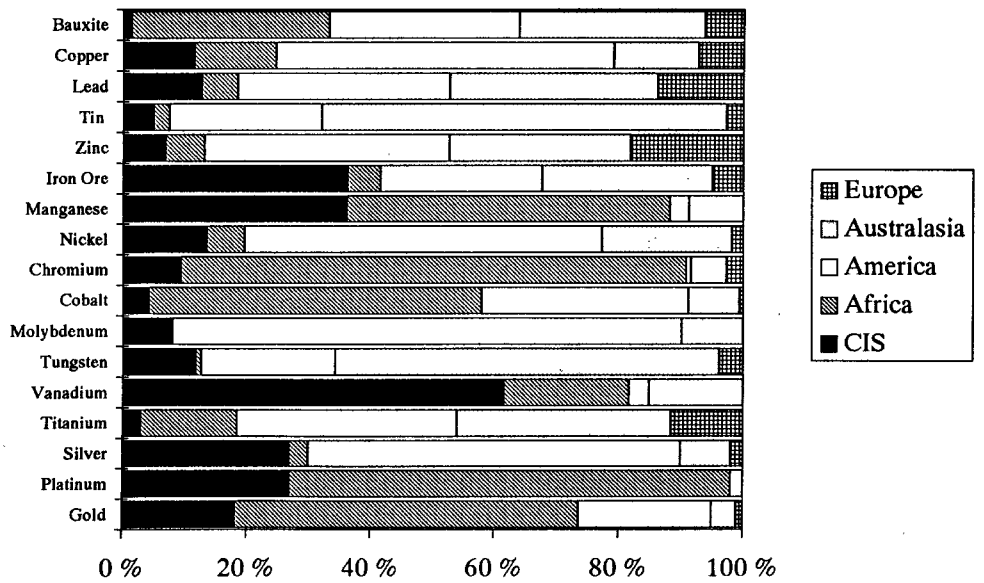
A number of Russian geologists consider today that geological operations under a central control were not so efficient as reported. It is now admitted, for example, that for security reasons, the Soviet Union maps for public distribution were deliberately falsified misplacing natural features. Criticism is also and particularly directed to failures in finding new deposits to replace the declining ore grade of the Soviet Union mines and in general, to the large geological bureaucracy of those times (12).

2.2. CIS reserves and resources of major minerals

It is generally accepted that the CIS area, and Russia and Siberia in particular, contain an enormous and varied potential of metallic minerals as well as of industrial minerals and fuels. More than 5 per cent of total world reserves of almost every important mineral - bauxite is the exception - is found in CIS territory. The countries of the CIS posseses the largest ore reserves of iron and vanadium, and a significant second or third place in world reserves of copper, lead, nickel, cobalt, manganese, tungsten, platinum, gold and silver.

Worldwide, the concentration of mineral reserves is generally very strong, especially for chromium, manganese, vanadium, cobalt, platinum and gold. The dominant position of the CIS together with the Republic of South Africa in the ownership of world reserves of these metals is illustrated by the fact that around 80 per cent of the global reserves are found in these countries.

Figure 3. Distribution of World Reserves of Major Metals and Minerals,1990



Sources: World Resources: A Report by the World Resource Institute;
the United Nations Environment Programme; and the UNDP;
based on the US Bureau of Mines and UNESCO estimates.

The concept of mineral reserve is essentially dynamic, applying only to a limited period in time and is directly related to the intensity of mining exploration, metals prices, mining technology, environment, energy and politics. The significance of all these factors is of particular importance during the transition period of the CIS.

A significant share of the mineral resources of the CIS area is known for its extremely erratic location. Development operations are increasingly shifted to the sparsely populated eastern and northern areas in very harsh climatic conditions. This means increased cost of operations, working requires more time and transportation of the materials is one of the most difficult and expensive problems to be resolved. The Russian share in reserves of most minerals is superior. Exceptions are lead and chromium, the main reserves being located in Kazakhstan, and manganese reserves which are mainly in the Ukraine (table 1).

Table 1. Distribution of CIS Mineral Reserves, 1993 (in percentage)

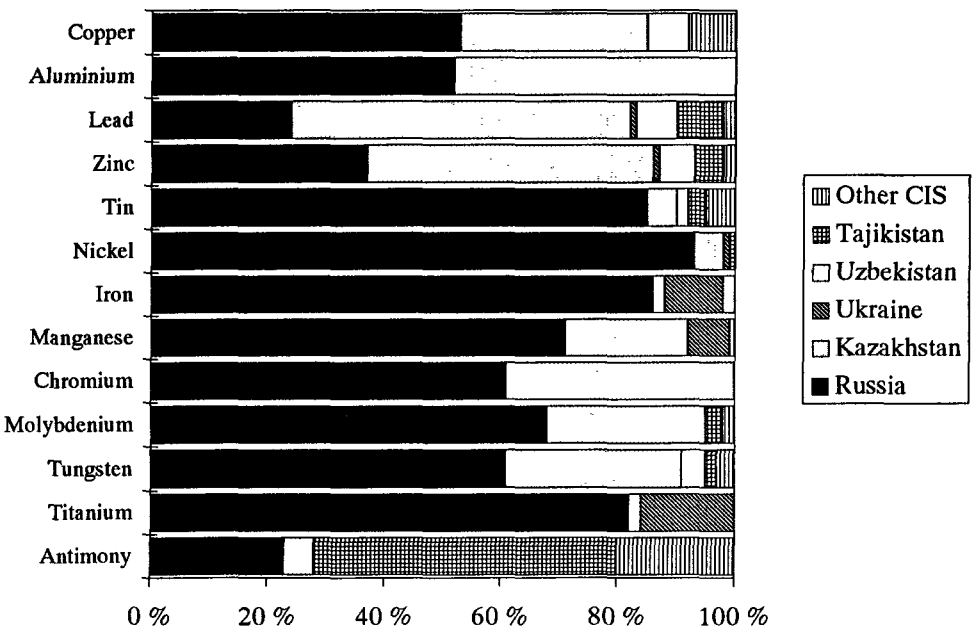
	Russia	Kazakhstan	Ukraine	Uzbekistan	Other CIS
Copper	53	29		12	6
Lead	34	38		9	19
Zinc	48	36	1	5	10
Tin	91	2			7
Nickel	95	4	1		
Iron	54	12	30		4
Manganese	5	13	75		7
Chromium	3	97			
Titanium	57		42		1
Gold	52	10		29	9
Silver	38	26		22	14

Note: Reserves are defined as being that portion of the identified resources from which the usable material can be economically and legally extracted at the time of determination.

Sources: International symposium "Mineral Resources of Russia", November 10-13, 1993, St. Petersburg;
V. P. Orlov: MRR 2.93, Russian Federation Committee on Geology and Subsurface Usage, 1993, Moscow.

The distribution of the minerals resource base - proven, probable and possible reserves - among the countries of the CIS shows an even greater concentration than that of mineral reserves in the territory of Russia; as high as 86 per cent in the case of iron, and 60% in chromium, where the Russian share in proven reserves is only 3% (14), (see Figure 4).

Figure 4. Distribution of CIS Potential Mineral Reserves (in percentage)



Note: Potential reserves include: projected resources of explored deposits or those under exploration (P1); projected resources of undiscovered deposits thought to exist on the basis of evidence from geological surveys, prospecting, and geophysical and geochemical tests (P2); and projected resources of potentially promising areas where new deposits may be discovered (P3).

Sources: Vitaly T. Borisovich, 'Commonwealth mineral resources and economic development', Paper presented at the Conference on Commonwealth Mining Development: Prospects, Problems and Cooperation with the Pacific Basin, Institute of Economics Research, Academy of Sciences, Khabarovsk, Russia, 2-5 June 1992, quoted in Resources Policy, Vol 18, Number 3, September 1992

2.2.1. Iron ore reserves

According to the World Resources Institute and the United Nations (13), proven world iron ore reserves amount to 151 billion tonnes, of which the CIS held 54.2 billion tonnes. The main part of these reserves - around 54 per cent - is concentrated in Russia. The balance is found in the Ukraine with 30 per cent and Kazakhstan 12 per cent (see Table 1).

During the cold war period, figures concerning the volume and distribution of mineral resources, elaborated by western institutions on the basis of the then available information were, almost invariably, obviously inflated. In the case of iron, for example, it was considered that proven reserves amounted to 110 billion tonnes of which the Ukraine held more than one third and Kazakhstan 15 per cent (15). At present, it is generally accepted that by far the largest part of iron reserves of the CIS are located in the european part of Russia, west of the Urals, in the Kursk-Magnetic Anomaly in south-central european Russia; and at the Krivoy Rog basin in the Ukraine.

The overall average of mineable Russian iron ores is, at present, estimated at 38 per cent compared with 45 per cent iron content in 1958. During that time it was published by Soviet Union authorities that more than 10 billion tonnes of the iron reserves assayed around 60 per cent (16) which is high by international standards and fall into the category of those ores which do not need enrichment to be usable in the iron and steel industries. The quality of the iron ore deposits have deteriorated during the last two decades so that they are at present of low and medium grade, and require large enrichment plants near the deposits. The recoverable iron content of the CIS reserves has been more recently estimated at about 23,5 billion tonnes from a total worldwide reserves of 64.7 billion tonnes (17).

There are different views on the present state of the CIS' mineral reserves in general and those of iron in particular. The older school of Russian geologists consider that there is an almost infinite mineral potential of exploitable grade ores disseminated in deposits throughout the CIS territory. Acording to this traditional interpretation, the Siberian mineral resources may be much more significant than has been realized, and that geologically speaking only the surface has been scratched (18). A different, and perhaps more realistic approach is represented by the younger school of geologists who consider that highly economic reserves have been exhausted, or are being depleted at a fast rate.

As a result of ore grade decline, more material has to be excavated and transported to maintain the production levels. Most of the CIS' iron is transported long distances by rail. Both transport and mining equipment are in decline. Statements concerning an almost infinite potential for a continuously increasing mineral and metal production seem to be a continuing bad habit of the past.

2.2.2. Manganese ore reserves

The first manganese mining operations in Russia were started in the 1880's by German and French companies at Chiatura, Georgia, in the Caucasus area although large ore deposits were known long before. World manganese mineable

ore reserves have been calculated to be around 3.3 billion tonnes. Recent studies estimate manganese metal content of global reserves at about 0.8 billion tonnes and CIS reserves at around 295,000 tonnes (19). After the Republic of South Africa, Russia held the second largest deposits in the world (See Figure 3).

For several decades the high manganese grade ores from Chiatura were transported all over Russia and Europe. Ore grade has been declining continously so that reserves assaying an average of about 25 per cent manganese content require efficient beneficiation plants. The high phosphorus and silicon content of the ores have also adversely affected the manganese production.

At present, proven reserves of manganese are concentrated in the Nikopol region in the Ukraine, in Kazakhstan where important reserves are found in the central part of the country, and in the south-eastern part of Russia. About 70 per cent of the CIS potential resources are found in the Russian territory followed by Kazakhstan and the Ukraine (See Figure 4).

2.2.3. Nickel ore reserves

The CIS' nickel reserves were estimated at 6.6 million tonnes of nickel content in 1990 (20), which means the 13.6 per cent of the world total reserves. After Cuba (37.3 per cent), and Canada (16.7 per cent), Russia holds the third largest reserves. Nickel ores are concentrated on the Kola Peninsula and in Norlinsk in Krasnoyark Kray, East Siberia.

The Norilsk nickel deposit is one of the largest in the world. These nickel-copper ores are complex sulphides such as pentlandite, chalcopyrite and pyrhotite with commercial content of platinum group metals, gold and cobalt. The ore averages 0.6 per cent nickel and 0.8 per cent copper. The rich ores contain as much as 1.5% nickel, 3% copper, and 10% grammes per tonne of platinum group metals, platinum and palladium. A World Bank study estimates that the rich ores contain as high as 7-10 per cent combined copper and nickel. Richest ores do not need to be concentrated before smelting (21).

Complex sulphide nickel-copper reserves are also found in the Kola Peninsula. Significant efforts to expand the reserve base at Pechanga and Severonickel combine in the Kola's region have been made for several years. Pechanga- nickel, former Petsamo, belonged to Finland until the Second World War and was known as one of the richest nickel deposits in the world with ores containing an average of 3.8 per cent nickel, 1.8 per cent copper and 0.08 per cent platinum metals (22) .The rest, around 5 per cent of the CIS proven reserves of nickel are found in northwestern Kazakhstan. These ores average over 1 per cent nickel content.

2.2.4. Chromium ore reserves

The world chromium reserves are estimated at around 0.5 billion tonnes held principally by the Republic of South Africa (70 per cent), Zimbabwe (10 per cent) and the CIS (9 per cent), (See Figure 3).

The largest proven chromium ore reserves are found in Kazakhstan in the Donskoye mining and beneficiation complex near Khromtau. This area contained rich ores with an average chromium oxide content of 40 to even 60 per cent sufficiently high to be used without previous concentration. At present, nearly all the ore has to be benefitiated at the Donskoye concentration plant. Metal content of chromium ores has been continuously declining; therefore the percentage of crude chrome ore to total mined material decreased from 60 per cent in the 1930's to only 7 per cent in the 1990's (23).

Although a large proportion of proven chromium reserves are found in Kasakhstan, potential resources are estimated to be in the Urals. These ores are, at present, low-grade and mostly used for refractories and the chemical industry. The concentration of practically the total proven chromium reserves in Kazakhstan is a problematic issue for Russian steel. Russia is now actively trying to improve the potential chromium ore reserves base in its own territory, of which it has more than the 60 per cent of the CIS countries (see Figure 4).

2.2.5. Other ferro-alloy reserves

In the 1970's, world vanadium reserves were estimated at 10 million tonnes, the metal content of which 75 per cent was in the Soviet Union (24). In 1990, respective figures were estimated at about 5 million tonnes and the CIS share at 62 per cent of this volume (25).

The most important sources of raw material for vanadium production are the titaniferous magnetite ore from Kachkanar in the Urals, and Chusovoy and Nishijiniy Tagil mining complexes also in The Urals. Although the vanadium pentoxide content is only 0.5 per cent, the Kachkanar ores are relatively clean and near the surface and easy to beneficiate (26).

The CIS tungsten reserves are estimated at 0.28 million tonnes of metal content which means 12 per cent of world reserves (see Figure 3). Russia has the largest resources among the CIS countries with 61 per cent of the total. The main deposits are found in Antonovogorsk, Belukha and Sherlovogorsk in East Transbaykal, Iultin in Magadan Oblast in East Siberia and Tyrny-Auz in Caucasus.

In 1970, Russian tungsten reserves were estimated at more than 1 million tonnes (27). Efforts to expand the tungsten reserve base during several years have been unsuccessful at least in Iultin and Tyrny-Auz. The territory of Kazakhstan is considered to have nearly one third of the CIS tungsten reserves. The most important deposits are in Akchatau, Karaoba, Koktenkol and Verkhnye Kayraktin. The rest of the resources are found in Tajikistan and Uzbekistan.

The CIS is relatively poor in titanium resources, about 3 per cent of the world global resources are found in the Russian Urals and in the Zaporozhyie titanium-magnesium complex ore deposits (28).

2.2.6. Copper ore reserves

The proven world reserves of copper in ore are estimated at 321 million tonnes of copper. In addition, an estimated 550 million tonnes of copper is available in other resources worldwide (29). Five countries, in order of importance, Chile, United States, the CIS, Zaire and Mexico account for 68 per cent of world copper reserves and 55 per cent of potential resources.

The CIS accounts for 12 per cent of known world copper reserves and around 16 per cent of other copper resources. Copper reserves are concentrated in three main regions:

- the Ural mountains, where rich cupriferrous pyrite and complex copper-zinc ores can be found,
- Central Asia, especially Kazakhstan and Uzbekistan with large but relatively low-grade copper porphiries and with copper-lead-zinc complex ore worked for hundreds of years,
- The Norilsk region in Siberia, where copper is associated with nickel sulphides.

Apart from these principal three regions, copper finds are reported in northern Russia, in the Kola Peninsula and in Armenia in Transcaucasia, with a number of very old, small and medium size copper-molybdenum porphiries. A very important copper ore deposit is found at Udokan, north-west of Lake Baikal, where reported ore finds contain one of the largest copper deposits in the world.

Kazakhstan, according to the VSEGEI (30), contains about one third of the CIS' copper reserves in its vast territory. The two major mining centres are Dzhezkazgan and Balkhash. The ore deposits, which supply both centres have been facing a depletion of ores. During the 1980's new exploration operations have been apparently succesful in revealing new reserves.

The Uzbekistan copper reserves represent around 12 per cent of the CIS' total. The ore deposits are exploited in the form of two open-pit mines, which contain large but relatively poor copper porphyries.

Although the most known and traditional copper ore deposits in the CIS territory are reportedly near depletion, it is considered that, along with the Udokan area, there are a number of deposits which contain potentially much more than an estimated 37 million tonnes of copper reserves.

2.2.7. Zinc and lead reserves

Demonstrated world reserves of zinc amount to 144 million tonnes of metal content. If all other zinc resources of explored deposits or those under exploration were included, the total would exceed 295 million tonnes. The corresponding figures for lead reserves are 70 million tonms and 120 million tonnes (31).

The CIS reserves of zinc metal content are estimated to be around 10 million tonnes - the fourth largest after Canada, United States and Australia - and those of lead amount to 9 million tonnes. These polimetallic ores can be classified generally in three categories:

- lead-zinc or zinc ores with a small content of precious or rare metals,
- lead-zinc ores enriched with rare metals, and
- zinc-lead-copper ores enriched by precious and rare metals.

The most important zinc-lead resources are found in the territory of Kazakhstan, especially in the Altai area, where around 40 per cent of CIS zinc and lead ores can be found. The southern part of Kazakhstan, near Kirgizia and Uzbekistan is also a significant area of zinc-lead-copper polimetallic ores. The largest deposits in the Russian territory are found in the Urals, Gai, Buribay and Uchaly areas. The remaining zinc and lead reserves are located in Tajikistan, Uzbekistan, Georgia, Azerbaijan and Armenia.

The CIS zinc-lead ores are in general low-grade, between 1-2 per cent of metal content (32). Only modernization and constant expansion of the beneficiation operations have made zinc-lead mining possible in the past. However, the constant decline of ore grade is rapidly depleting reserves. Economic compensation has been possible during recent years, however, by the recovery of a number of by-products such as gold, silver, copper, antimony, and the high priced indium, gallium, thallium, etc.The depletion of zinc , and especially lead reserves could be a serious problem for the CIS mining sector in the medium term.

2.2.8. Other non-ferrous reserves

Commercial-grade bauxite to produce aluminium is the only important mineral which has not been found in large deposits in the CIS territorry. In the 1930's relatively small bauxite deposits were found in the northern Urals. Later, new finds of bauxite were made in Kamensk and Bashkir, in the central and southern Urals. Bauxite was found also in eastern Siberia and at Turgai in Kazakhstan. However, only 1 per cent of the world bauxite reserves are found in the CIS territory.

The Soviet Union has long developed processes for recovering aluminium from non-bauxitic materials, such as nepheline and alunite. Nepheline is mined in the region of Irkutsk, in Siberia, and is obtained as a by-product of apatite in the Kola Peninsula. Alunite is mined in Azerbaijan, Kazakhstan and Armenia.

Proven tin reserves in the world amount to about 6 million tonnes, of which the CIS territory posesses 0.3 million tonnes (33). Tin ore deposits are found in three particular areas, all of them in Eastern Siberia:

- Yakutia, where most of the ores are of placer type and are thought to be the most valuable,
- the Far East, near Khavarobsk and Komsomolsk, and
- Transbaikal, near the border with China.

Smaller deposits are also found in Tajikistan and Kirgizia. CIS tin ores are of low-grade quality and generally contaminated with impurities such as iron, antimony, copper, lead and arsenic. To benefitiate these low-grade and dirty ores Russia has developed a concentration process by fuming which has also been applied in Bolivia with relative technical success.

Although Russia possesses only 5 per cent of the proven world tin reserves, probably as much as 20 per cent of the potential tin resources could be found in the vast territory of Siberia.

3. RESTRUCTURING OF MINERAL EXPLORATION ACTIVITIES

The basic problem for restructuring the CIS mining sector and that of the minerals prospecting activities, is the absence of a clear concept of the laws and mechanisms of the free market economy. After the collapse of the Soviet Union, officially dissolved on the 31st December of 1991, there has been little consensus as to what the CIS' common interests are, and a great deal of doubt as to whether the states will be able to create a coordinated strategy for the development of the mining industry, from minerals prospecting to the trade of metals.

As shown before, the Russian Federation is, by far the dominant country in the CIS by possessing the richest and most varied mineral resources base. However, Russia alone contains 20 republics in a situation where almost every region demands that it be the unique owner and co-partner for international negotiations concerning natural resources. As a result, particularly in those regions and republics rich in mineral resources, geopolitical tension and conflicts are emerging at CIS level and among the Russian republics and regions.

The planning and execution of geological prospecting activities was centrally controlled for more than sixty years. At present, the whole sector is undergoing a radical transformation as a result of decentralization measures and regulations. The problems of the CIS' geological services were intensively discussed by local geologists in an international symposium in November 1993, in St. Petersburg. (The Second International Exhibition and Symposium "Mineral Resources of Russia" took place on October 25-29, 1994, also in St. Petersburg).

Some papers presented to the symposium reflected a profound concern for the position and future of geological activities in the territory of the Russian Federation and other CIS countries. The discussions emphasized the necessity of urgent solutions to a number of problems in order to increase the mineral reserves and mineral resources base in new mineral raw material producing regions to replace those depleted. A large group of top geologists and mineral economists consider that if immediate measures to carry out the required geological exploration and prospecting works are not taken, in the year 2010 Russia will have to import most of the manganese, antimony, chromium, titanium, lead, zinc, and rare metals to satisfy its industrial needs.

Russian specialists complained that central political power in Moscow considers the mineral raw material base has been sufficiently covered in the medium term and investment in geological research should be reduced. Cuts in financing have been made for four consecutive years since 1990. It seems, however, that reductions in the geological exploration budget are probably more a result of the Russian economic situation than of neglecting the importance of these activities. The transition of the CIS' mining industries to a market economy system, where

operations have to be measured on a basis of international metal market prices, has greatly reduced the balance of reserves of hundreds of mineral deposits which previously operated under complex subsidy systems.

The preparation of new resource regions such as the shelf of the northern seas and East Siberia, has practically ceased. With the reduction of geological operations the ratio of proven reserves to production has decreased, in some cases very abruptly, as is the case of gold. The share of the most valuable complex lead-zinc ores has also decreased and low quality resources are not sufficient to compensate depleting volumes.

3.1. Russian Federation mining legislation

By mid 1992, a draft "Law on Underground Natural Resources" and "Regulations on the Licensing Procedure for the Exploitation of Underground Resources" was confirmed by decree.There were subsequently several amendments to these laws (34). In December 1992, regulations on the functions and structure of the Russian Federation Committee on Geology and which defines the objectives, purposes, functions and rights of the Russian Federation Committee on Geology as the central body of the federal executive power, in coordination with the Geological Survey and the State Subsurface Fund of the Russian Federation.

According to the "Regulations", geological prospecting should be financed with funds paid by producing enterprises and accumulated in an extraordinary budget. The Chairman of the Russian Federation Committee on Geology and Subsurface Usage considers that this fund can provide only 65 per cent of the 1991 volume for geological prospecting works, even in the case of 100 per cent of the deductions being collected. As a consequence, the Russian geological prospecting programme started its 1993 activities with a budget deficit in the of 40 billion roubles (35). In 1992, financing of currency needs to continue exploration of the oceans, as well as for the purchase of spare parts and materials for imported equipment was cut off. Producing enterprises are not very enthusiastic about the idea of financing basic research in the geological, geophysical or geo-ecological sector which are not directly related to the exploitation and production of minerals.

Up until 1991, industrial and scientific institutions combined their efforts to form an efficient geological service, including 350 permanent field expeditions, 34 scientific and design institutes and 10 plants for the manufacture of geological exploration and prospecting equipment. The volume of work decreased by around one fourth in 1991 and by more than one third in 1992, and the number of workers in the sector was reduced by 118 000. According to the Committee on Geology (36), field geologists, their families and related infrastructure personnel

are in a critical situation, isolated in remote regions, without salary payments for several months and without even a basic means of survival.

3.2. Foreign involvement

Recent Russian Federation legislation on mineral resources represent the preliminary attempt to promote investments in a transition period from a centrally planned economy to a market economy. The process is reviving two opposing forces in connection with the development and administration of the CIS and the Russian Federation mining industry. The traditional management is in favour of a strong centralized control, and the reformers would like to accelerate the decentralization process so that the different states, republics and autonomous regions gain greater control over their mineral resources.

The transition period, however, is accompanied by a number of obstacles: the number of orders for prospecting and development is falling, unemployment in the sector is increasing, financing is being cut off, the process of disintegration in the organizational structure is becoming more evident and the interest of the producing enterprises in geological research is low. Under these circumstances the CIS innovative groups find themselves in a difficult position. In an effort to revive the mining activity in all its phases, the administrative bodies of the republics of the CIS are trying to encourage foreign involvment in the sector.

The attraction of foreign investment for geological research in Russia has proved to be very difficult. The primary cause of the slow progress in encouraging investment is the lack of, or in some cases, insufficent and contradictory legal and taxation laws related to mining. According to J.H. Hill's analysis of the Russian Mining Legislation (37), some of the main reasons which may tend to inhibit investment are:

- an emphasis on the State Balance of Resources and its replenishment through private enterprises funding of state exploration entities,
- the absence of provisions for the protection of an exploration success except through open tender or auction,
- the degree of commitment required by an investor as a of winner of a competition or auction does not appear to consider the later results of a feasibility study,
- without exclusive mineral rights there can be little incentive for exploration due to the difficulty of protecting a discovery under the public system of auction or tender,
- the holder of a geological licence can complete work, make a discovery, and be forced to participate in a competition and possibly loose control of the

discovery. The legislation is silent on the specific assistance provided to the geological licence holder to obtain a fair compensation.

Foreign enterprises have to make additional appeals to the central administration to obtain specific guarantees and privileges, and so only a few hundred offered proposals have been developed during the last four years. A partial list of the deposits up for tender in the Commonwealth's territory, in 1990 (see Table XX) shows that most of them were of minerals with a low unit value in the international market, such as iron, tungsten, bismuth and tin. There is no information about which of the offers in the list have been further developed by foreign or Russian enterprises. In addition to several restrictions in the mining legislation most of the deposits are located in remote areas and are little known geologically.

As long as the situation concerning control of mineral resources in the CIS continues to be a issue of debate, the response of foreign companies - at the geological, mining and metallurgical level - will be slow. Despite the CIS' largest world mineral potential, virtually no western geological institution has obtained the right to operate in the non-fuels mineral sector. The present situation can easily be compared with that of the developing countries in the past two decades: a combination of economic nationalism with an acknowledged need for developed countries capital and expertise. It took a long time before governments in developing countries established a clear framework for foreign investment.

3.3. Policy options and prospects

The prerequisite to facing the complex problems of the CIS geological services is to integrate the mining industry into the world mining industry. Opening the metal sector is not an automatic consequence of economic reform; it is the result of the acknowledgment that the CIS mining industry cannot be isolated from the laws and regulations of the international metal market.

There is, however, a controversial approach which needs clarification. The argument concerns certain western and CIS mining enterprises managements who often claim that opening the mining sector means the complete elimination of state control over national and foreign mining companies. In the minerals prospecting area this is incorrect. There is no country in the world claiming to be a sovereign nation, where the state has nothing to do with the mineral resources of its own territory.

A major feature of world mineral exploration is the large extent of state participation, both in developed and developing countries. Specific policies for individual national geological services differ depending on the country size and level of development. Most Western European geological institutions are

financed by the State, for example the Geological Survey of Finland, one of the leading geological organizations in Europe.

The transition from one extreme to another; from one hundred percent state budget financing for geological prospecting to one hundred percent private financing has proved to be very difficult. A coordinated strategy for geological prospecting between public and private interests would probably result in innovative activity across the CIS territory. It will be necessary, first of all, to determine exactly the role and interests of the state in the study of the subsurface. Equally important is to determine by law the detailed conditions for the attraction of foreign investment to explore and develop the mineral deposits of the CIS.

The first attempt on the legislation of cooperation with foreign companies to explore and produce minerals in Russia has been the establishment of joint ventures according to the "Law on Underground Natural Resources" and "Regulations on the Licensing Procedure for the Exploitation of Underground Resources". Later, there have been some amendments and additional regulations dealing with two new forms of cooperation: concessions contracts and production sharing agreements. The legislation does not, however, delineate clearly enough taxation and payment mechanisms for these two further forms (38).

The lack of corresponding laws - at least at the time of writing (mid-1994) may tend to discourage investment, particularly for further exploration and exploitation of potential deposits under difficult natural conditions. Concession contracts could also be used in those regions where physical and social infrastructure are not available, as well as for the exploitation of those mineral resources demanding expensive and technologically advanced methods of treatment.

International investors in the mining industry obviously compare mining legislation and investment environments worldwide. They tend to work with those companies and countries that offer a detailed and stable mining legislation and the best opportunities for a reasonable return on their invested capital.

While diverse sectors of the Russian and the rest of the CIS economies are increasingly being opened, transparency principles and coordination policies have not yet extended to the mining industry. At this stage of the transition period a review of the progress made on the entire cycle, from geological exploration to the marketing of the finished product should be made. Such an analysis would play an important role in the regulating of legislation mechanisms. Until the present, such an analysis has not been made, or at least has not been openly discussed. A comprehensive system for the assessment and forecast of the CIS mining industry should include geological exploration as a central element in promoting a balanced long-term exploitation of their mineral resources.

4. REGIONAL DISTRIBUTION OF THE CIS MINERAL AND METAL PRODUCTION

4.1. Planning the location of the Soviet Union mining industry

Minerals and metals production and consumption patterns vary widely among countries all around the world in accordance to the size of their economies, the share of the metal industry, as well as the importance of their mineral resources, and the capacity of their beneficiation, smelting and refining plants. Some general conditions determining the location of beneficiation and metallurgical plants are needed: near the ore deposits, near the sources of water and energy, near the market, and at some intermediate point with the most appropriate infrastructure. The operations of the mining industry in market economy countries takes into account one or a combination of these conditions and consequently, the large majority of the western mining and metallurgical operations - both in industrialized and developing countries - fall into some of the above categories.

The Soviet Union strategy for the development of the mining industry included not only the former conditions but additionally followed an ideology demanding maximum human effort, often as a result of the overplanning of goals having been set too high. All resources, human and material, were mobilized to fulfill the high priority objectives of heavy industry, military power, electrification and nuclear energy, etc., while problems of working and living conditions of the people, consumer goods production and environment, received only secondary attention.

As described before, the economic areas of the Soviet Union vary greatly as regards the scale of mineral reserves. Despite these differences, and from the marxist perspective, the economy of each area constituted a single component of the entire Soviet Union economic complex. The planning for the location of mining industry operations was made according to the following basic principles:

- to increase the economic efficiency of industry in particular areas,
- to integrate development through the centrally planned use of the area's natural, labour and economic resources,
- to favour the inter-sectorial specialization, the establishment of specialized plants to supply various sectors of the economy, and the intersectorial complement of production,
- to develop industrial centres within a specific republic or economic area,
- to establish "optimum" human and economic links within and between the republics and economic regions (39).

The location of mining and metallurgical operations based on the above principles tended to incorporate every region or republic of the Soviet Union in the global socialist division of labour. To develop the mining industry in the underdeveloped areas of the Soviet Union territory, the Soviet Union government established smelting plants deep in Siberia, Kazakhstan and Central Asia. In some cases production works were established even if it was known that the supply of resources from local deposits were not satisfactory. Ore deposits were not large enough or their quality required extensive and costly preparation and beneficiation. Mining operations were so widely separated both from one another and from the markets, that capital investment in the operations and transport facilities were disproportionately large.

A central aspect of the development philosophy was the conviction that socialist man could do any task successfully; even though economists in the capitalist world thought it was not viable. For example, centrally planned mining policy demanded inter-regional migrations and changes in the dispersion of the population. Skilled labour for mining and metallurgical operations was needed in remote areas. In practice, this "tactical" and "strategic" (40) massive movement of Russians and non-Russians, to and from mining centres perpetuated an old semi-feudal pattern of discrimination against non Russian populations.

The strong development of the Soviet Union mining industry served to reach two concrete goals; first, to increase the political power of the state and second, to expand heavy industry all across the inmense territory of the Soviet Union. The first corresponded to the strategy of establishing state controlled enterprises with strong economic and social bonds with Moscow. The second purpose was that of satisfying the country's minerals and metals requirements and ensuring independence of raw materials base from sources outside the Soviet Union.

4.2. Geography of the CIS mining industry

The Russian Federation has a population of 149 million, which represents 51 per cent of the CIS total, and occupies 76 per cent of the land mass; its GDP amounted to USD 387,5 billion in 1992 representing around 65 per cent of the CIS total GDP (See Table 2).

Table 2. CIS Basic Socio-economic Iindicators

	Population (million) 1992	Size (1000 km2)	GNP Bn USD 1992	GNP per capita USD 1992
Armenia	3.7	29.8	2.7	780
Azerbaijan	7.4	86.6	5.4	740
Belarus	10.3	207.6	30.1	2 930
Georgia	5.5	69.7	4.7	850
Kazakhstan	17.0	2 717.3	28.6	1 680
Kirghizia	4.5	198.5	3.7	820
Moldova	4.4	33.7	5.6	1 300
Russia	149.0	17 075.4	387.5	2 510
Tajikistan	5.6	143.1	3.8	490
Turkmenistan	3.9	488.1	6.4	1 230
Ukraine	52.1	603.7	94.8	1 820
Uzbekistan	21.5	447.4	14.9	850

Source: World Bank: World Development Report, 1994, (Note: Estimates for economies of the CIS are subject to more than usual range of uncertainty and should be regarded as very preliminary).

In the three years since the Russian government launched its radical market reforms, the country has not been successful in achieving macroeconomic stability; real GDP declined by 11.5 per cent in 1993, and further decline of almost 10 per cent is expected in 1994 (See Table 3), external debt has reached over USD 8 billion and there are virtually no foreign exchange reserves; industrial production fall continues, 18 per cent in 1992 and 16 per cent in 1993; fixed investment shows a decline of 40 per cent in 1992 and 16 per cent in 1993, oil production - the most valuable Russian single commodity - decreased by 14 per cent in 1992 and by 12 per cent in 1993.

Minerals and metals output figures fell even more abruptly compared with the declining trend of industrial production. Copper production fell by 50 per cent, nickel by 20 per cent, lead by 25 per cent, tin by 30 per cent and zinc production by 13 per cent. Compared with 1992, crude steel production declined by 16 per cent in 1993.

Table 3. CIS' Annual Percent Change of Real GDP, 1991 - 1994

	1991	1992	1993	1994
Armenia	-11.8	-52.0	-28.0	-
Azerbaijan	-0.7	-26.8	-14.4	-
Belarus	-1.9	-11.0	-11.7	-9.4
Georgia	-20.6	-45.6	-30.0	-5.0
Kazakhstan	-13.0	-14.0	-10.0	-3.0
Kirghizia	-5.0	-19.1	-16.4	-5.2
Moldova	-18.0	-21.3	-15.0	-3.0
Russia	-12.9	-18.5	-11.5	-9.9
Tajikistan	-8.7	-30.0	-30.0	-15.0
Turkmenistan	-4.7	-5.3	8.5	-12.3
Ukraine	-11.9	-17.0	-17.0	-18.0
Uzbekistan	-0.9	-9.5	-	...

Sources: IMF: World Economic Outlook, October 1993 and May 1994, Washington.

The rest of the CIS countries have also been unsuccessful in achieving macro economic stability. Whilst estimates for 1994 remain pessimistic, although to a lesser degree than in 1993, the region as a whole is expected to show signs of recovery in 1995. Those republics like Azerbaijan, Georgia and Tajikistan will all be facing economic and political collapse if armed internal conflicts continue.

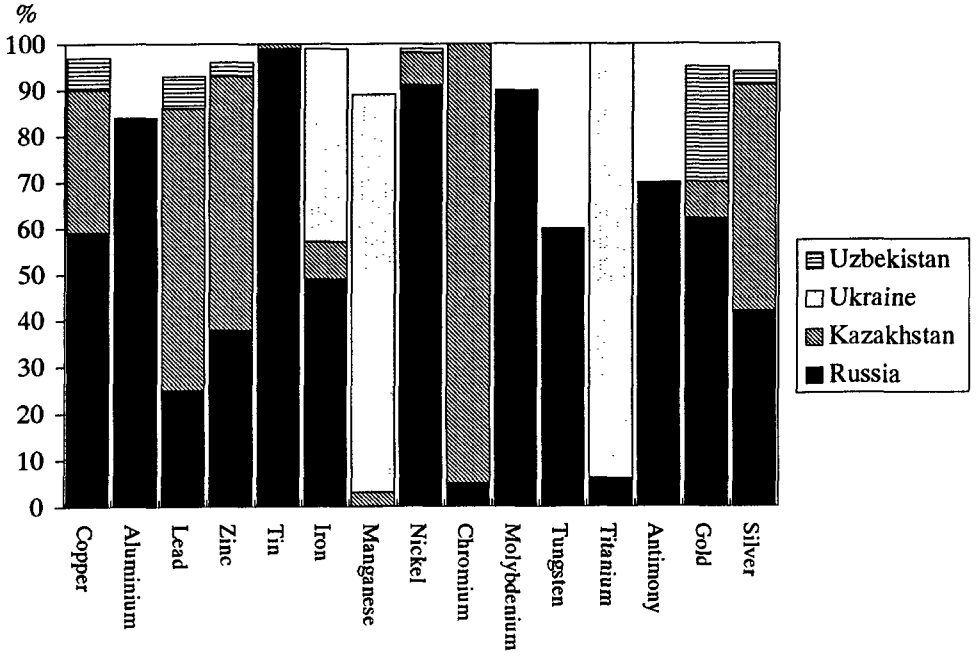
4.3. Production and consumption of major minerals and metals

The Russian Federation is, by far the largest producer and consumer of minerals and metals in the CIS countries, followed by Kazakhstan, the Ukraine and Uzbekistan. Very roughly, more than 80 per cent of the CIS metals is supplied by these four countries. The dominant position of the Russian Federation is illustrated by the fact that it produces more than two thirds of the aluminium, tin, nickel, molybdenum and antimony of the total CIS production corresponds to this country (See Figure 5). For the majority of minerals the Russian Federation is self-sufficient and, in turn, most of the Soviet Union republics are dependent on Russia for the supply of their energy and non-energy minerals. However, Russia was never, during the Soviet Union period, and is still not today, self-sufficient in a number of mineral raw materials, and is still dependent on the import of minerals or metals from the other Soviet Union/CIS republics. This is particularly true in the case of manganese and titanium concentrates from the Ukraine and Georgia; chromium, lead, zinc and copper concentrates from

Kazakhstan; and copper concentrates from Kazahkhstan, Uzbekistan and Armenia.

Decentralization of smelting activities started in the 1940's; while the most intensive expansion of mining occurred in the 1960's, mostly due to depletion of high quality reserves in the traditional producing centres of Russia and the Ukraine. Large metallurgical plants operate on the basis of complex inter-regional production links.

Figure 5. CIS Production of Minerals and Metals, 1992

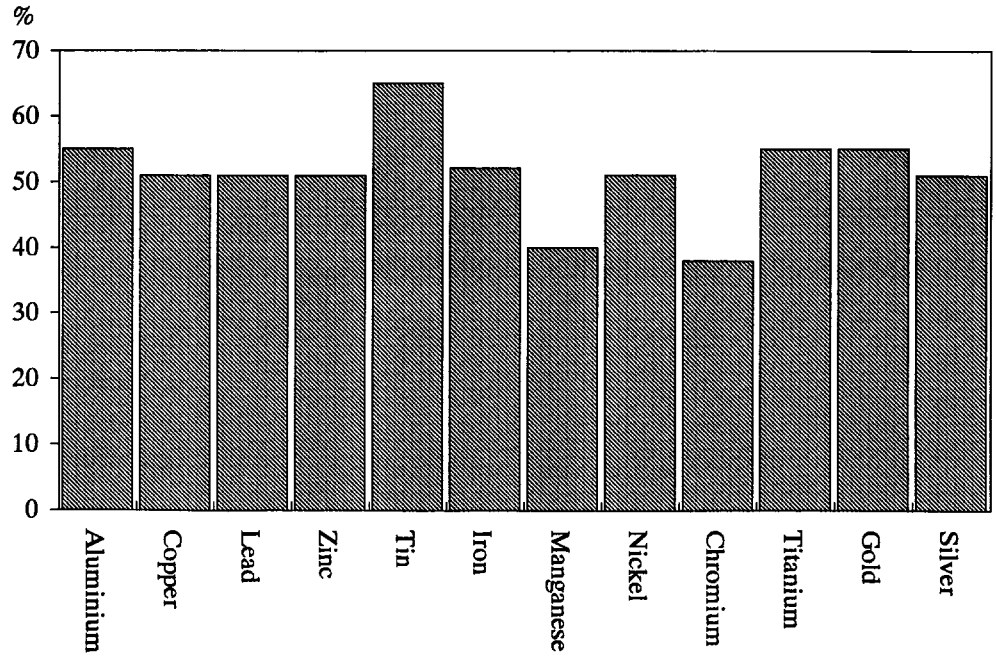


Sources: International Symposium "Mineral Resources of Russia", November 10-13, 1993, St. Petersburg; V.P. Orlov: MRR 2.93; Development of the Mineral Raw Material and Fuel Base should be supervised by the State, page 6-7; Distribution of iron ore production is based on UNCTAD statistics and corresponds to 1993; TD/B/CN.1/Iron ore/12, 2 August 1994; Mining Journal: Mining Annual Review, 1993.

There is no official data to provide information about the Soviet Union internal distribution of concentrates and metals production and consumption before 1990; but distribution shares in Figures 5 and 6 should give a rough idea of the 1980's

trend. The Russian Federation consumes about 50 per cent of major minerals and metals. In 1992, for example, total CIS consumption of aluminium was 2.15 million tonnes, from which Russia accounted for 55 per cent. In the case of iron ore, copper, lead, zinc, nickel and silver, the corresponding figure is around 50 per cent.

Figure 6. Russian Share of CIS Consumption of Minerals and Metals, 1992



Sources: International Symposium "Mineral Resources Of Russia", November 10-13, 1993, St. Petersburg; V.P. Orlov: MRR 2.93; Development of the Mineral Raw Material and Fuel Base should be supervised by the State, page 6-7; and several sources.

4.3.1. Russian Federation

As shown in Figure 2 and in Table 4 the principal centres of minerals and metals production in Russia include:

- the Urals region, which remains an important source of ferrous, non-ferrous, minor and precious minerals and metals,
- the Urals' ore deposits prolongation into Novaya Zemlya, in the north,

- the Baltic Shield of the Kola Peninsula in the far north-west, where nickel and iron are the most important minerals, but also copper, rare earths, and platinum group metals are produced,
- the important Far East region, which can be divided into four areas: southern Siberia, including parts of Khabarovsk territory and the Amur region (tin, gold); the Pacific zone, including the Sakhalin and Kamchatka peninsula (polymetallic ores of lead and zinc, tungsten and mercury) ; the northern central zone, including Yakutia (non-ferrous, diamonds iron); and the far north-east zone, extending from the Lena into Magadan Oblast (non-ferrous, gold and diamonds).

Table 4. Location of Major Mining and Metallurgical Production Centres in the Russian Federation

Mineral-Metal	Location
Aluminium	Bogoslovsk, Bratsk, Kandalaksha, Krasnoyarsk, Novokuznetsk, Sayansk, Urals, Volgograd and Volkov aluminium plants.
Cobalt	Norilsk and Pechenga mixed sulphide deposits Khovu-Aksy cobalt-arsenide deposit in Tuva Republic.
Copper	Mining areas: East Siberia, Norilsk and Talnakh deposits Urals: Deposits in Bashkir Republic, Chelyabinsk, Orenburg, and Sverdlovsk Oblasts, Gay Volkovskiy and Turinskiy deposits. Smelters: Gay, Karabash, Kirovgrad, Krasnouralsk, Mednogorsk, Srednouralsk (Urals), Norilsk (East Siberia) Pechenga, Monchegorsk (Kola Peninsula) Refineries: Kyshtym, Moscow, Norilsk, Pyshma.
Gold	Mining regions: Lena, Maritime, Northeast, Transbaykal, Urals and Yakutian gold production regions.
Iron Ore	Mining regions: Kursk Magnetic Anomaly (KMA) containing Lebedi, Mikhaylovskiy, and Stoylensk mining and beneficiation complexes, Northwest region containing Olenegorsk, Kovdor, and Kostamuksa complexes, Urals region containing Kachkanar, Magnitogorsk and other complexes, East Siberian region containing Korshunova and Rudnogorsk complexes.

Lead-Zinc	Mining Enterprises: Altay, Buribay, Gay, Kirovgrad, Srednouralsk and Uchaly copper zinc mining enterprises Dalpolymetal, Nerchinsk, Sadon, and Salair lead-zinc mining enterprises. Smelters: Chelyabinsk zinc smelter, Dalpolymetal lead smelter, Elektrozink lead-zinc smelter in Caucasus.
Nickel	Mining areas: Norilsk in East Siberia, Orsk in Southern Urals, Pechenga on Kola Peninsula, Smelters and refineries: Norilsk complex (smelting and refining), Pechenga (smelting), Monchegorsk (smelting and refining), Yuzhnouralnikel complex (smelting and refining).
Platinum Goup Metals	Norilsk complex in East Siberia and on Kola Peninsula, Metal production at Krasnoyarsk refinery in East Siberia.
Steel	Largest Production Plants - Northwest region: Cherepovets plant, Central region: Elektrostal, Lipetsk, Oskol, Tula plants, Volga region: Nizhniy Novgorod, Vyksa, Volgograd plants, Urals region: Chelyabinsk, Chusovoy, Izhevsk, Magnitogorsk, Nizhniy Tagil, Orsko-Khalilovskiy, Serov, Zlatoust plants, West Siberian region: Novokuznetsk, Novosibirsk plants, Far East region: Komsomolsk na Amure plant.
Tin	Mining and beneficiation complexes: Khingan and Solnechnyy in Khabarovsk Kray, Iultin in Magadan Oblast, Khrustalnyy complex in Primorskiy Kray, Deputatskiy complex in Yakut Republic. Smelters: Novosibirsk in West Siberia, Podolsk and Ryazan in European Centre.
Titanium	Metal production: Berezniki plant in Urals, Moscow and Podolsk plants in European Centre.

Sources: Mining Journal: Mining Annual Review, London, 1992 and 1993.
Sutulov, A.: The Soviet Union Challange in Base Nikls, Utah, 1971.

4.3.2. Central Asia

Economic and social indicators place Kazakhstan - and the rest of the Central Asian republics: Kirgizia, Tajikistan, Turkmenistan and Uzbekistan - more in the range of low middle-income developing countries than of industrial reforming economies. According to the World Bank estimates average GDP per capita ranged from USD 1680 for Kazakhstan to USD 490 for Tajikistan (see Table 2). During the early 1990's, the deterioration of their economic performance accelerated rapidly and according to the IMF, the regions' economic growth will continue to be on the minus side in 1994 but compared with the 1993 figure the economic decline will be slower (see Table 3).

The economic situation of the region has been exacerbated by the disruption of its trade relations with the other CIS republics. The reduction in trade is principally a result of the global slowdown in economic activity, but the problems related to non-confidence in the rouble, the deterioration of the inter-republican payment mechanisms and temporarily increased export controls have accelerated this decline. These CIS republics are actively looking for increasing economic and trade relations with the Islamic world, particularly with the western-facing secular Islamic Turkey. Saudi Arabia, Iran and Pakistan have also been active in making overtures to gain a foothold in this vast market and its varied natural resources, particularly metals, natural gas and oil.

The CIS Central Asian republics, and particularly Kazakhstan, have important mining and metallurgical production centres. This immense country - eight times larger than Finland - to the south of Russia and bordered by Uzbekistan, Kirgizia and China, is the second most mineral rich CIS republic. In 1992, Kazakhstan produced the largest part of the CIS total output of mine production of a number of minerals and metals including lead, zinc, chromite and silver, as well as having a significant production of copper, bismuth, ferro-alloys and titanium metal (see figure 4), as well as many other energy and industrial minerals. As in the rest of the CIS countries, minerals and metals production in Kazakhstan has reportedly been decreasing in the early 1990's.

Table 5. Location of Major Mining and Metallurgical Production Centres in Kazakhstan

Mineral-Metal	Location
Aluminium	Turgay and Krasnooktyabr bauxite mining directorates, Pavlodar alumina plant.
Bismuth	By-product of lead-zinc and copper metallurgical processing.
Cadmium	By-product of lead-zinc and copper metallurgical processing.
Chrome	Donskoye mining and beneficiation complex near Khromtau.
Copper	Mining: Balkhash, Dzhezkazgan and Zhezkent mining-beneficiation complexes, East Kazakhstan copper-chemical complex, 50 year October Anniversary Mining Directorate. Smelting and refining: Balkhash, Dzhezkazgan, and Irtysh smelting and refining enterprises.
Ferroalloys	Aktyubinsk, Yermak ferroalloy plants.
Gold	By-product of polymetallic ores.
Iron ore	Sokolov-Sarbayskiy and Lisakovskiy mining-beneficiation complexes.
Lead-zinc	Mining: Achisay, Irtysh, and Leninogorsk polymetallic complexes. Tekeli lead-zinc complex, Zhayrem mining-beneficiation complex, Zyryanov lead complex. Metallurgy: Chimkent, Leninogorsk, and Ust-Kamenogorsk smelting and refining enterprises.
Manganese	Dzhezdinkiy mining directorate.
Silver	By-product of polymetallic ores.
Steel	Karaganda iron and steel mill.
Titanium metal	Ust-Kamenogorsk titanium-magnesium plant.

Sources: Mining Journal: Mining Annual Review, London, 1992 and 1993.

This vast territory does not posses an efficient infrastructure, both in terms of transport and communications. Most beneficiation and smelting plants were developed along existing railways for the transport of metals to the great Russian ports. During the Soviet Union system, smelting plants in Kazakhstan did not need to look for foreign markets, as its main role was to supply metals to the Russian industry. At present, the large copper and lead enterprises are important hard currency earners with exports to Western European markets. Domestic industry capability is so limited that there are virtually only few other goods, in addition to minerals, that can earn hard currency.

After the Soviet Union collapse, the Kazakstan metals trade degenerated to a chaotic situation, but measures are being applied to put sales in the hands of the government. In 1991, a consortium named Kazalmazzoloto was formed to handle all the marketable gold, silver and diamonds produced in Kazakhstan.

The ferro-alloys and chrome industry has also formed a new organization to "promote and defend its interests internationally" called the International Chromium Committee of Kazakhstan. Western markets have been blaming the Kazakhstan chrome and ferro-alloy industry for the weak market situation (41). The Government in Kazakhstan is making clear efforts to move towards a market system and encouragement of foreign investment. Western investors' operations are progressing very slowly although the government promotes itself as stable and peaceful.

Uzbekistan is the third most populous republic of the CIS, and the fifth largest in land area (see Table 2) After Kazakstan, it is the second richest CIS Central Asian republic with regard to the value of its mineral production. Gold is the basis of the mining sector of this country, which produces around one fourth of the CIS' total gold output. The Muruntau open-pit mine and complex is considered to produce 80 tonnes of gold annually, comparable with the largest South African mines. Uzbekistan is planning to double gold extraction in the near future (42). The non-ferrous mining industry includes exploitation of bismuth, copper, lead and zinc.

The Uzbek Government has developed a programme to attract foreign investment in order to expand and modernize its gold production sector. The interest of Western enterprises has been significantly more active in comparison to other mining operations in the CIS republics.

Table 6. Location of Major Mining and Metallurgical Production Centres in Uzbekistan

Mineral-Metal	Location
Copper	Almalyk mining and metallurgical complex.
Gold	Muruntau complex.
Silver	Kyzylkum district.
Lead-zinc	Almalyk metallurgical complex.
Steel	Uzbek steel works in Bekabad.

Sources: Mining Journal: Mining Annual Review, London, 1992 and 1993.

Tajikistan possesses a variety of non-energy minerals. Non-ferrous mining is the most important and includes lead and zinc production centres, as well as the large Tajik aluminium plant with a production capacity of 500,000 tonnes per year. Tajikistan also produces rare and precious metals. Bismuth and antimony have been mined there for half a century. The Government of Tajikistan has emphasized that the main prospects for development lay in developing the mining of precious and non-ferrous metals.

Table 7. Location of Major Mining and Metallurgical Production Centres in Tajikistan

Mineral-Metal	Location
Aluminium	Tajik (Regar) aluminium plant.
Antimony	Dzhidzhikrutsky complex.
Bismuth	Bismuth ore mining in the Chatkal mountains, By-product of polymetallic ores.
Cadmium	By-product of Kansay lead-zinc mining centre.
Gold	Darvaza placer mining district.
Lead-zinc	Altyn-Topkan, Kansay, and Kurusay mining complexes.
Tungsten	Chorukh-Dayron, Maykhura deposits.

Sources: Mining Journal: Mining Annual Review, London, 1992.

Kirgizia produced 55 per cent of the Soviet Union mercury output and 10 per cent of the antimony, mainly from imported ores from Russia. This country is also expanding its gold mining sector. Kirgizia also produces small quantities of tin and tungsten. Economic policy reform has been more rapid than in the other Central Asian republics.

4.3.3. The Ukraine

The Ukraine, the second most populous republic of the CIS, is suffering from a significant deterioration in its economy. The GDP fell by 17 per cent in 1993 in comparison with 1992 and estimates made by the IMF forecast a still worse situation for 1994 with a further real GDP fall of 18 per cent (43). The Ukraine does not have a significant production of oil and gas, being dependent on imports of energy from Russia. Its industry has been strongly tied to the heavy and defence production sectors, even before the first world war when the Ukraine was considered as a central part of Soviet Union industry. Large steel production plants were located around the iron, manganese and coal deposits of the republic.

Table 8. Location of Major Mining and Metallurgical Production Centres in the Ukraine

Mineral-Metal	Location
Aluminium	Dneprovsk, Nithe The Kolayevsk alumina plants, Dneprovsk aluminium plant,
Antimony	Nikitovskiy complex,
Ferro-alloys	Nikopol, Zaporozhye plants.
Iron ore manganese	Krivoy Rog Basin.
Nickel	Pobuzhskoye deposit, Pobuzhsky nickel plant.
Steel	Azov, Dneprodzerzhinsk, Dnepropetrovsk (electric furnace and open hearth-oxygen converter plants), Donetsk, Kommunarsk, Krivoy Rog, Makeyevka, Mariupol, Zaporozhye plants.
Titanium	Kharkov, Zaporozhye plants.

Sources: Mining Journal: Mining Annual Review, London, 1992.

During the 1990's, a serious decrease in minerals and metals production has been reported owing to energy shortages and scarcity of raw materials. Steel production in 1993 fell by around one fifth to 30.5million tonnes in comparison with 1992 (44). It is the CIS main manganese source of the CIS and production of this important element for the steel industry is likely to continue, although in 1992 output fell by 12 per cent. Iron and steel production plants are located in the Krivoy Rog Basin, west of the Dnieper, while manganese and ferro-alloys are located in Nikopol, to the east of the country. The Krivoy Rog steel plant is the third largest in the CIS and two more Ukrainian steel plants are among the ten largest.

The Dneprovsk alumina refinery located in the city of Nikolayev was one of the most modern of the Soviet Union, with a capacity of 1 million tonnes of alumina production, one of the largest in the world. It operated with imported bauxite from Guinea and planned to supply the aluminium plants in Tajikistan and Sayanogorsk in Russia. The second alumina-aluminium plant is located at Zaphorozhye, and also operates with imported bauxite from Hungary and Greece.

The reform of the mining industry in the Ukraine is being hindered by difficulties in implementing political understanding between the diverse political parties and movements. Economic and political disarray could cause the Ukraine to accept increasing concessions to Russia in return for cheaper energy supply.

4.3.4. Transcaucasia

Of the three Transcaucasian republics, Georgia and Armenia have a relatively large mining sector, particularly in manganese, copper, molybdenum, lead and zinc. Georgia is a major producer of manganese from its Chiatura mines, which supplies the Zestafony ferro-alloy plant. During the centrally planned Soviet Union system, Georgia supplied Russia with copper, lead, zinc and gold minerals. The Government has made some efforts to develop its own metallurgical processing in order to achieve added value from their minerals. Foreign investment was being sought for this purpose, but the unstable situation there is impeding progress in this direction. Georgia is greatly dependent on foreign supplies of energy resources, satisfying only 15 per cent of its own needs.

The major mining centres in Armenia are primarily engaged in the production of copper, molybdenum and gold. Armenia had an important metallurgical industry which was partly shut down in the late 1980's for environmental reasons. The republic has been dependent on imported energy minerals, although its geostructure - their neighbors are Azerbaijan, Iran and Turkey - provides some reason to suspect the existence of oil in the Armenian area. The Armenian mining sector has, as has the whole economy, been suffering from severe energy

shortages, since it was subjected to a blockade of gas and oil produced in or passing through the Azerbaijan territory.

Unlike the other two Transcaucasian republics, Azerbaijan has been an important oil and gas producer. It also produces aluminium and alumina, based on alunite raw materials. The alumina from Gyandshinsky is shipped to the Sumgait aluminium plant in Azerbaijan, which has reportedly been operating at half capacity since 1992 due to environmental problems (45).

Azerabaijan has a programme to attract foreign investment to participate in the renovation of its metallurgical plants. In general, the Transcaucasian metal industry has been particularly problematic regarding environmental issues. It seems to be very difficult for the output of concentrates and metals to reach the levels of production of the Soviet Union period, at least until they have solved the already grave pollution problems of the region.

Although Azerbaijan is blessed with a rich variety of natural resources, such as oil, and other minerals, its economy and prospects for progress are being ruined by the old dispute over Nagorno-Karakbakh. From a broader perspective, this conflict is only one of the compelling illustrations of the inter-ethnic and political violence that could sink the CIS republics progress.

Table 9. Location of Major Mining and Metallurgical Production Centres in the Transcaucasian republics

Mineral-Metal	Location
	Armenia
Copper	Mines: Zangezur copper-molybdenum complex (mines Kadzharanskoye deposit), Agaraksky copper-molybdenum complex, Kafanskiy Mining Directorate, Shamlugsky Mining Directorate, Akhtalsky Mining Directorate.
Gold	Zod mining complex.
	Azerbaijan
Aluminium	Zaglinsky alunite mining directorate (mines non-bauxite aluminium ore), Gyandzhinsky alumina complex, Sumgait aluminium plant.
Copper-molybdenum	Paragachayskoye copper-molybdenum deposit.
Iron ore	Dashkesansky mining-beneficiation complex.
Lead-zinc	Gyumyshlugskoye and Agdanrinskoye deposits.
	Georgia
Copper	Madneuli deposit.
Ferroalloys	Zestafoni plant.
Lead-zinc	Kvaisi, Madneuli deposits.
Manganese	Chiatura basin.
Steel	Rustavi steel works.

Sources: Mining Journal: Mining Annual Review, London, 1992 and 1993.

5. CIS METAL PRODUCTION IN THE WORLD CONTEXT

In 1984, the Soviet Union ranked first worldwide in mine production of nickel, mercury, iron and manganese as well as in the metal production of nickel, cadmium and steel. In 1993, steel production in the CIS had slumped from a traditional one quarter of the world output, when the Soviet Union was the world's largest producer, to a mere 13 per cent. Mine and metal production of several metals decreased in 1992 and 1993 to levels that had not been seen for 15 to 20 years. Table 10 show the development of minerals and metals production in the Soviet Union/CIS in the years 1984 and 1992/1993, their percentage of the total world production and their respective ranking in the world. With the exception of nickel, mercury and manganese ore production - the largest part being produced in the Ukraine - the CIS has lost its leading position in the world. However, the CIS' share is still very large in most minerals.

Official data on production and consumption of minerals and metals is only partially delivered to external use outside the enterprises and in some cases it is contradictory or remains in practice as a state secret of the republics of the Commonwealth. Unlike the Soviet Union period there are no more secrecy laws regarding relevant information on this matter. It seems, however, that lack of detailed statistics is not the result of a deliberate policy but simply because the whole question is not considered to be seriously needed. Although the mechanisms to implement economic and political transparency in the CIS countries are being rapidly expanded, data on mineral and metal production, consumption, trade and reserves remains mostly as an unofficial estimate elaborated by local and international institutions.

In 1992, some important publications related to the international mining industry have reassessed statistics on metal production of the Soviet Union/CIS, (Metallgesellschaft, Commodities Research Unit, Lead and Zinc Study Group). According to them and in the light of information so far available on past trends in the Soviet Union and current levels of mine and metal production in the CIS, figures on metals production and consumption are considerably lower than those formerly estimated in the West. This is particularly true in the cases of lead and zinc and probably copper and some minor metals. Revised figures consider that lead mine production has been less than half the yearly average of 500 000 tonnes estimated by western institutions during the 1980's and the first two years of the 1990's. Zinc mine production could be less than two-thirds to 40 per cent of the previously estimated nearly one million tonnes (Metallgesellshaft). New estimates suggest that in spite of a strong policy of self-sufficiency for the centrally planned economy, the Soviet Union was not self-sufficient in mine production of copper, zinc, lead or tin.

Table 10. Production of Metals and Minerals in the Soviet Union (1984) and the CIS (1992/1993)

Metal/Mineral (1000 metric t)	Metal/Ore Production		Percentage of total world		Ranking in the world	
	1984	1992/1993	1984	1992/1993	1984	1992/1993
Copper	1 260	875	13.3	8.1	2	4
Zinc*	750	433	11.9	6.1	2	4
Lead*	575	342	11.1	6.4	4	5
Aluminium	3 200	3 220	18.9	16.6	2	2
Tin	18.5	13	8.3	6.8	5	6
Nickel*	193	190	25.4	23.3	1	1
Antimony	9.3	8.5	12.9	10.6	2	2
Cadmium	1.9	1.3	9.8	6.7	1	3
Magnesium	85	80	25.8	24.4	2	2
Silver	1.3	1	9.8	7.2	5	7
Mercury	1.2	1.2	21.6	34.2	1	1
Gold (t)	269	302	18.8	14.4	2	2
Platinium (t)	115	125	52.5	43.6	2	2
Cobalt	2.6	2.4	8.4	9.9	3	3
Iron ore* (million t)	247	154	28.8	16.4	1	3
Crude steel* (million t)	154	96	21.7	13.2	1	2
Chrome ore (million t)	3	3.8	31.6	29.7	2	2
Manganese ore (million t)	10	6.5	41.7	31.4	1	1
Molybdenium	11.2	11	11.8	9.8	3	4
Vanadium ore	9.5	9.5	28.5	27.9	2	2
Tungsten ore*	10	5.7	18	8.8	2	2
Titanium ore	440	430	10.9	10.7	4	4

* 1993 figures

Sources: Metallgesellschaft: Metal Statistics, 1982 - 1992, Frankfurt 1993; UNCTAD: Commodity Yearbook, 1994; Metal Bulletin Monthly, 1994; Mining Journal: Mining Annual Review, 1993; International Lead and Zinc Study Group, ILZSG, July 1994; UNCTAD: Tungsten Statistics, July 1994; UNCTAD: Bauxite, Alumina and Aluminium Statistics, 1987 - 1993, April 1994.

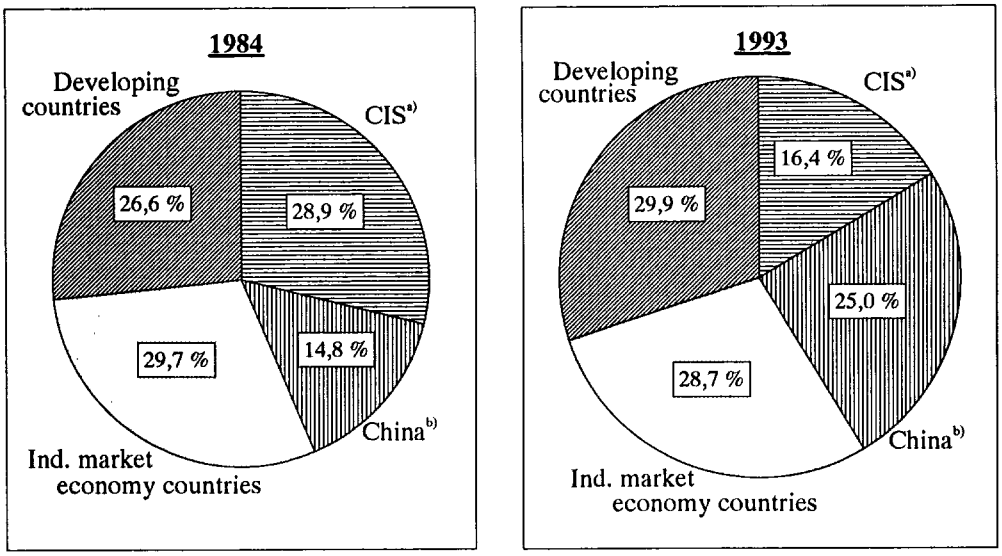
The revised production cut backs have been far from proportional among the various metals and minerals. However, in the case of non-ferrous output figures have been revised downwards. Estimates of production during the 1970's and the first half of the 1980's may reflect what are believed to have been plant capacities rather than actual output.

5.1. Iron ore

After five consecutive years of decline, iron ore production in the CIS area reached its lowest level of 155 million tonnes in 1993, compared to 247 million tonnes in 1984. For the first time in decades, the CIS lost its position as the world's largest iron ore producer (in natural weight of ores) to China in 1992 and Brazil in 1993 (see Table 11).

Table 11. World Iron Ore Production 1984 and 1991 - 1993 (million tonnes)

Country/Area	1984	1991	1992	1993
Eastern Europe				
FSU/CIS	247	199	175	155
Russian Federation	..	91	82	76
Ukraine	..	87	..	..
Kazakhstan	..	..	..	13
China	122	175	196	235
Ind. market ec. countries	260	281	268	270
Developing countries	231	282	268	282
Brazil	92	151	146	159
World	875	950	918	942



a) includes other Eastern European countries

b) includes the Dem. People's Republic of Korea

Sources: UNCTAD: TD/B/C.1/Iron ore/7, Rev. 1; Iron ore statistics 1981 - 1990, 17 December 1991; UNCTAD: TD/B/CN.1/Iron ore/12; Review of Iron ore Statistics 1986 - 1993, 2 August 1994

Iron ore production is being affected mainly by the inefficient supply of raw materials between the CIS republics; a fact that has resulted in the stoppage of several blast furnaces and the abrupt fall in iron ore domestic consumption in the 1991-1994 period.

In the 1980's, annual iron ore production in the Soviet Union amounted to around 250 million tonnes from its more than one hundred underground and open-pit mines. The largest producer was the Ukraine with 55-60 per cent of the Soviet Union total production. About 95 per cent of this ore was produced in the Krivoi Rog region, where it was estimated that half of this production was high grade hematites assaying 55 per cent iron for direct shipments. The other half was obtained by concentration of low grade ores.

The second largest producer was the Russian Federation. Most of the ores were high grade type from Kurski Magnetic Anomaly, Western Siberia and the Kola Peninsula. The third in importance was Kazakhstan with its usable ore from the Atasu mines in Karaganda and the Sokolevski-Sarbai mines near Kustanay.

The fast expansion of the steel industry in the Soviet Union led to a gradual depletion of high ore grades and increased requirements of ore beneficiation. At present, the Russian Federation is the largest CIS producer followed by the Ukraine and Kazakhstan. However, most ores are low grade and about 80 per cent have to be concentrated at high cost with outdated technology. Nearly 15 per cent of the mines are underground and extraction costs are consequently also high. Many mines have been operating for a long time and have low productivity.

The Ukrainian government has drawn up a programme to restructure its iron ore industry by promoting the Krivoi Rog metallurgical complex as a potential world supplier of iron ore, particularly to the West European markets. Iron ore exports from the Ukraine amounted to 14-15 million tonnes in 1993, clearly less than the previous years. Problems in shipment through the former Yugoslavia have contributed to the drop in tonnage. However, the main problems are structural. The iron ore mining enterprises in the Ukraine are operating at less than two thirds of their concentration capacity of nearly 70 million tonnes annually. In order to make the Krivoi Rog iron ores commercially attractive two main problems have to be solved: the need to improve the quality of the ore by lowering the silica content, and the need to establish efficient transportation links (46). In the near future, the cost of shipping via the Danube could be reduced when the river port of Ismail increases its capacity.

In the beginning of 1994, an agreement was signed between Russian steel producers and Kazakhstan to ensure supplies of iron ore to steelplants in both countries. The agreement proposes joint Russian-Kazakhstan finance for the Sokolovsko-Sarbainsky iron ore mine in the Kazakhstan northern region of Kustanay. Production of iron ore in the old mines has slumped to half of the 20 million tonnes from the Sarbainsky mine and from 10 to 3 million tonnes in the Sokolovsko mine. The richest Kacharsky mine has an estimated volume of 1 billion tonnes of iron reserves, but are located 160 meters underground. The agreement emphasizes the importance of maintaining a Russian market for Kazakhstan mineral raw materials which would be too costly to ship to western markets. From the Russian perspective, the agreement can be seen in the context of a global policy to reverse the decline in the whole industrial production.

The CIS iron ore industry is slowly being modernized. Some new equipment has been introduced to increase the productivity of the concentration plants, However, very large investments are required to improve the performance, efficiency and transportation in the CIS iron ore sector. Some positive results have been obtained with improvements of ore dressing techniques, which makes it possible to produce high quality concentrates. The volumes of CIS iron ore exports in 1992 remained at the same level as in 1991, and even increased in 1993 by nearly 10 per cent from 27 to 30 million tonnes (47). The CIS supplied

90 per cent of the needs of the Eastern European markets, which are greatly dependent on iron ore imports.

Efforts to better integrate the iron industry with the needs of the CIS economy and to improve its international competitiveness in terms of iron content, variety and types of products, handling and delivery conditions are a continuing matter of concern for the relevant officials (48). In 1993 and 1994, measures to facilitate the creation of joint ventures with foreign companies to develop iron (and other minerals) resources and to remove market constraints and administrative obstacles were also adopted. However, the restructuring of the iron ore and steel industry in the CIS is far from completion. While the under-utilized and inefficient capacity tends to disappear, iron ore supply and demand will be reduced much further in the region. In terms of iron resources quality, volume and mine capacity, South Africa, India, but particularly Australia and Brazil are the most important producers and exporters. The CIS iron ore production will not recover its pre-transition level during the 1994-2000 period.

5.2. Steel industry

Steel production in Russia grew very rapidly in the first decades of this century as a result of a strong expansion of the heavy industry and the infra-structure. The construction of railroads and equipment, defence systems, ship building, the development of machinery for industrial and agricultural uses, together provided an enormous impulse for the development of the steel industry. After the Second World War, along with the quantity of steel, development of steel production methods and the diversification of steel quality became the crucial objectives of the Five Year Plans beginning in 1946.

The Sixth Five Year Plan (1956-1960) was programmed as a great qualitative and quantitative leap forward. The government wanted to prepare the country for a decisive step to seize supremacy in world metal production from the United States. However, the plan proved to be too ambitious because it was based on production growth rates beyond the existing resources in the Soviet Union (49).

By that time the two basic principles of mineral economics were apparently realized. First, that the possibilities for expansion of the metal sector on the basis of potential or even undiscovered resources were unrealistic, and second, that new investments and construction of new plants were absolutely necessary to make drastic changes in the quality and quantity of production. These two principles are now completely valid in the present circumstances of the mining industry of the CIS.

In the 1970's, the Soviet Union economy was the second largest in the world and far ahead of Japan, Germany or Great Britain. In 1971, for the first time, a previously unreached objective of the revolution and an idée fixe of the Soviet Union planners was accomplished: Soviet Union crude steel output amounted to 121 million tonnes compared with the112 million tonnes produced in the United States.

In that year, the Soviet Union had 317 iron and steel enterprises, over 120 mines, half of which were open-cast, 76 steel plants and more than 100 plants for special steels. The enormous industry employed more than one million workers and 200 000 engineers and technicians (50). At that time a very ambitious economic programme was set for the next twenty years and it was claimed that not only the metal sector but the whole industry had to be developed as the "most powerful in the world" (51). It is difficult to understand, for example, the rationale that steel production in the Soviet Union was clearly higher than in the United States, even though its economy was around one tenth the size. The only conceivable reason for producing so much steel is the oversized military-industrial complex and associated civilian heavy industries.

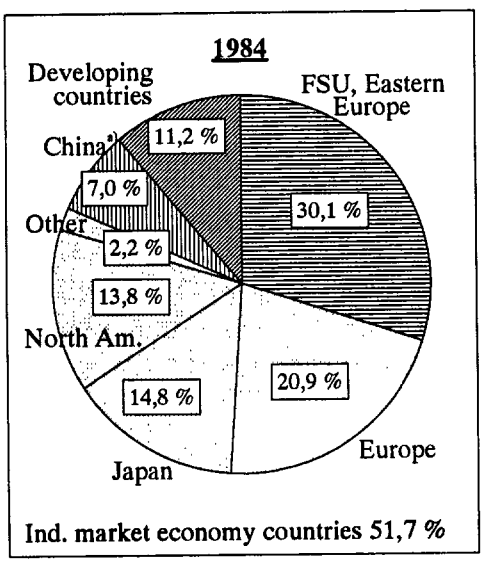
Two decades later, the centrally planned economy system has collapsed, However, goals for metal output levels, at least in the steel industry seem to remain the same as before 1993, when a national plan was approved to upgrade and streamline Russia's ferrous and non-ferrous industries. Prior to the introduction of that plan, governmental policy which aimed for a continuous expansion of the mining industry, led to the fact that capital investments were mainly directed to increase the volume of production by maintaining old mines and metallurgical plants in operation at any cost. Even today, some local officials consider reduction of uneconomic steel output as a calamity (52).

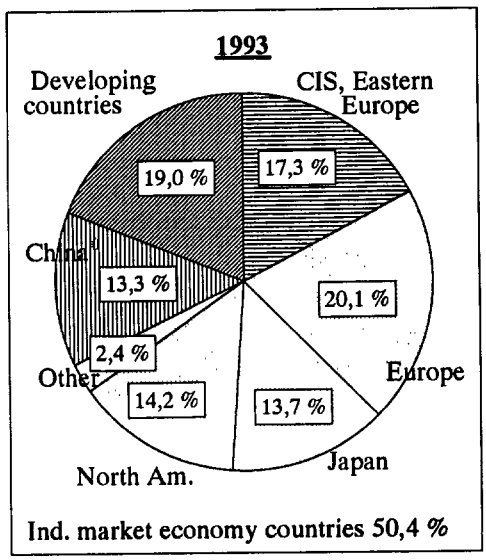
Parallel to the deterioration of the CIS economy, steel production has been falling sharply. During the last six years the level of steel produced in the region decreased by 42 per cent and in 1993 alone it declined by 16%. The countries of the CIS remained the world's largest crude steel producing area until 1992 with a production of 112.6 million tonnes. In 1993 Japan ranked first with an output of 99,6 million tonnes with the CIS at 95,7 million tonnes (see Table 12).

In terms of capacity size of production the region remains extremely important as the biggest in the world. Before the end of the centrally planned system, the Soviet Union's annual steel output of 163 million tonnes in 1988 represented nearly one half more than that of the United States and one third more than the production of Japan.

Table 12. World Steel Production 1984 and 1992 - 1993 (million tonnes)

Country/Area	1984	1992	1993
FSU/CIS	154.2	116.8	95.7
Belarus	..	0.8	0.8
Kazakhstan	..	5.7	4.2
Russia	..	67	58.2
Ukraine	..	38.4	30.5
Uzbekistan	..	0.6	0.6
Azerbaijan	..	0.4	0.2
Georgia	..	0.5	0.2
Moldova	..	0.6	0.6
Ind. market ec. countries	367.2	357.6	365.7
- European Union	134.5	132.2	132.5
- Japan	105.6	98.1	99.6
- United States	83.9	84.3	88.8
China	43.5	80	89.5
Developing countries	79.8	107.6	117.5





a) includes the Dem. People's Republic of Korea.

Sources: UNCTAD: TD/B/C.1/Iron ore/7, Rev. 1; Iron ore statistics 1981 - 1990, 17 December 1991; UNCTAD: TD/B/CN.1/Iron ore/12; Review of Iron ore Statistics 1986 - 1993, 2 August 1994.

Production decline has not stopped. A number of western observers predict further falls are to be expected as increasing openness to market forces exposes the technological and economic uncompetitiveness of many steel plants in the Soviet Union (53). The problems faced in the area had been mainly due to rising costs of energy and, as in the case of iron production, the distribution of raw materials and scrap inside the CIS republics. Equally important problems demanding solutions are a massive excess of production capacity, a large excess of workforce, obsolete and greatly polluting plants, declining demand and an oversupplied international market. Moreover, the management of the CIS mining and metal industries is not familiar with the free market system and the process of price formation according to the game rules of their western competitors.

In January 1993, an arrangement for the steel industry of the CIS was approved by the Russian Federation, the Ukraine and Kazahkstan. The plan makes possible the duty-free trade in metallurgical products and steel-related commodities between these three countries. The objective of the negotiations is to establish an organization among CIS members similar to the Western European steel community. Some measures are slowly being implemented with the aim of organizing the internal distribution system for steel, iron ore and other related raw materials, and to facilitate the administrative and financial arrangements among the CIS steel and iron producing countries.

Russia is markedly dependent on the Ukraine for coke and pipes and on Kazakhstan for iron and chrome ores. The major problems for implementing the 1993 arrangement has been the lack of investment and the insolvency of the mills involved. The restructuring of the iron and steel industry in these three countries still has a very complex and long way to go. However, regardless of the effectiveness of their policies, the CIS will continue to influence the world steel market on both the supply and demand side, in both the long and short term perspectives.

The Russian steel industry is the biggest of the CIS. Russian plants directly involved in production represented 60 per cent of the CIS steel output in 1993 (See Table 12). Around one million people are employed in the sector. According to the International Iron and Steel Institute (IISI), 139 joint stock steel companies were registered in Russia on September 1993. New policies will result in the privatisation of 90 per cent of enterprises operating in the steel industry. In 60 per cent of the already privatised enterprises, the main shareholders are the workers. There are also other large enterprises such as Magnitogorsk, Lipetzk and Cherepovets, where the privatisation process has also begun, although workers` groups may not be the main shareholders. The State plans to influence the operations of the new joint stock companies by remaining a shareholder or by controling the issuing of the shares for a period of at least three years.

The Russian Federation Committee for Metallurgy has drawn up a national plan to reorganise national ferrous and non-ferrous industries, under the title of "The National Programme for the Technical Rehabilitation and Development of the Metallurgical Industry of Russia". The seven years programme was submitted to the government in mid-1993 and first estimates were as high as USD 12 billion in terms of financing needs for modernization projects, over the period 1993-2000. The initial plan considered the following sources of financing: the enterprises' own funding, 80 per cent; users of the products, commercial institutions and foreign investors, 12 per cent; government support, 8 per cent (54).

According to revised but still very ambitious estimates, Russia plans to spend around USD 10.6 billion in modernising its metallurgical sector, both ferrous and non-ferrous. The new figures for the programme have been approved by the government and provides for 70 per cent of the finance to come from the industry itself, 7 per cent from the government and a further 23 per cent from private and foreign investment (55).

The government estimates that USD 7,4 billion of the new investment is needed by the Russian steel industry for restructuring: mainly to replace old fashioned open hearth steel production with oxygen and electric processes and to introduce a gradual increase in the use of continous casting to around 70 per cent of the total steel output by the year 2000 (56). At present almost half of the Russian steel is produced in open hearth furnaces; and although continuous casting was a Soviet Union metallurgy innovation, only one fifth of rolled steel products is, in fact, produced by this technology.

The purpose of the plan is to solve the following major problems:

- the expansion of the domestic raw materials base,
- an improvement in the quality of products and their competitiveness,
- the reduction of material and energy expenditures,
- the improvement of the ecology,
- to maintain a rational level of employment to ensure social stability at enterprise level.

The programme suggests that only 15 per cent of Russian steel producers are competitive in the international market and that practically 85 per cent of the steel mills were bankrupt by the end of 1993, bolstered only by soft loans from the Russian state. However, as a result of the continuing economic recession, termination of the subsidies has been necessary and has almost finished hopes for the promised financial aid from the government.

The Metallurgy Committee plans to raise about USD 10,5 billion in metal export revenues for the programme over the next seven years. This means that one third of current exports value will be absorbed by the programme. In 1993 Russian metal export earnings were around USD 4 billion. The plan also considers the redundancy of 140.000 jobs in the steel sector alone by the year 2000, mostly before 1996. The targets to reduce environmental pollution, which are included in the plan, are very modest.

Export capacity and competitiveness

The export capacity of the Russian steel industry in a free market is determined by the balance of production cost and the export price of its products and by their quality and diversity. According to the Russian Federation Committee for Metallurgy (57) the following products are competitive: electrical steels, ships' plates and reinforcing bars, alloyed profile sections and semi-finished products. High consumption of raw materials, rising energy and transport costs, as well as an increase in labour costs are, however, making most of the steel produced in the CIS less competitive than western products.

Recent studies (58) indicate that a tonne of Russian steel requires 20 per cent more raw materials, 30 per cent more energy and five times the number of workers than a tonne of steel produced in the United States. Compared with other big crude steel producers, the costs share of raw materials and energy is much higher in Russia (91 per cent) than in Japan (54 per cent) or Western Europe (60 per cent). The markedly lower wage levels, represent 6 per cent of the labour costs compared with 28 per cent in the United States. Transport costs can vary from USD 6 per tonne in the north-west part of Russia to USD 30-35 per tonne in the east coast ports.

Comparing the combined hourly wages and raw materials costs with the prices paid in the industrialized market economy countries, CIS steel manufacturing costs systematically exceed the price levels of the world market. This situation is aggravated by the fact that prices paid for CIS steel are on average about 5-10 per cent, or even 20 per cent in the case of the Ukraine or Kazakhstan, below Western European or Latin American prices for steel products.

Official figures published in government newspapers (59) indicate that the Russian steel industry is losing USD 3,5 to 4 billion annually, because the industry's operating capacity is underutilized (see Table 13). In 1992, the operating rate was 65 per cent of the total steel production capacity of Russia and only 50 per cent is projected for 1994.

Table 13. Capacity Utilization of the Russian Iron and Steel Industry, 1993

Product	Capacity (million tones)	Output (million tones)	Capacity utilization (percentage)
Iron ore	103	76	74
Steel	94	58	62
Finished rolled products	67	43	64

Source: IISI, The Iron and Steel Industry in Russia, October 1993.

The only real solution to the problems of the CIS steel industry would be a massive investment in the sector. However, it is very difficult to see where the money will come from. Despite the sector's large potential export capacity - both ferrous and non-ferrous - enterprises are highly in debt. In February 1994, authorities of the Metallurgy Commitee of the Russian Federation calculated that domestic users owed near USD 2 billion to the enterprises, while their own debt was the equivalent of around USD 2,5 billion, mostly as a result of the increase in raw materials, energy and transport costs.

One of the few steel enterprises in Russia that has been making some progress in its modernization project is Magnitogorsk, the world's largest single steel plant, which had the capacity to produce 16 million tonnes of crude steel annually and is now producing less than 10 million tonnes (see Table 14). The cost of the first three-stage project has been estimated at USD 600 million, to be financed by share issues to form a joint stock company. Magnitogorsk is one of the several CIS steel plants which are actively seeking funds to finance development projects (60). After the government's decree releasing Russian enterprises from having to sell 50 per cent of their foreign currency to state banks, possibilities for success in their financial commitments have been increased. Magnitogorsk is a crucial challenge for the Russian and the whole CIS steel industry to become strong factors of influence in the world market. If Magnitogorsk succeeds, it will be more an exception than the rule because the Russian, Ukrainian or Kazakhstan steel enterprises do not have the funds or the necessary technical and financial conditions for international credit. Large steel works throughout the Soviet Union are searching for funds to finance expensive development projects.

In terms of production, the Ukrainian steel industry is performing even worse than Russia; crude steel output volume in 1992 declined by more than 20 per cent in 1993; and in the first quarter of 1994 by 36 per cent. Only Kazakhstan, of the CIS important steel making countries, is doing even worse. The Ukrainian steel industry's present decline is the mainly the result of the national energy problem.

Crude oil supplies for the industry in general is a crucial factor in the Ukraine. The government has failed to establish any credit system to pay for gas and oil imports from Russia and temporary cuts are a continuous threat. The fall of industrial production, around 35 per cent in 1994, an annual inflation of 9000 per cent and an unstable social climate, have together strongly hit the steel and base metals industry.

Table 14. The Largest Steel Plants of the CIS,1992 - 1993 (million tonnes crude steel)

		1 992		1 993	
		Ranking in the world	Output	Ranking in the world	Output
Magnitogorsk	Russia	5	11.92	9	9.90
Cherepovets	Russia	11	9.89	14	8.51
Krivoy Rog	Ukraine	16	8.34	22	6.39
Novolipetsk	Russia	19	7.19	24	5.87
Nizhny Tagii	Russia	23	5.88	29	5.29
West Siberian	Russia	39	4.26	32	4.78
Chelyabinsk	Russia	31	5.11	33	4.57
Mariupol	Ukraine	28	5.42	35	4.51
Karaganda	Kazakhstan	26	5.68	38	4.28
Azovstal	Ukraine	29	5.25	52	3.49

Source: Based on Metal Bulletin data, 21 February 1994

The present problems in the Ukrainian steel industry have their origins in the Soviet Union centrally planned system; it was never intended to satisfy domestic demand. Steel plants made products for the defence industry and are now mostly dependent on sales to the other CIS republics. However, decline of demand in the area has caused the loss of a large part of its traditional markets. Steel plants with easy access to the Black Sea are seeking exports to the western markets and for the other mills it is imperative to solve internal energy and transport problems. The short-term prospects for a large number of steel plants in the Ukraine, around 50 per cent of the present capacity, is bankruptcy. This situation requires a structural reform of the metal industry, which is characteristically one of the most conservative of the CIS countries and where only a little more than 10 per cent of the industrial enterprises have been privatised. Foreign investment will have to wait for greater confidence in the political and economic system.

5.3. Aluminium industry

International organizations and metal traders are increasingly accepting that they have underestimated the Russian ability to maintain the high production levels of its aluminium industry. Already in the beginning of 1992, traders and specialists considered that the Russian and the CIS aluminium industry would collapse, mostly due to shortages of raw materials, by the end of the same year. However, CIS smelters produced around 3,2 million tonnes of aluminium, not too far from the industry's capacity of 4 million tonnes annually. Most of this capacity is located in Russia (3,3 million tonnes), with Tajikistan, the Ukraine and Azerbaijan accounting for the rest. Amongst the CIS aluminium plants are the four largest in the world; the Bratsk, (1 million tonnes/year), Kraznoyarsk (800.000 tonnes/year) and Sayanogorsk (500.000 tonnes/year) in Siberia; and Tursunzade (500.000 tonnes/year) in Tajikistan.

The aluminium industry of the Soviet Union reflects in a clear form the achievements and the errors of the Soviet Union mining industry in general. On the one hand, a very rapid growth of production volumes was achieved, for example, from 850.000 tonnes of aluminium in 1962 to 3,5 million tonnes in 1989. On the other hand, however, an overplanning of goals with their consequent unfulfillment and poor coordination of projects was more the rule than the exception. Aluminium smelters were built before electric power plants or alumina plants, the efficiency of the production process was low and disregard for production costs and poorly designed transport were some of the typical characteristics of that period. The problems of the CIS aluminium industry have their origin in such policies and are being aggravated by the scarcity of raw materials, particularly of bauxite, alumina and electric power and especially since smelters and refineries do not conform with basic environmental regulations.

Table 15. CIS Aluminium Smelters Capacity*

Operation/location	Capacity (1 000 metric tonnes per year)	
Azerbaijan	**60**	
Sumgait		Opened 1954, uses alumina from Sumgait refinery, conversion planned, closed down in 1992 due to transportation difficulties
Russian Federation	**3 300**	
Bogoslovsk, Ekaterinburg region	150	Opened 1945, uses alumina from Bogoslovsk refinery
Bratsk, Siberia	1 000	Opened 1966, uses alumina from Kazakhstan refineries and imports from elsewhere
Irkutsk, Siberia	275	Opened 1962, uses alumina from Kazakhstan refineries modernization programme under-way
Kamensk, Ekaterinburg region	100	Opened 1939, uses alumina from Kamensk refinery
Krasnoyarsk, Siberia	800	Opened 1964, uses alumina from Achinsk refinery and imports from elsewhere, modernization programme under-way
Nadvoitsky, Karelia	70	Opened 1954, uses alumina from Kandalaksha refinery, modernization planned
Novokuznetsk, western Siberia	200	Opened 1943, uses alumina from Novokuznetsk refinery
Sayanagorsk, Krasnoyarsk region, Siberia	520	Opened 1985, expanded gradually
Volgograd (Tsaritsyn)	135	Opened 1958, uses alumina from Hungary and Nikolaev refinery
Volkhov, St. Petersburg region	20	Opened 1932, rebuilt after World War II, uses alumina from Volkhov refinery
Tajikistan	**520**	Opened 1975, uses alumina from Nikolaev, operated at reduced capacity end 1992
Regar, Tursungade		
Ukraine	**120**	Opened 1934, rebuilt 1949, uses alumina from Zaporoshye refinery and from Hungary
Zaporoshye		
Total	**4 000**	

* Note: Smelting capacity in this table is based on estimates and cannot be considered as variable as the corresponding data concerning the rest of the world.

Sources: UNCTAD: TD/B/C:N:1/RM/Bauxite/2. Market situation and outlook for bauxite, alumina and aluminium, 2 March 1993.
Mining Journal: Metals and Minerals, Annual Review, 1992.

Bauxite and Alumina

Plans and efforts to achieve self-sufficiency in bauxite supply have failed in the Soviet Union. CIS aluminium smelters use alunite and nepheline as well as bauxite. The Soviet Union has been traditionally the second largest importer of bauxite in the world, after the United States. The main sources of supply were Yugoslavia, Hungary and Guinea. At present CIS bauxite imports are also coming from such distant countries as Australia, Brazil and Jamaica.

Bauxite will have to be imported in order to continue aluminium production operations on the present scale. This dependency on foreign raw materials will also affect the refineries' development programmes in the medium-term perspective. Russia has potential deposits of high quality bauxite, particularly in the northern Ural region of Ekaterinaburg (Sverdlovsk) where production could possibly be expanded to replace the exploitation of non-bauxite and low-grade bauxite deposits in the country. According to specialists in the Urals, high quality bauxite deposits of 53-55 per cent alumina, represent huge reserves of 460 million tonnes (61). Many of these deposits, however, can be exploited only through expensive underground mining methods. Existing mines are near depletion, with the remaining ores too deep to be exploited economically. According to official information, an alternative rich bauxite resource has been found in the Komi Autonomous Republic, to the north-west, with around 300 million tonnes of reserves (62), However, as in the rest of the CIS mining industry, the problem is principally one of investment to develop the new deposit.

The situation with regard to alumina plants is similar to that of bauxite. The main suppliers of alumina to the Soviet Union (63) have been Yugoslavia and Hungary. Since production collapse in Yugoslavia, imports of alumina have been made from a number of countries, particularly Australia, Italy, Ireland and Jamaica. CIS alumina refineries are old, particularly those located in Kazakhstan and Azerbaijan and are a threat to the environment. These plants would require better quality imported raw materials in order to be able to operate competitively. Accordingly, dependency on imported materials would automatically place the alumina plants at a disadvantage because of the much higher costs once the transport-added costs and the international prices for the raw materials were introduced. It is then probable that these plants of around 1,6 million tonnes capacity would have to close operations (64). This would further exacerbate the difficulties of the CIS aluminium smelters which would then have to rely largely on imported alumina.

Primary aluminium

CIS aluminium production in 1992 was estimated at around 3,2 million tonnes, down from the 3,5 million tonnes in 1988, however, clearly above the average level of production previously assumed in the west, of 2,2 million tonnes. The world aluminium industry has for a long time considered that the CIS smelters are inefficient, technologically poor, are short of raw materials, plagued by corrupt management, gross pollution, etc. All these may be partially true. However, the fact is that Russian smelters are proving their ability to maintain output levels and increase exports - a fact which is causing great disturbance amongst western producers - at least temporarily.

Aluminium exports have been earning the CIS a minimum of USD 1 billion - 1,5 billion yearly during the 1988-1993 period (63) in desperately needed hard currency. It is then easy to understand why aluminium plants are still managing to produce large volumes of metal and able to produce high-quality products in very difficult circumstances.

Western observers point out that it is virtually impossible to determine the real production costs of CIS aluminium. The Russians claimed, in 1992, that they produce aluminium for about USD 500 a tonne, when energy costs were heavily subsidized. However, as CIS energy costs were permitted to rise to world market levels, to meet the IMF membership requirements, some plants became uncompetitive. Compared with western costs, CIS smelters were producing aluminium for about USD 25 cents/lb, clearly below the USD 54 cents/lb average for smelters in the rest of the world for 1992 (64). Aluminium smelters in the western world are estimated to have continuously decreased their operating costs in 1992 and 1993 so that average costs are estimated to be USD 50 cents/lb (around USD 1110 per tonne).

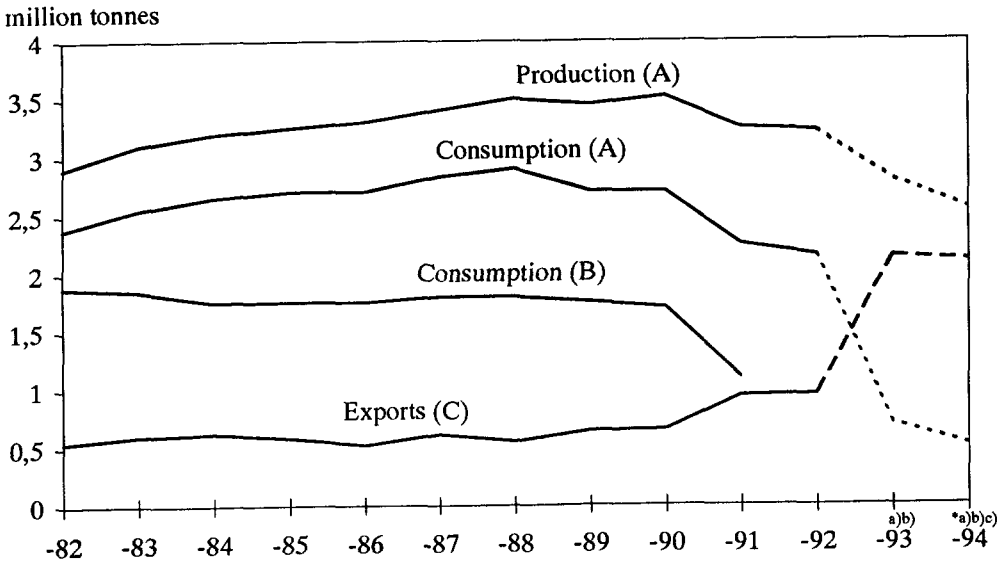
The abrupt increase of energy prices raised the operation costs of some of the CIS smelters to an estimated figure of USD 1200 a tonne, around the same level as the high-cost smelters of Western Europe and well above those in developing countries (65). However, energy prices differ sharply between European Russia and the Urals and those in Siberia and Tajikistan. The former are dependent on expensive and polluting coal energy; the latter, like Bratsk and Krasnoyark (the world's largest smelters) are power sourced from hydroelectric dams, which is subtantially cheaper. The Urals is the region particularly badly hit, as it is dependent on neighbouring Kazakhstan, which charges international market prices to the other CIS republics for its raw materials. As a result of the freeing of energy prices, plants such as Bogoslovsk, Volgograd and the Urals Aluminium Works might well be forced to close as they are not able to compete with the low energy costs of the Siberian smelters.

Of the 14 aluminum smelters operating in the CIS, 10 smelters representing 78 per cent of the total capacity use the Söderberg technology, which has not been installed in new plants in the West for the past 25 years, where modern technologies like the pre-bake is mainly preferred because it permits more efficient control of the emissions and because of the reduced amount of power required to produce aluminum metal. The first years after the Soviet Union system collapsed, ambitious modernization programmes emerged in connection with the CIS aluminium industry. One of the most impressive plans was to convert the majority of the aluminium plants using the outdated Söderberg technology to the cleaner and less expensive pre-bake method. Financial constraints, in particular, are motivating a more realistic approach to the problem. Although conversion to modern technologies remains as a target in the long term, a more immediate goal as a real solution for the CIS aluminium industry in the coming 6-8 years is considered to be the upgrading of the existing Söderberg technology to reduce pollution and increase productivity.

Primary aluminum production in the CIS can be expected to fall from more than 3,5 million tonnes in 1990 to about 2,5-2,7 million tonnes in 1995. There are no indications, however, that exports to the West would decline automatically by the same levels, since large amounts of metal may still be stored for transportation to the international markets and since CIS demand may decline further. Russian authorities in the aluminium industry agreed on several occasions to respect international undertakings on the reduction of aluminium production. Intergovernmental negotiations between east and west were already initiated in 1993 and continued in 1994 with the aim of finding mechanisms that would reduce the excess supply of aluminum on the international market. According to the initial agreement, the rate of primary aluminum output in 1994 and 1995 will be reduced by an amount corresponding to 2 million tonnes annually compared to the production level at the end of 1992. Of the total, a reduction of 0,5 million tonnes would be undertaken by producers in the Russian Federation. The full implement of the agreed cutback should help the CIS aluminum industry to increase financial and technical assistance from the West for modernization and restructuring of their plants.

The problem hinges on the fact that management boards of the Russian aluminum plants are not very enthusiastic over the cuts agreed with western producers. Local traders estimate that due to a sharp decrease from 2,4 million tonnes of aluminium domestic consumption in 1990 to 0,7 million tonnes in 1993, whilst maintaining practically the same levels of production, exports are their only means of survival.

Figure 7. Soviet Union/CIS Primary Aluminium Production, Consumption and Exports 1982 - 1994 (million tonnes)



Notes:

A: Revised figures: Metallgesellschaft: Metal Statistics ed. 1982 - 1992 and UNCTAD: Commodity Yearbook 1994.

B: Former estimates: Metallgesellschaft: Metal Statistics ed. 1981 - 1991.

C: UNCTAD: Review of the Current Market Situation and Outlook 1982 - 1991, 11 February 1993 and UNCTAD: Commodity Yearbook 1994.

* *projected*

a) G. Volfson, director of the Russian producers group Aluminiy, at the MB Conference on CIS Metals, June 1994.

b) Estimate based on Russian sources.

c) Estimate based on metal trade publications.

Table 16. Soviet Union/CIS Primary Aluminium Production, Consumption and Exports 1982 - 1994 (million tonnes)

	Production	Consumption		Exports
	A	A	B	C
1982	2.90	2.38	1.88	0.54
1983	3.10	2.55	1.85	0.60
1984	3.20	2.65	1.75	0.62
1985	3.25	2.70	1.75	0.58
1986	3.30	2.70	1.75	0.52
1987	3.40	2.83	1.80	0.61
1988	3.50	2.90	1.80	0.55
1989	3.45	2.70	1.75	0.64
1990	3.52	2.70	1.70	0.65
1991	3.25	2.25	1.10	0.94
1992	3.22	2.15		0.95
1993	2.80 [a)]	0.70 [b)]		2.14 [a)]
1994	2.55 * [a)]	0.51 [b)]		2.10 [c)]

Sources: See notes of Figure 7.

It should be noted that the data on CIS and Russian aluminium production, consumption and exports is diffuse and many times contradictory. In a Metal Bulletin conference on Metals in the CIS, in June 1994, Russian authorities indicated that Russian aluminium output will decrease some 250,000 tonnes in 1994 from 2,8 million tonnes output in 1993. Exports, however, will remain at 1993 levels, around 2,14 million tonnes (66).

CIS aluminum producers are increasingly convinced that the financing of a comprehensive restructuring programme has to come mostly from their own sources. A process of transformation intended to increase operating efficiency and reduce pollution has already been initiated in several smelters, particularly at the Urals Aluminum Works and Regar in Tajikistan, in addition to the modernisation projects completed in cooperation with foreign companies.

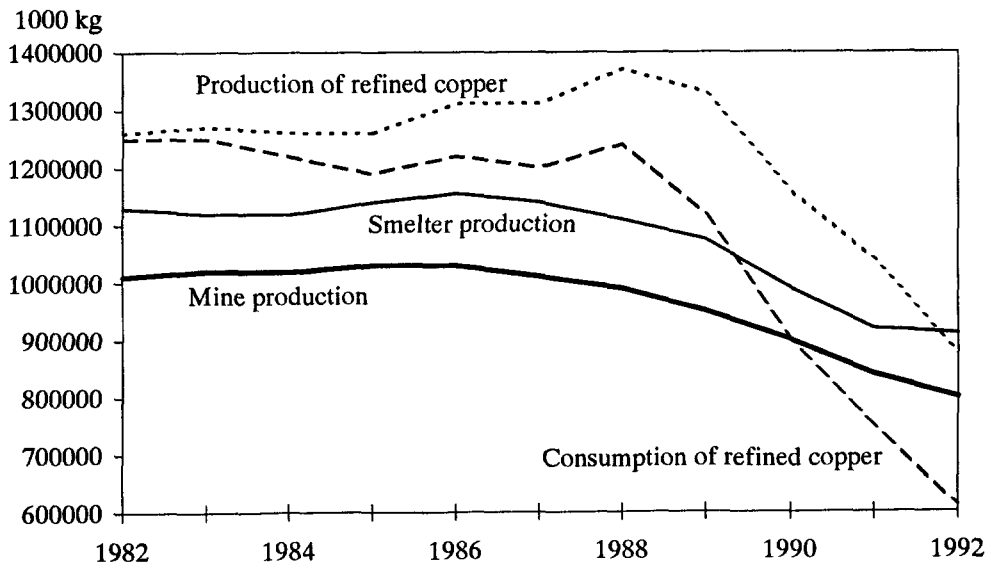
Exports from the CIS republics, in particular from the Russian Federation to the international market, are reportedly not decreasing in any significant way. As long as demand for aluminum in the CIS domestic market does not sharply re-emerge, then about 80 per cent of the production will be exported. Smelters will continue producing for export to earn the dollars needed to finance modernisation. At the price level of the first quarter of 1994, the funding of modernisation of the existing Söderberg plants would require around USD

300-500 millions over the next six or seven years (67). Conversion to pre-bake anodes would require exports of about 1 million tonnes yearly over the same period.

5.4. Copper industry

The copper output growth in the Soviet Union has been one of the most spectacular, compared with other non-ferrous metals, since the Second World War. As a result of intensive development of reserves during the 1950's, new mines and metallurgical plants were constructed. Copper output increased from 275,000 tonnes in 1950 to half million tonnes in 1960 and over 1 million tonnes in 1970, when the Soviet Union became the second largest copper producer in the world after the United States. According to the Ninth Five Year Plan, approved in 1971, copper production was to be expanded to 1,5 million tonnes in 1975 and it was expected to reach the two million tonnes level in 1980 (67). At present, the CIS has maintained its third position, far below Chile and United States with an estimated output of 800,000 tonnes in 1992 (see Table 10).

Figure 8. Soviet Union/CIS Production and Consumption of Copper, 1982 - 1992



Source: Metallgesellschaft

From 1984 to 1992, CIS mine copper production decreased by 3.1 per cent annually and consequently the region's share fell from 12.3 per cent to 8,6 per cent of world output. The CIS countries have been the world's largest primary refined copper producers for the first half of the 1980's. From 1984 to 1992, their share dropped from 14 per cent to 8 per cent, due to the fall in output in Russia and Kazakhstan. The output volume did not shrink at such a high rate as consumption. The 20 per cent reduction in CIS primary refined copper between 1984 and 1992 compares to a much larger drop in domestic demand. This difference, as it is the case of several base metals, caused a rapid increase in the volumes of copper available for export.

For a long time, a central problem for CIS copper mining has been the decreasing quantity and quality of its reserves. Consequently the volume of ore mined had to be increased to sustain copper production levels. Average ore grades are between 0,8 and 0,5 per cent copper content. Such low grades can be mined profitably in the United States or Canada, but only in very large and highly mechanized open-pit mines.

Table 17. CIS Copper Smelters and Refineries Capacity

Location	Smelter Capacity (1000 metric tonnes per year)	Refinery Capacity (1000 metric tonnes per year)
Russian Federation		
Karabash	100	..
Kyshtym	..	100
Kirovgrad	90	..
Pyshma	..	280
Krasnouralsk	90	..
Sredneuralsk	100	..
Mednogorsk	15	..
Moscow	40	40
Kazakhstan		
Balkhash	200	300
Dzhezkazgan	180	280
Irtysh	70	50
Uzbekistan		
Almalyk	250	250

Source: IMF, World Bank, OECD and EBRD: A study of the Soviet Union Economy, February 1991; Data of the United States Bureau of Mines.

The grade of the concentrates is mostly low compared with that of the West. Larger volumes of lower grade concentrates have to be transported large distances to the smelters and this increases relative transport costs. As a general rule, copper ores are very complex and the fine dissemination of metals make the metallurgical performance of concentration plants difficult. In the Urals, copper concentrates are smelted in five large plants with a capacity of around 400,000 tonnes annually. Copper smelting capacity in the CIS is estimated to be around 1,3 million tonnes (see table 17). In addition, the Norilsk and the Kola nickel plants produce 0.7 million tonnes of copper (68). Most of the smelters were built before the Second World War and modified during the 1950-1970 period. The only modernization programmes reported in the CIS copper smelting and refining during the 1980's, are the Norilsk plant where an Outokumpu flash smelter was installed, and the large Almalyk smelter, in Uzbekistan, where the same system was installed.

New operations; the case of the Udokan copper deposit

The most important project for the development copper mining in Russia, is the Udokan deposit in Siberia, east of Lake Baikal in Chita Oblast. This project was discussed for many years (already during the Soviet Union period) with Japanese, West European and Chinese interests as a potential multi-national venture. In 1992, the government announced an international tender for the rights to develop the deposit. Important western companies, such as the British RTZ and the Australian BHP invested in technical and economic researching of the deposit long before the tender was announced. In January 1993, a Russian entrepeneur won - in alliance with a number of foreign investors - the rights to develop the deposit.

Udokan is estimated to produce 400.000 tonnes annually of copper-in-concentrate, sometime in the future. It was initially proposed that half of the concentrates will be smelted in Russia and the other half will be exported to China. Russian authorities, however, would desire the total production of copper concentrates to be smelted in their own country. Originally it was estimated that the project could cost up to USD 1 billion to develop, including infrastructure costs which are estimated to be considerable. This huge figure changed to a more realistic level of USD 250-300 million (69). After defeating major western mining companies in the first big international tender for a large Russian mining project, the winner's present challenge is how to raise the finance and how to create a technologically and administrative world class management to operate the project.

There has been a lot of controversial talk about the Udokan project, mostly as an example of the difficult or, at least "sui generis" Russian investment climate. In

the case of mining, there is an intrinsic reluctance to the opening of the sector to foreigners. It seems that the whole Udokan operation reminds developing countries of policies to establish joint ventures in the mining sector during the 1960's and 1970's.

Consumption and trade

Consumption of refined copper in the Soviet Union was estimated at an average of 1,25 million tonnes for the period 1980-1988. In 1992, consumption amounted to 0.6 million tonnes. Copper use decreased at a very slow pace between 1980-1988 but slumped in the years 1990-1992 as a result of the disruption of the economic structures which brought a sharp fall in economic activity, particularly in industrial production.

Table 18. Per Capita Copper Consumption by Regions (kg Cu/person)

	1951 - 1959	1965 - 1969	1975 - 1979	1985 - 1989	1990 - 1992
WORLD	1.3	2.3	2.6	2.6	2.5
Developed market-economy countries	5.5	7.3	8.1	8.4	8.7
America	7.0	9.6	8.7	8.9	8.3
West Europe	4.5	6.3	7.4	7.6	8.3
Japan	1.0	6.0	9.7	10.8	12.3
Developing countries and territories	0.2	0.3	0.5	0.8	1.0
Latin America	0.4	0.8	1.5	1.6	1.3
Africa	0.0	0.0	0.2	0.3	0.3
Asia	0.1	0.1	0.2	0.6	0.9
China	0.0	0.2	0.4	0.4	0.5
FSU	2.0	3.8	5.1 [a)]	4.9 [a)]	2.9 [a)]

a) Includes countries in Eastern Europe

Sources: Economic Planning Centre, Helsinki 1976; and UNCTAD: A review of major developments in the world copper market and industry from 1980 to 1992 and future prospects, UNCTAD/COM/37, 8 February 1994

During the 1980's, the Soviet Union was the third largest copper consumer in the world after the United States and Japan. In 1991-1992, Germany consumed 40

per cent and China 30 per cent more copper than the CIS countries. Before the collapse of domestic demand, per capita copper consumption in the Soviet Union countries was approximately 40 per cent lower than in the developed market economy countries (See Table 18). A return to the per capita consumption levels of 1985-1989 is likely to take a long time. It should be noted that consumption levels were inflated by inefficiencies in raw materials use and by the disproportionately large consumption for military purposes.

The decline in domestic and Eastern European copper consumption from the beginning of the 1990's has been one of the main reasons for sharp increases in exports to the West. The exported copper, mostly in the form of refined metal amounted to an average of 100,000 tonnes between 1980-1986, of which approximately 75 per cent went to other socialist countries. According to figures reported by the Russian authorities, copper exports to the West were as follows: in 1990, 176.800 tonnes, in 1991 174.000 tonnes and in 1992 145.000 tonnes. According to UNCTAD's estimates, from 1987 onwards exports increased to 200,000 tonnes annually and above in 1990-1992 (70).

In general, there is some degree of confusion regarding the quality and category of the metals exported from the CIS area. Much of the exports - in the case of copper - are in the form of metal, which, while not registered on the London Metal Exchange or even necessarily of LME quality, is nevertheless used as direct feed by western manufacturers. Export estimates for the 1990-1994 period range from below 0.2 million tonnes (UNCTAD) to as much as 0.5 million tonnes annually (traders). Most estimates are, however, nearer to the lower figure than to the higher. Copper exports from the Soviet Union/CIS to countries outside Eastern Europe account for around 90 per cent of total CIS exports of refined copper, during the same period.

The rapid increase of exports from the CIS countries and the diversion of its flows have a marked impact on the world copper market structure, particularly on Western European markets. In Germany, for example, the share of the CIS in total copper imports jumped from less than 1 per cent in 1980-1982 to approximately 20 per cent in the early 1990's, displacing former developing countries suppliers such as Peru and Chile.

CIS copper exports will continue in the short-term period, However, they are expected to decline. In addition, much of the CIS exports reflect toll contract smelting for the western countries. Exports of copper concentrates to the CIS are believed to have reached around 100,000 tonnes yearly. Since most of this metal is returned to the west, the toll contracts serve to deplete western countries' stocks of copper concentrates, but at the same time increase their stocks of refined metal. While smelting costs in the CIS develop to international free market levels, toll contracts are likely to be reduced drastically.

5.5. Nickel industry

Nickel production in the Soviet Union started in 1934-1935 when a plant for treating oxide nickel ores was built in the Urals region. At the same time, large reserves of complex Ni-Cu sulphide ores were found in two northern regions; first in the Kola Peninsula in european Russia, and the second, at Norilsk, in Siberia. In the Kola Peninsula, the Severonickel smelter started operations in 1940 and in Norilsk in 1942 (71). By the end of the 1970's, the Soviet Union became the largest mine and refined nickel producer in the world.

Table 19. CIS Nickel Mines, 1992

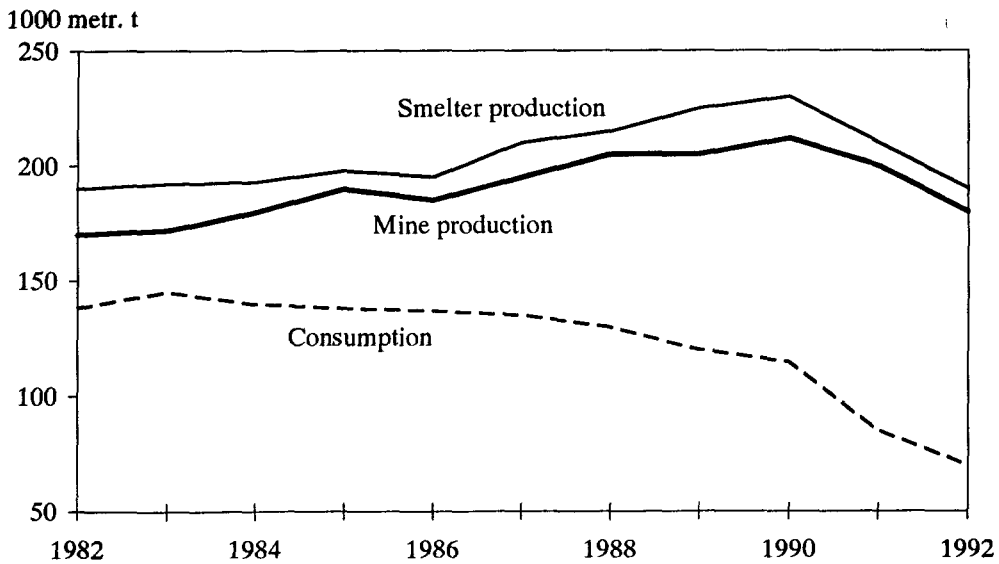
RUSSIAN FEDERATION	Mining method	Capacity
Norilsk Nikel Kombinat Norilsk and Talnakh Areas Siberia	Norilsk: one open pit and one underground mine, one concentrator; Talnakh: four underground mines and one concentrator.	Total mining capacity 200 000 t/y Ni content. Some ore shipped to Kola. Concentrates smelted at Norilsk and Kola Pen.
Norilsk Nikel Kombinat Pechenganikel Nikel and Zapolyarnij areas Kola Peninsula	Two underground, two open pit mines.	Some ore and concentrate production shipped to Severonikel for smelting. Capacity about 50 000 t/y Ni content.
Ural Mountains Orsk-Chelyabinsk-Svedlovsk region (possibly extending into northern Kazakhstan)	Up to 18 mines or mining operations, presumed open pit.	Ore production processed at Orsk, Buruktal, Ufaley and Rezh, all in same region. Total ore production may contain 40 000 to 60 000 t/y Ni.
UKRAINE REPUBLIC		
Pobugskoya Kombinat Pobuzh	Three mines, presumed open pit.	Ore processed at local smelter. Mining capacity reported to be 5 - 7 000 t/y Ni content.

Source: International Nickel Study Group, INSG: World Directory of Nickel Production Facilities, 31 August 1992.

The Soviet Union nickel mine output has always been about the same as that of Canada, although refined nickel production volume is greater in Russia. The International Nickel Study Group, INSG, estimates that the refined nickel output was, in 1992, more than 50 per cent greater than in Canada, although CIS production has been decreasing clearly during the 1990's. Western publications

are sceptical about the reported production levels of Russian officials, of around 250,000 tonnes in 1992, at Norilsk Concern alone. A more realistic figure could be the same volume for the global CIS output. Russian officials reported that 1993 nickel output amounted to around 80 per cent of the 1992 level (72). The main reasons for the slump in nickel production in the CIS area are the same as for the rest of the major metals: i.e. the slump in Russian industrial production, the breach of economic ties among the former republics of the Soviet Union, the big change in the defence industry and the insolvency of customers. Short-term forecasts of nickel production average around 200,000 tonnes annually, which means near to 65 per cent utilization of the CIS smelting capacity.

Figure 9. Soviet Union/CIS Production and Consumption of Nickel, 1982 - 1992



Source: Metallgesellschaft

The largest nickel producer in the CIS is Norilsk Nickel Concern, which controls around 85 per cent of the Russian Federation total output. The concern was established in 1989 and initially declared independent of governmental control, although the Russian state has a 37,5 per cent stake in the company. Norilsk Nickel includes mining and metallurgical enterprises in the Norilsk region of East Siberia and in the Kola Peninsula. Other producers are the Ural enterprises, which include Yuzhuralnickel, Ufaleinickel and Rezhsky plants.

Table 20. CIS - Nickel Smelters and Refineries

RUSSIAN FEDERATION	Capacity and products
Buruktal Approx. 100 km E of Orsk	1 000 t/y Ni in ferro-nickel (% Ni not avail.) plus up to 18 000 t/y Ni in anode (87 % Ni) 1990.
Norilsk Nikel Kombinat Norilsk Smelter and Refining Complex Norilsk, Siberia	120 000 or more t/y Ni in matte, and to 110 000 t/y in refined metal.
Norilsk Nikel Kombinat Pechenganikel Smelter Nikel, Kola Peninsula	50 000 t/y Ni in Ni-Cu matte (40 - 50 % Ni).
Norilsk Nikel Kombinat Severonikel Smelter/Refinery Monchegorsk, Kola Peninsula	45 000 t/y Ni in matte of own make and to 140 000 t/y Ni in refined metal.
Rezh Smelter Rezh, Central Urals About 80 km NE of Sverdlovsk	5 000 t/y Ni in matte.
Ufaley Smelter/Refinery Verkhiy Ufaley About 100 km SW of Sverdlovsk	25 000 t/y Ni in refined metal.
Yazuralnikel Orsk Smelter/Refinery Orsk, South Urals	16 000 t/y Ni in granules (96.8 % Ni, 0.5 % Co). plus 16 000 t/y Ni in refined metal.
UKRAINE REPUBLIC	
Pobugskoya Combinat Pobuzh	5 - 10 000 t/y Ni in ferronickel.

Source: International Nickel Study Group, INSG: World Directory of Nickel Production Facilities, 31 August 1992.

Russian officials in charge of privatisation planning have recently announced that the Norilsk Nickel Concern has been included in a wide privatisation programme of 62 state-owned companies (73). The programme was completed during the summer of 1994. According to the programme, 12 per cent of the Norilsk shares will be made public. The present government stake will rise to 50-51 per cent for three years, after which the majority ownership will return to the Norilsk enterprise. A limited percentage of the shares will be distributed freely among the employees, while another part will be sold to them at a lower rate. Shares will be available only to Russians. The nickel industry privatisation will include the Pechenga, Severonickel, Monchegorsk and Norilsk plants.

Western sources estimate that approximately one half of the CIS nickel is consumed domestically and the other half of around 125,000 tonnes is exported. The significant increase in Russian nickel exports over the past five years is the

result of the expansion of mining operations at Norilsk and refining capacity in the Kola Peninsula, and particularly because of the abrupt decrease in Russian industrial production. It is difficult to estimate exact figures of nickel exports from the CIS to the western markets because the 1990's has seen a large illegal trade in nickel. According to Russian officials (74), in 1992 around 30,000 tonnes of nickel were exported illegally in the form of ferro-nickel, nickel scrap, and nickel alloys manufactured at ferrous metallurgy enterprises and plants which do not normally produce nickel. Another 20,000 tonnes of nickel were exported on a barter basis or exported illegally through the Baltic countries.

In 1993, and according to figures reported by Russian officials, nickel exports amounted to 110,000 tonnes, of which 42 per cent went to Germany, 20 per cent to Great Britain, 11 per cent to Netherlands and 11 per cent to Finland. In 1994, there has been an abrupt decrease in nickel exports to the western markets. Metal traders consider that the lack of CIS metal may be due to difficulties in production and transport, but also, however, to the impending changes in the Russian export laws. The Russian Ministry of Economic Foreign Affairs, on the initiative of the metal enterprises, such as the Norilsk Nickel Concern, is taking measures to restrict the number of metal trading companies. Decrees, if approved, will include most non-ferrous metals.

To maintain the nickel production levels of the 1980's, considerable investments in technical development and modernization programmes will be required. The Norilsk Nickel Concern alone requires around USD 4 billion up to the year 2000 (75). Russian authorities consider that this money will come mostly from nickel exports.

6. CIS METALS IN THE INTERNATIONAL MARKET

The minerals and metals trade is a significant sector of the international trade of commodities with large scale export-import flows of raw materials, semi-manufactured and finished metal products. A balance in supply and demand for these goods is a key objective of international relations between producing and consuming countries and a central target of the complicated legal dispositions and institutions of the international metal market. Sharp price fluctuations in the international metal market have been traditionally a cause of great concern for mineral producing and consuming countries.

There was a general belief in the early 1970's that metal prices could only go up. Fear about physical scarcity of unrenewable resources and the effects of producer cartels' policies were considered as proper reasons for increases in metal prices. International trade of some major and strategic metals was also influenced by cold war arguments, which made stockpiling of metals an important defence argument.

At present, western mining industries are demanding cuts in CIS metal exports and the acute foreign exchange needs of the CIS producers reflect a situation of clear confrontation in their metals trade practices.

As a significant mineral region in the world, the CIS and particularly Russia, have a clear influence in the international market of minerals and metals, on their international value and price developments, on the profit levels of producers, exporters and importers and on the medium and long-term prospects of the mining and metal sector operations all around the world. A severe struggle in the international metal market commenced in the first years of the 1990's. Market economy countries were growing increasingly resolute in opposing the unpredictable CIS metal exports to the international markets and in rejecting the often anarchaic CIS metals trade practices. An example of this confrontation can be seen in the western pressures for cuts in Russian aluminium production and the United States dumping threats against aluminium imported from the CIS.

6.1. The 1980's market situation for major metals

Average prices of minerals and metals reached their highest postwar levels in real terms in the mid-1960's. Prices rose again in the first half of the 1970's but declined sharply to less than half their highest levels, to a record low during 1984-1986. Price declines occurred during a period of economic recovery in the industrialized countries which raised concerns about the nature and causes of such development, particularly as to whether it resulted more from structural

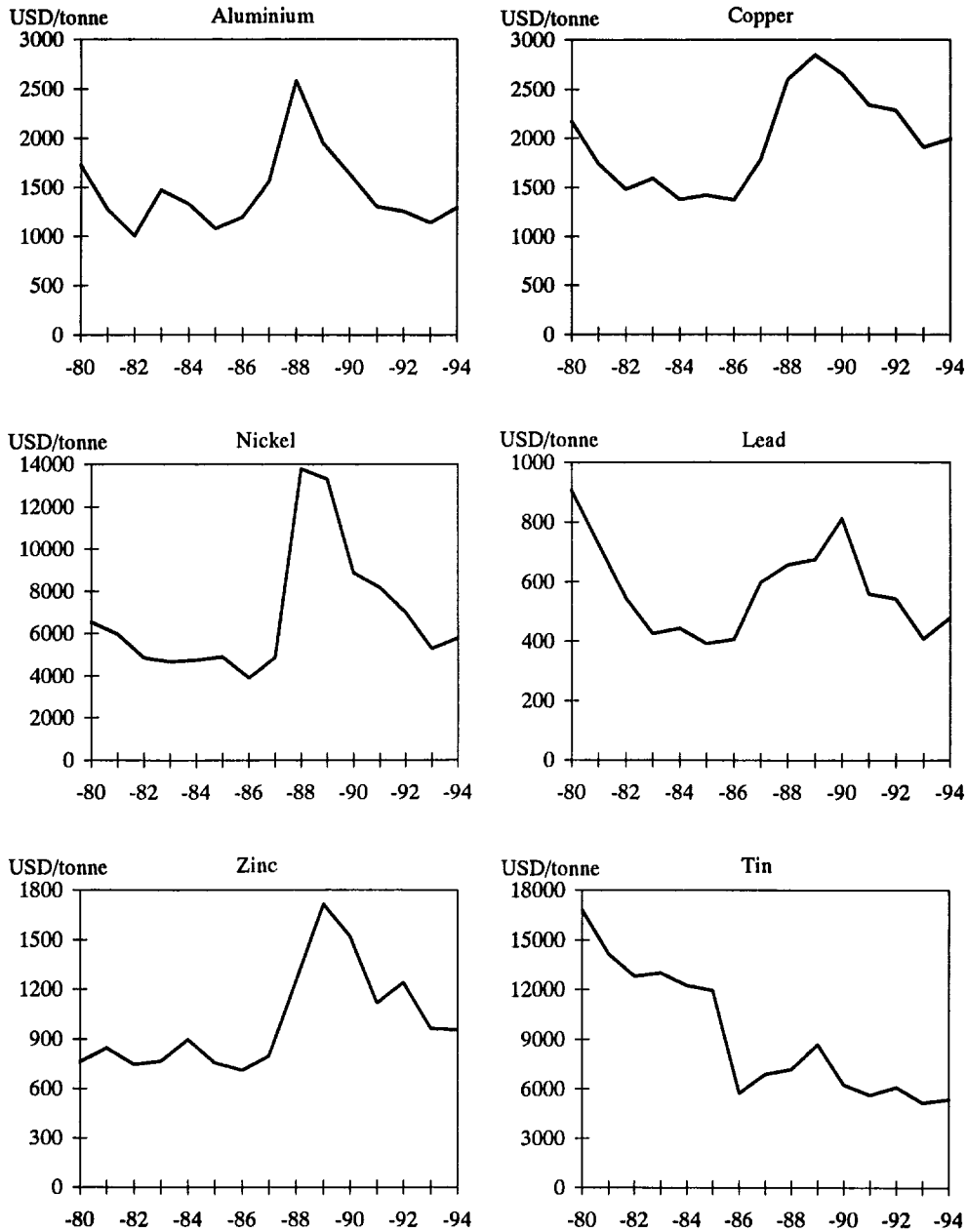
factors than from short-term cyclical changes. Tin, aluminium and zinc led the sharp declines in metals and minerals prices.

Basically, the reasons for this period's weak market situation were: the large capacity increases resulting from the high prices and low interest rates of the 1970's; and the technological changes favouring less use of traditional metals as a result of the energy-saving innovations generated by the energy crisis of the 1970's. Base metals were hit by the increased substitution of plastics, ceramics and glass. In addition, growth of industrial production in developed countries was too low to have a significant impact on minerals and metals demand.

The period of the late 1980's was marked by exceptionally high prices. The World Bank's nominal price index for the base metals increased between 1986-1989, to reach a peak in early 1989 at a level more than 80 per cent higher than in 1986. Aluminium, copper, nickel, zinc, silver and gold achieved the sharpest increases and their prices remained high through 1988-1989. The growth of industrial production in industrialized market economy countries and, particularly, in the industrializing countries of East Asia was the most important single factor for higher metals prices. Higher prices were also due to temporary factors, such as fluctuations in exchange rates, low metal stocks and, in some cases, supply disruptions due to capacity reductions during the low price period of 1982-1986. Production disruptions occurred, for example, in Peru for copper and zinc, Bolivia for tin and Papua New Guinea for copper. The financial restrictions of developing countries made it difficult to import equipment and materials to maintain their production capacity. Also social and labour unrest in the sector due to wage losses affected the minerals and metals production process in a number of developing countries.

From a worldwide perspective, in the first half of the 1980's, the market situation for major metals and minerals had a predominantly depressive effect on the world mining industry. Large mineral producing developing countries were impelled to maintain output levels at any cost to finance their financial constraints at a time when demand growth slowed. During the late 1980's, when demand for metals increased clearly there was little idle capacity available to expand production. In fact the previous low prices period made it difficult for minerals producing developing countries to respond to growing demand.

Figure 10. Metals Prices, 1980 - 1994*



* Note: Yearly average price, LME, USD/tonne
January-June 1994 average.
Sources: UNCTAD: Monthly Commodity Price Bulletin, Supplement 1970 - 1989;
UNCTAD: Monthly Commodity Price Bulletin, Volume XI, July 1991 and Volume XIV, July 1994.

For the mining industries in the industrialized countries, the 1980's were a decade of mixed experiences. In the Western European and in the United States' mining and metallurgical sectors, the main target of the decade was the introduction of efficient mining and processing techniques to keep costs competitive. The 1980's was also a period during which a large part of the mining industry really started to consider the environment factor as a very central issue. Pollution controls increased production costs but were generally absorbed by the process of costs rationalization as a whole.It was also the decade when the large oil companies in the Arabian countries, particularly, made important acquisitions of mining companies both in industrialized and developing countries. By the late 1980's most of these companies had failed in their aim to have a dominating role in international mining and had sold their shares.

The worldwide recession of 1981-1982 caused a rapid fall in copper consumption much more steeply than world production. Copper supply increased after 1986 to balance expansion of demand, but not fast enough to cover the market deficit. During 1987-1988 copper nominal prices increased to the highest levels ever reached. World refined copper production amounted to 10,7 million tonnes in 1990, while consumption followed the same trend increasing to 10,8 million tonnes. The growth in demand occurred noteably in the industrializing countries of East Asia and in the OECD countries. World stocks of copper were at their highest level in 1983 with 1,7 million tonnes and later decreased to 0,8 million tonnes in 1988, the lowest level in around twenty years.

The Mining capacity and mine production of zinc increased rapidly during the 1980's. Demand, particularly in the construction and automotive sectors increased markedly, too, (6,1 million tonnes in 1981 to 7,0 million tonnes in 1990) so that refined zinc supply (6,3 million tonnes in 1981 to 7,1 million tonnes in 1990) and demand were generally in balance. Known stocks remained relatively stable at levels of 0,5 to 0,9 million tonnes.

Consumption of aluminium exceeded production throughout most of the 1980's, and reached a balance in 1988, but at the end of the decade there was an increasing surplus of the supply over demand so that world stocks grew sharply. Both production and demand growth were concentrated in developing countries.

In the nickel market, the situation of excess supply over demand in the 1970's period was reversed in the 1980's as demand increased firmly from 651,000 tonnes in 1981 to 857,000 tonnes in 1990. During this period smelter production of nickel reached a balance from 707,000 tonnes in 1981 to 860,000 tonnes in 1990.

For most of the 1980's, the iron ore market was in balance. After the sharp contraction of the market in 1980-1983, production and consumption increased steadily. Production grew particularly in developing countries, of which Brazil became the largest producer.

The initial process of economic reforms in the Soviet Union was seen as an intended aim to improve the mechanisms of the traditional centrally planned economic system. It was then believed that advances towards market oriented reforms would accelerate their growth in demand for minerals and metals.

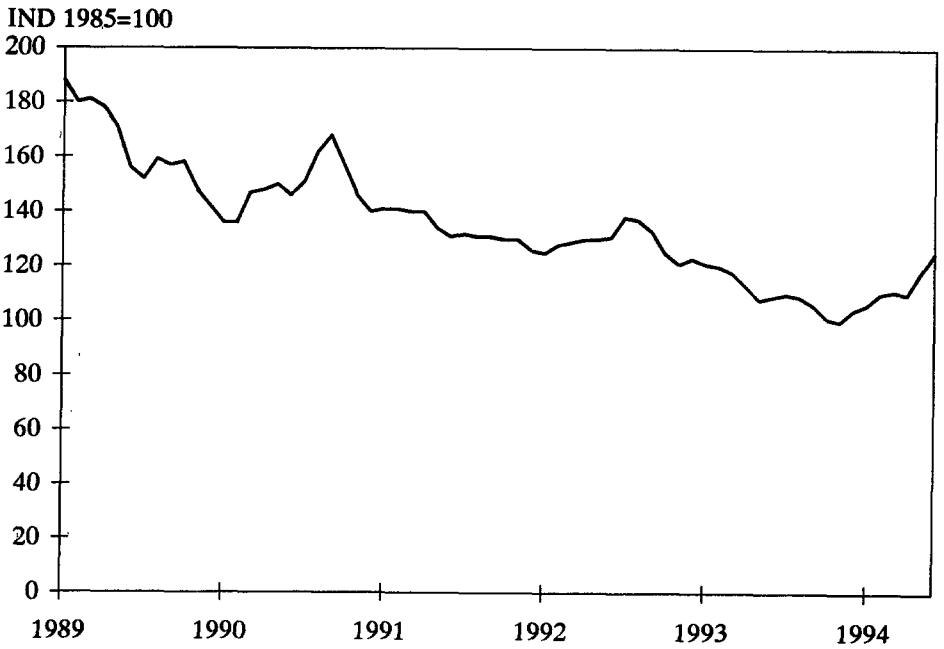
6.2. The changing market of the 1990's

The international mining industry entered the 1990's with expectations that the decade would see supply in reasonable balance with a growing demand for most of the major metals. It was already recognized that the political events in the Soviet Union were going to play a significant role in the market up to the year 2000. In addition, China was already increasing its influence in the market as a large producer but also as a big importer of minerals and metals. In the industrializing developing countries, the growth of industry as a main component of the GNP is reflected by a growing trend of the metal-intensive phase of development and an increase in export oriented industries.

Those new factors which were incorporated into the general frame of minerals and metals demand as early as the 1980's such as recycling, substitution, miniaturization and smaller metal stocks in the industry, are likely to be permanent. Mining industry adjustment to slower demand growth and higher productivity for most mineral commodities took a long time and was still in the process of reaching a fragile equilibrium. The political events in the CIS had a clear impact on the world mining industry.

The metal prices have been confronting high volatility periods, both upwards and downwards, during the 1980's and the current years after 1990 (see Figures 10 to 11). The latest downturn of the early 1990's was exceptionally severe and development of CIS metal exports - particularly in the cases of aluminium, nickel, copper, zinc and tin - was blamed as being the main reason for the prices fall. The majority of international institutions suggested then, that prices would not recover for a long time because of the oversupply of metals in the market.

Figure 11. Minerals and Metals Prices 1989 - 1994*



Monthly indices of free market prices in US dollars
Sources: UNCTAD: Monthly Commodity Price Bulletin, 1991 and 1994.

Improving economic conditions in the industrialized market economy countries have changed attitudes of mineral raw materials producers and consumers. Particularly in those countries where a solid recovery has been occurring around 2-3 years from 1992, (United States, Canada, Oceania, United Kingdom, etc) demand has reactivated so that metal prices increased sharply in 1994. Growth rates above world average in the newly industrialized countries of Southeast Asia together with China and Latin America's more moderate but also above growth rates of the OECD countries have contributed to continued expansion of metals demand. Announcements of production cuts, particularly of aluminium, induced further mineral raw materials buying despite reported high stocks in a number of countries. In addition, speculative purchases are also contributing to the upward trend of metals prices.

6.3. CIS metal exports

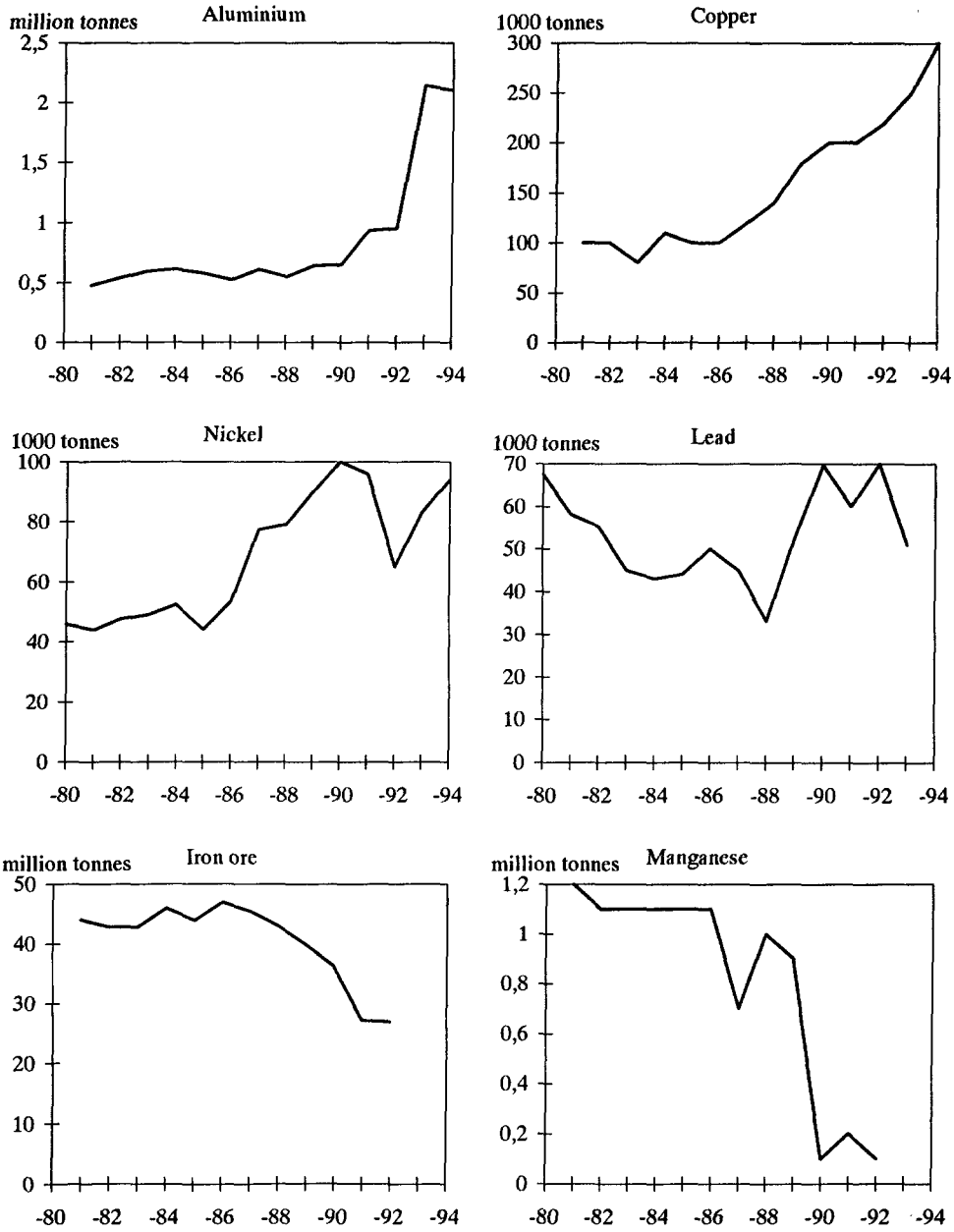
The state controlled metal exports of the Soviet Union operated on the basis of long-term agreements in a centralised system. From the beginning of the 1990's the sharp increase of some major metal exports from the CIS has caused much confusion and uncertainty among producers, consumers and traders in the western markets.

In the begining of 1992, the Russian government imposed export licensing and tariffs for metals. At the same time, mines and smelting plants were allowed to market their products independently. The initial regulations resulted in the appearance of a large number of metal trade organizations. The state lost foreign exchange and taxes, and illegal exports and corruption increased. New regulations had to be designed to bring some order into an increasingly erratic situation. Metal traders have been obliged by law to register their organizations with the Russian Ministry of Foreign Economic Relations before they can legally operate. Attempts to reduce the number of metal traders or to restrict non-ferrous export licences to a few state companies have in practice failed. Government officials in Russia have repeatedly announced that regulations and mechanisms to rationalize metal exports are being continuously reviewed.

Metal exports were liberalised from the begining of 1994 and licences and quotas are no longer necessary. Special alloys and other stategic metals will still be subject to a tough quota regime and trade should legally be authorised only to special companies registered as strategic raw materials traders. The estimated number of non-ferrous metals, steel and steel-alloys trading companies - local and foreign - in Russia and the rest of the CIS varies from a few hundreds to more than one thousand. The state owned Promsyrio concern has lost its monopoly position of the Soviet Union period. After trade liberalization it had approximately a 20 per cent share in the Russian steel export market. Razno, the state's non-ferrous trading company has also lost its monopoly rights. By the end of 1993 it became a joint stock company owned by the state, the metals producers and the management.

Metal exports from Russia and other members of the CIS expanded so strongly, after 1990, that the mining industry in industrialised, as well as in developing countries, considered the changing situation as a motive of tensions and the weakest link in the economic relations with the CIS. There is, however, a clear degree of uncertainty and even controversy about the real volumes and the duration and intensity of the impact of CIS metal exports on western markets. Figure 12. refers to export volumes reported by official sources.

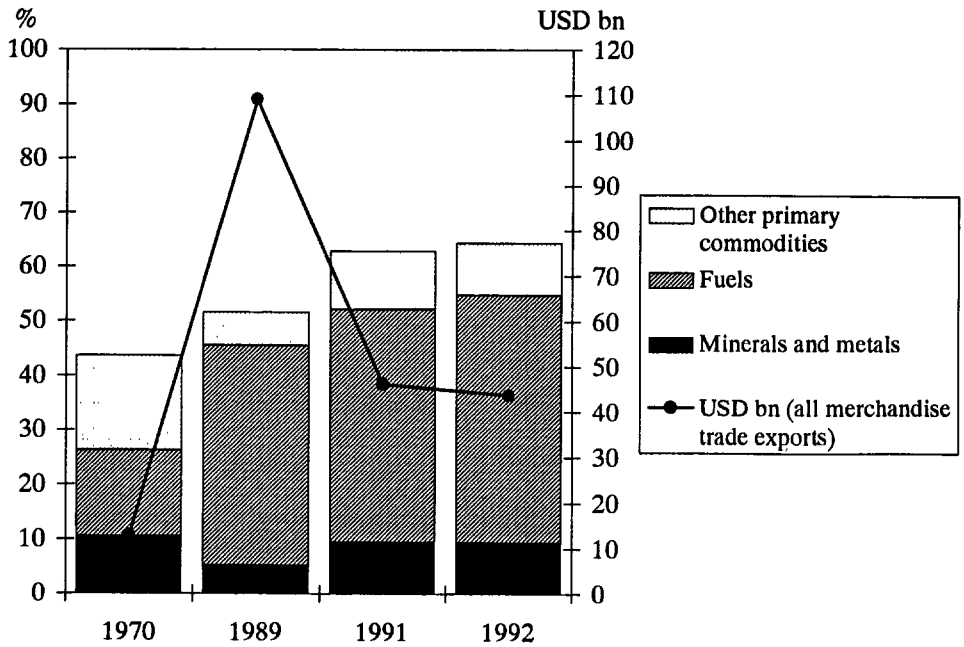
Figure 12. Soviet Union CIS metal exports, 1980 - 1994



Sources: UNCTAD: Commodity Yearbook, 1988 and 1994;
Metallgesellschaft, 1982 - 1993 and Metal Bulletin issues 1993 - 1994;
Nickel figures 1991 - 1993 and estimated figure for 1994: S. Kornejev, Norilske Nickel, June 1994; Zinc and lead figures 1991 - 1993, ILZSG, September 1994;
Aluminium figures for 1993 and estimated for 1994: G. Volfson, Aluminy, June 1994.

According to estimates from Metallgesellschaft, in 1992, Russia alone exported 1.4 million tonnes of non-ferrous metals to a value of USD 2.5 billion (76). The Russian Department of Metallurgy reported slightly smaller figures for the same year; 1.3 million tonnes with a value of USD 2.4 billion (77). Diverse estimates made by western metal traders fluctuate between 1.5 million tonnes to as high as 2,6 million tonnes of total metal exports from the CIS. Minerals and metals export value increased from 5.3 per cent in 1989 to 9.5 per cent of CIS countries total exports in 1992 (see Figure 13).

Figure 13. Soviet Union/CIS Exports of Primary Commodities (percent of total exports)



Sources: UNCTAD: Commodity Yearbook 1988 and 1994.

The western mining industry has commonly described CIS metal exports as a negative and disturbing market factor. Particularly EU and United States producers and traders have been active in blaming CIS metal trade practices. From the Russian perspective, local authorities claim that the United States and EU countries are guilty of discrimination against CIS metal producers. In the case of steel, for example, the Russian delegation at the MB's Fifth European Steel Conference in June 1994, indicated that in 1985, steel production in the

EU countries was 136 million tonnes from which 6.8 million tonnes were exported to the Soviet Union. At present, with a production of around 100 million tonnes the EU has imposed a quota of only 0.35 million tonnes of finished steel on CIS imports (78). In addition, world steel production increased by 1.2 per cent in 1993, but regional differences were very marked (see Table 12). Most of the steel production growth occurred in developing countries and United States while production in the CIS area slumped.

The central point of the EU steel producers is that European steel, in the east and the west, will have to cut crude steel capacity by 70 million tonnes and rolling capacity by 65 million tonnes to balance a utilization rate in the area of 80-85 per cent by the year 2000. Western producers argue that steel in the CIS must be linked to restructuring and that subsidised steel in the market results in an unfair competition. In these circumstances - according to EU countries - free trade in steel in the european market should be only gradually introduced (79). Proposed solutions include such extreme models like the western European steel reductions of labour from 0.9 million workers to 0.35 million since the 1970's. Taking note that Russian steel alone employs more than 1 million persons, this would mean a workforce reduction of 0.4 to 0.5 million persons, which should also be considered as an unrealistic goal from the long-term perspective.

Aluminium is of great significance for the CIS metal foreign trade. As described before, unlike other non-ferrous metals which depend on domestic and increasingly unreliable feed of concentrates, the aluminium industry uses imported bauxite and alumina. CIS demand has, collaterally, revitalized raw materials production in bauxite-alumina exporting countries, through barter and toll contracts. At the same time, and despite West European producers proposed restrictions, the CIS aluminium industry has been able to maintain its export levels in the 1992-1993 period.

Large producers in the west had started to cut production in 1993. After several meetings and long negotiations, reductions intensity remains unclear. The original aim was to reduce output by 2 million tonnes to stop oversupply and accumulation of stocks. The main problem was to what extent CIS producers were prepared to accept any output reduction. In January 1994, Russia agreed to a conditional cut of 0.5 million tonnes, once western producers reduce their own output volumes. Production cutbuck has remained largerly theoretical.

World aluminium production increased by 4.9 million tonnes between 1982-1992, from which CIS output has accounted for only 0.25 million tonnes of the global figure. Most of the increased volume (3.5 million tonnes) came from Canada, Australia, United States and Brazil. Russian officials have thus complained about the EU's "unilateral protectionist measures" to impose import restrictions on their aluminium (and other base metals) exports to the western markets. Low energy costs which gave a clear advantage to CIS producers in

the market until 1991 are now on average comparable to those in Canada or United States and are no more an argument of "unfair competition". In fact, CIS aluminium producers are at present regarded as high-cost producers.

Restrictions on imports imposed by the Western European countries and United States are affecting a continuously decreasing number of CIS products. Nevertheless, there are still imports of several product categories restricted by tariff and non-tariff barriers like steel and non-ferrous metals. The central argument of the CIS mining industry is, and will continue to be, that the EU and United States must establish equal metals trade relations with the CIS as with the other countries, especially in the transition period.

Although tensions between western and CIS metal producers have clearly lost intensity as a result of strengthening demand in the world market, there is a recognized need for fundamental changes in the industry. The dramatic rise in CIS metal exports has to be seen as a cyclical issue. Reductions of metals production capacity, in Western Europe, United States and Japan are not the result of CIS metal exports. Cuts started long before the collapse of the Soviet Union, as a result of the construction of new mines, smelters and refineries in countries and regions economically and physically (from the viewpoint of mineral resources) more favourable. At the same time, there was an increasing need in the international mining industry to cut costs to be competitive.

As seen before, the rise in CIS metal exports has led to growing protectionist sentiments in the west. Import controls in the EU particularly, are considered to be necessary to protect jobs. In fact, there is little evidence that such imports have contributed significantly to the problem of unemployment in these countries. The problem reflects more a situation of tranfer of resources from uncompetitive industries to activities with higher productivity. However, reductions in production capacity have not been big enough to correct what has been proved to be temporary worldwide overcapacity of some of the most used metals. Already a short period of high prices serves as the argument to postpone reductions planned in periods of weak demand. Aluminium and particularly steel are a good example. The European Commission's long negotiated plan to cut steel production capacity will hardly receive support from european steel enterprises at a time when they are operating at full capacity.

The protectionist actions of the industrialized market economy countries cannot be effective because CIS metal finds different channels into the international market. Large world enterprises are increasingly accepting the fact of the CIS entry into an organized system of metal trade and the need to eliminate trade barriers according to the GATT regulations. Metals export from the CIS will decline as a result of a stabilization of production levels, stagnant and long investment lead periods, recovery in domestic demand, lower volumes of toll

conversion and more severe environmental standards in the area. Not because somebody in the west tries to stop it.

6.4. Prospects of the CIS mining industry

Production, consumption and trade outlook for major minerals and metals of Russia and the other CIS countries is unprecedently uncertain. Forecasts even for the short-term are exceedingly difficult; first, because of the widely varying estimates concerning the probable overall economic situation and industrial activity; and second, because of the unpredictable political course of the transition period.

Over the next years up to the year 2000, an accelerated and widespread diffussion of western modern mining technology and heavy investment into the CIS mining sector seems to be improbable. Output levels over a period of six years, are thus estimated on the basis of the foregoing discussion, although there may be significant problems of different types associated with specific metals:

- deterioration of geological conditions, poorer ore grades and more complex mineral bodies;
- increasingly remote mining locations with higher costs of infrastructure, energy, labour and transport;
- high capital intensity for large-scale projects;
- due to the particularly long investment lead times - from 5 to 10 years for "green field" expansion, inflation and exchange rates uncertainty in the region reduce viability of mining projects in the area;
- risks related to changing metals demand both in the international and domestic market; intensity of economic growth in the metals consuming countries;
- more rigorous international and local environmental standards;
- political uncertainty, instability of governments and mining sector authorities;
- particularly the policies of the republics of the Russian Federation , regarding their territories' mineral resources control of mining and marketing operations, can vary greatly. Diverse movements and conflicts in rich mining regions were reported, especially in the first two years after the collapse of the Soviet Union (the Urals, Krasnoyarsk, Cherepovets, Yakutia, South Ossetia, Checheno-Ingushetia, Yakutia, etc.)

6.5. Energy sources

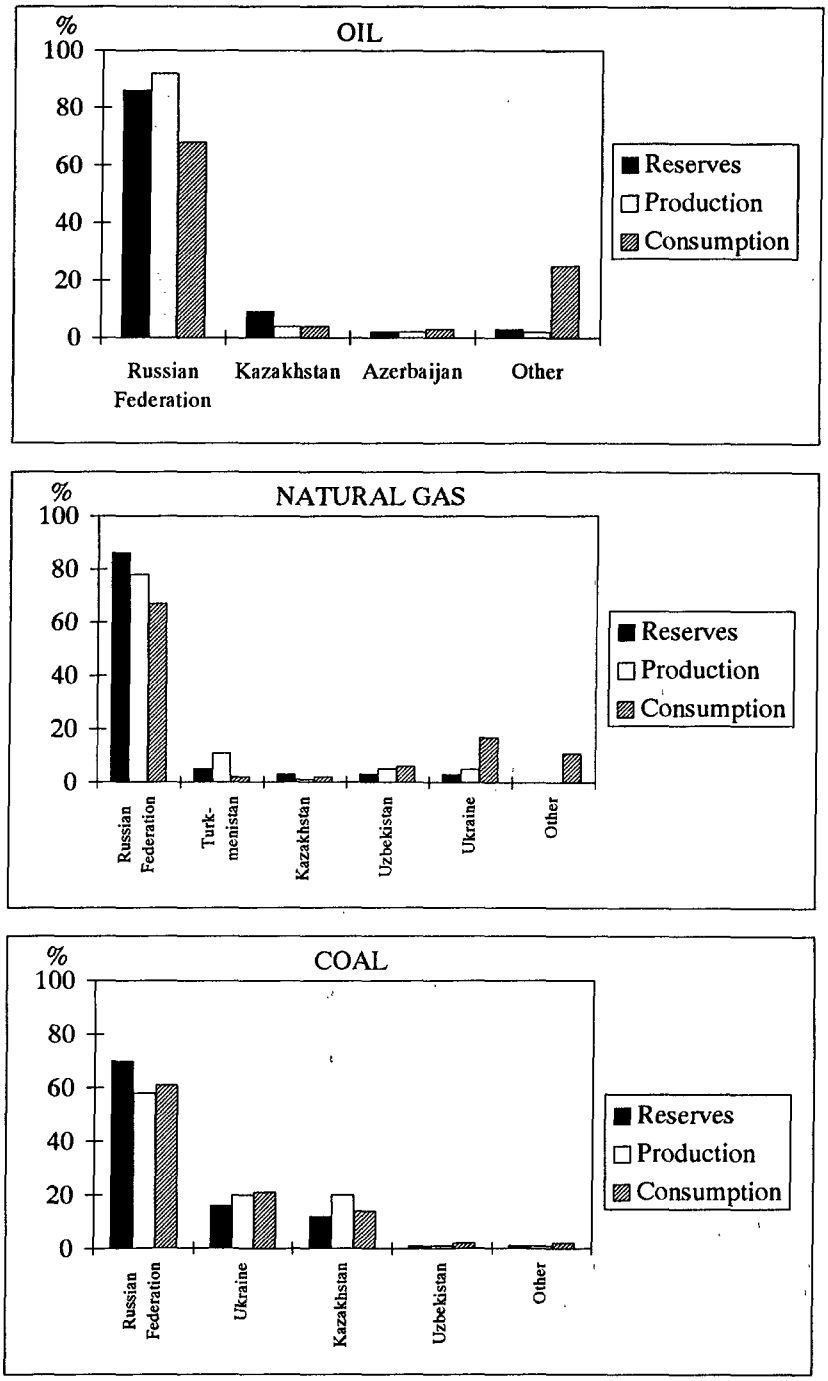
It is extremely difficult to generalize on the factors cited above as they vary according to the individual mineral or metal. Nonetheless, the energy factor is of crucial importance when estimating CIS mining industry prospects, in general. The rise in energy costs is likely to be comparatively sharp. Energy costs represents roughly up to one third of the total costs in aluminium production, most for electricity in the smelting stage. The energy costs in the production of other metals is probably lower judging by comparative energy consumption: one tonne of copper or steel has been estimated to require one third less of energy at the smelting stage, as compared with the average 16.000 kilowatt hours per tonne of aluminium in the Russian smelters. Since the late 1980's, the CIS mining industry has been facing two problems in the energy issue: irregular supply and increasing prices. The former will probably become one of the most serious concerns for the continuation of mining operations in the area.

In 1992, around 90 per cent of the explored oil reserves of the CIS were assigned to operating local oil producing enterprises. Development works of new production areas has been practically ceased and the volume of exploration drilling has been reduced drastically during the last five years. Unavailability of petroliferous areas prepared for development has become one of the major reasons for the lower oil output levels in the area.

Oil production in the CIS countries declined from 632 million tonnes of oil equivalent (mtoe) in 1987 to an estimated 420 mtoe in 1993. Particularly the oil producing areas in Western Siberia show the most marked declines (80). To prevent a further fall in energy production, the CIS countries are looking for foreign investment in the oil sector. According to the World Bank, a significant impact on the CIS crude oil production from foreign investment is not likely to be realized until late in the 1990's. The Republic of Kazakhstan is the second largest oil producer of the CIS and has the most favourable conditions to significantly increase its oil production in the long-term.

Around 70 per cent of the CIS coal resources are located in the Russian Federation (see Figure 14). Traditional coal mines west of the Urals are near depletion and have higher production costs than mines located in the eastern part of Russia. The share of the most valuable coking coals and anthracites amounts to only 10-15 per cent of the total explored coal reserves (81), which is insufficient to compensate for the depleting capacities. The rest are low quality and highly pollutioning brown coals. In the 1950's, coal accounted for about 70 per cent of the total primary energy requirements. Since the 1970's the share of coal has been around 20 per cent. The iron and steel and non-ferrous metal industries consume about 20-25 per cent of the total coal consumption. The shift of coal production and consumption to remote regions of Siberia has resulted in deteriorating working conditions. Unrest in labour-management relations will

Figure 14. Distribution of Reserves, Production and Consumption of Energy Minerals in the CIS Area, 1992



Sources: International Symposium "Mineral Resources of Russia", November 10-13, 1993, St. Petersburg; V.P. Orlov: MRR 2.93; Development of the Mineral Raw Material and Fuel Base should be supervised by the State, page 6-7; and several sources.

probably continue affecting depressed production levels, also in the medium-term (82). The rich coal deposits in the Ukraine and Kazakhstan are increasingly likely to be utilized for political, social and economic reasons (83).

The territory of the CIS has the largest natural gas reserves in the world. The Russian Federation possesses around 70 per cent of the CIS total gas resources, located in Siberia, Central Asia, Sakhalin Islands and also in the western part of the Urals (see Figure 14). West Siberia is the largest gas producing region, accounting for almost 70 per cent of the total gas output. The european part of Russia produces around 12 per cent of the total output and Central Asia and Kazakhstan account for about 15 per cent of the total. West Siberia would continue to be the most important source of gas in the CIS, also in the long-term perspective. Natural gas accounts for about 40 per cent of the energy consumption in the area, particularly for use in the industry and power generation (84). Environmental pollution problems have also affected the gas industry throughout the CIS area. One major concern was the Astrakhan gas processing plant near the River Volga. Development of the huge gas fields represents one of the most important prospects for the energy sector in general, and the mining sector in particular. A large transaction involving a joint venture agreement between enterprises from Finland, United States and the Russian Federation to build three petrochemical plants in West Siberia has been functionioning from the early 1990's (85). According to Russian officers, emphasis of energy prospects in the country will be directed to the construction programme for pipeline expansion and storage capacity.

While there is a large hydro potential in the Russian Federation, the development costs involved seems to be far from the possibilities of the country, at least in the 1990's. In addition, plans for construction of hydroelectric plants have been abandoned for environmental reasons and growing public opposition. Hydroelectric generation has been a major cause of removal of land from other productive uses in the CIS republics.

The ambitious objectives of increasing the hydroelectric capacity in the Caucasus, Pamir, Tian Shian and the eastern regions of Russia up to the year 2000 seem to be difficult to meet.

6.6. Metals production prospects

Available information and data on mineral raw materials production, consumption, capacities, diverse factors of supply and determinants of investments in the CIS area are not definitive and cannot be considered as corresponding western data. Collecting information on investment in mineral production directly from government or from private sources in the CIS is not

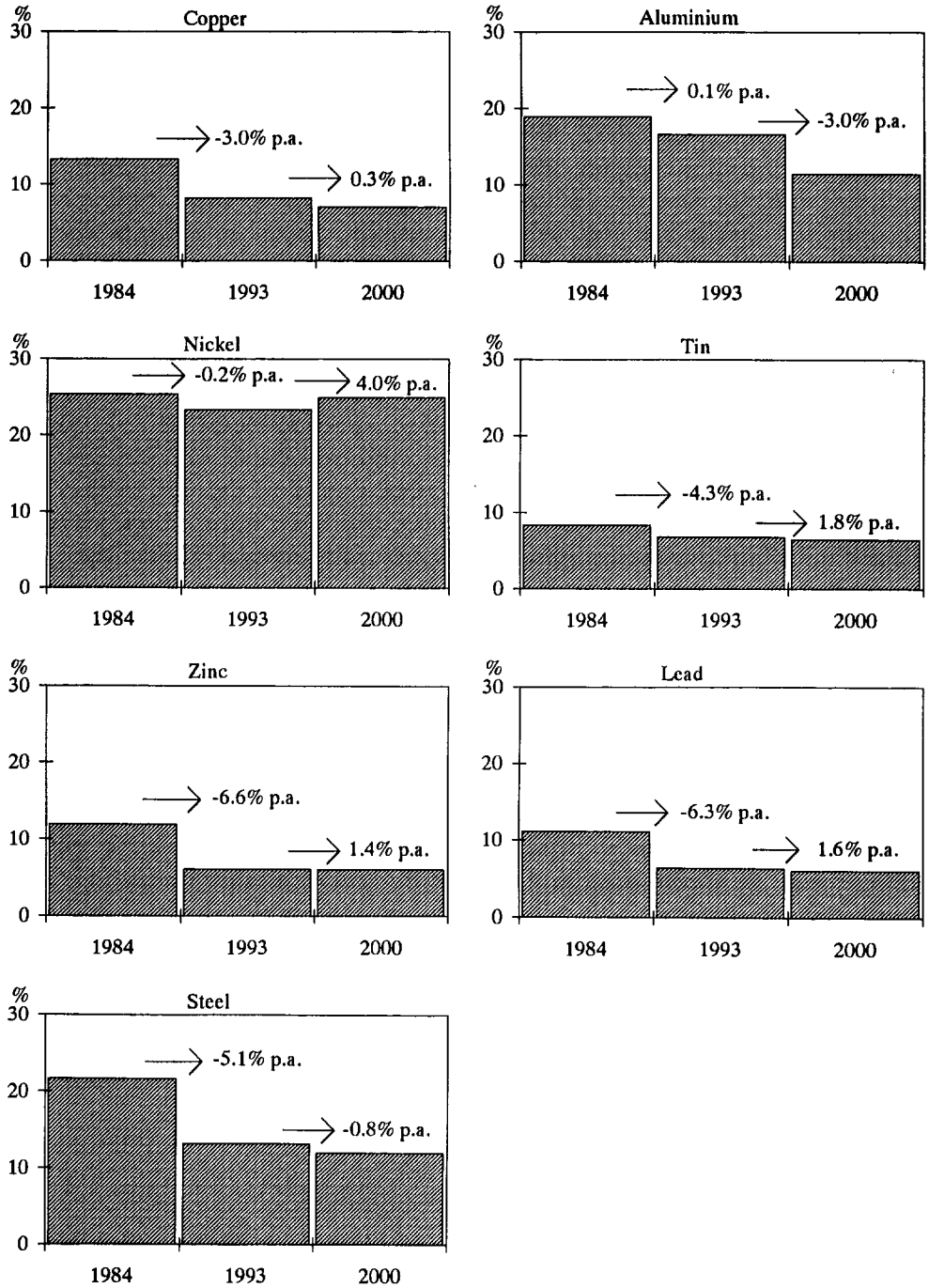
feasible, at least at present. Various Russian and international institutions, study groups and specialized publications increasingly include information on a, still partial, product-by-product review, which provided the basis for the interpretation of relevant information to estimate the medium-term CIS metals production prospects (see figure 15).

Developments which took place during 1989-1994 in the CIS mining policies were caused - to a large extent - by a dramatic reduction in metals demand from the military-industrial complex. The deceleration of the global arms race which was using roughly one trillion US dollars a year during the 1980's, and the reductions of metals use for defence purposes - both in western and CIS countries - have a great significance on the prospects for metal markets. Not only because metals demand for defence industry decreases but also because metals already used in military equipment are sold in the market as scrap or as raw materials from western and eastern strategic stockpiles.

After a long period of hostile relations between western industrialized countries and the Soviet Union, improvement of the political climate and the economic relations would increasingly facilitate western access to the CIS mineral raw materials. At the same time, the United States and West Europe dependence on CIS and developing countries mineral supplies will increase. Unlike the 1960's and 1970's, this dependence does not need to be seen as a negative aspect. A changing degree of dependence on foreign supplies of minerals will continue to be a concrete factor of the relations of all countries in the world. A complete self-sufficiency - so strongly pursued by the Soviet Union system - is impossible to achieve by any country, either physically or because it is too costly.

In the light of recent developments in the worldwide internationalization of the mining sector the possibility for a turn-back to future isolation of CIS mineral and metal industry appears weak. Whatever political economy for the CIS mining sector these countries implement, they cannot escape competition in the international market.

Figure 15. Growth Rates p.a. 1984 - 1993 and 1993 - 2000 and Shares of CIS in World's Metals Production, in 1984, 1993 and Prospects in 2000.



Sources: World Bank and Metallgesellschaft, (actual); VATT (projected).

6.7. A comparative view on the main differences and common problems of mining sectors in the CIS and developing countries

Before the disintegration of the Soviet Union, three country groupings in world economic analysis were usually made: industrialized market-economy countries, socialist countries and developing countries. In terms of economic growth, socialist countries had been trying for decades to catch up with the first category, while developing countries had been trying to find a place of their own. At present, and according to a classification of economies by income and region used by international institutions (87), more than 30 developing countries have already reached a higher stage of growth than the CIS lower-middle income economies.

From the mining sector perspective, the basic characteristics of these three groups are:

- very roughly around two thirds of the mineral reserves in the industrialized market-economy countries are located in United States, Canada, Australia and South Africa. The largest share of lead, zinc, gold and chromium reserves are held by these countries.
- the predominant part of developing countries mineral reserves are held by a limited number of countries. Very roughly around two thirds of these countries do not posses economically significant resources; the largest share of world reserves of copper, bauxite, tin, nickel, cobalt, tungsten, and antimony are found in developing countries (see Figure 3).
- the Soviet Union and now the CIS is nearly self-sufficient in most major minerals with the very important exception of bauxite, and probably in the case of tin, silver and tungsten. The concentration of CIS mineral resources in the Russian Federation area is very marked (see Figure 4) .
- the group of industrialized market-economy countries is the world's largest producer of major base metals with the exception of tin. At the same time, the group produces only around three quarters of their metal needs (81 per cent in copper, 87 per cent in aluminium) in spite of large surpluses of production over consumption in Australia (Al, Pb, Zn, Fe, Ni) and Canada (Al, Zn, Ni,) The characteristic trend may be a declining production share of practically all major metals and minerals in the 1990's, although the decrease will be far from the dramatic figures forecasted in the 1970's.
- the dominant trend for the 1980's in the minerals and metals global supply was an increase in the developing countries' share. This rise, however, was not as significant as it was generally anticipated in the 1960's and the 1970's, but may be predicted to be faster in the 1990's.
- in the case of CIS countries, new forecast figures are clearly different from those in the 1950-1979 period. Their share in the global supply of most

minerals and metals will decline slightly , although a decrease in steel and aluminium may be significant (see Figure 15).

- the economies of the CIS countries (increasingly) and those of the developing countries (decreasingly), are dependent on mineral raw materials and refined metals exports.

6.7.1. International cooperation

The main factors affecting global affairs in the post-war period reflected mostly East-West competition to achieve geopolitical and military objectives. Developing countries were regarded as some kind of stage for the extension of the economic and ideological conflict of the super-powers. The East-West competition also affected the intensity and the objectives of the international cooperation. Distribution of international aid depended to a large extent on the ideological orientation of developing countries' governments, for large-scale economic and technical assistance including their mining industry. In the 1990's a number of the CIS members and the majority of the heterogeneous group of developing countries are increasingly being classified as "politically safe" for external assistance and cooperation in their process of structural reform toward a market oriented economy. As a result, new trends are emerging in the character of mining agreements to better balance the local or national requirements of host countries, international mining enterprises and banks. The adjustment process, however, follows a more rapid schedule in developing countries than in the CIS area.

Improvement in the relations between partners in mining ventures in developing countries - host countries private and public mining sector and international mining enterprises and institutions - has favoured investment finance for diversification projects in non-ferrous as well as in precious metals.

On the contrary, foreign investment in the CIS mining and metals industry has been limited. Around three quarters of the projects negotiated are in the gold exploitation in regions where an appropriate infrastructure already exists. This trend could reflect two main influences: a shorter payback period associated with gold mining and the ease of transport by air or other means compared with the large volumes of ferrous and non-ferrous ores and metals which need massive means of transportation. International investment for diversification projects in the CIS mining industry require improvement in the supply of information. The growing interest of possible partners in mining-ventures is to increase competitivenesss of diverse metals, in addition to gold, and exploit the comparative advantages of the CIS mining sector.

6.7.2. Control over mineral resources

The political concept of "permanent sovereignty of developing countries over their natural resources", as used in United Nations' forums in the 1960's and 1970's, has been transformed over three decades. In most mineral rich developing countries, parallel to privatization processes, the concept has been stripped of all its connotations of economic independence or social claims and it is no longer considered as an obstacle to foreign investment expansion.

In many of the CIS republics, especially during the first years of the 1990's, governments - at local or national level - were convinced that they possess sufficient technical and financial resources to make the necessary adjustments in mining industry without external cooperation. The establishment of an appropriate athmosphere for foreign investment encouragement in the CIS countries is a very recent trend and it is still marked by sometimes strong nationalism.

6.7.3. State mineral enterprises

The mineral policy of the Soviet Union was based on the principle of maximum self-sufficiency at any price. The actual cost of production was not a significant factor in the selling price of the ores and metals on the domestic or international market. The centrally planned economy system enabled any price level suited to meet political and economic requirements. From the Soviet Union perspective, mining and metallurgical centres were kept in operation with government subsidies because the value or potential value - social, political, or strategic - exceeded the expenditure, and this relationship was expressed as a profit.

State mineral enterprises in developing countries (88) often had a complex and multiple goal structure, which may have involved a variety of social responsibilities including considerations on national employment, income distribution, regional development national sovereignty, etc. They operated under lower pressure to minimize costs. Corporación Minera de Bolivia (Comibol), for example, was for several decades (1952-1992) that country's most important company generating foreign earnings, due also to its social impact on the whole nation. Comibol, however, often made losses, and sometimes for long periods. The company was seen - internally and internationally - as a drag on the national economy, with a reputation of being overstaffed and under-efficient. Depending on the perspective of the observer, Comibol was either proof of the inherent inefficiency of the state mineral enterprises or a standard bearer of the public sector enterprise which made the best out of poor financial and technological circumstances. From a worldwide perspective, I. Dobozy (89) argues that it is not possible "to take the stand that

all state mineral enterprises engaged in non-commercial objectives must necessarily be financial disasters, but it would be too simplistic to assume that financially profitable SMEs are necessarily socially oriented."

Criticism on the SMEs in developing countries was not made by industrialized market economy standards alone. In the Soviet Union, it was considered necessary for developing countries to develop a rational and integrated system of efficiency criteria for the state sector which would identify the socio-economic and financial aspects of the state enterprise performance (90). The same criticism would be valid for the mining sector in the Soviet Union, too. From the western perspective, a large number of mining and metallurgical operations in the centrally planned system of the Soviet Union and state mineral enterprises in developing countries would have been uneconomic by market economy standards. Mining in the CIS and in several developing countries have their own specific characteristics, but one common challenge for the immediate future: how to implement structural changes to make their mining enterprises competitive apart from non-commercial, political and social considerations.

6.7.4. Environmental aspects of mining

The mining industry has an immense environmental pollution effect worldwide. Mining operations strip 28bn tonnes of material yearly, which means more than that removed by all the rivers in the world. Mining generates 2.7bn tonnes of waste, partly hazardous, which is far more than the world's total accumulation of municipal garbage. The mines and smelters use every year up to one tenth of all the energy used by mankind and pump 6m tonnes of sulphur dioxide into the atmosphere, a major cause of acid rain (91).

Mining, throughout history, has severely harmed the environment in industrialized and developing countries. Increasing pressure of public opinion has resulted in stricter regulations on mining operations worldwide. Serious efforts towards the solution of environmental problems resulting from mining and processing started in the early 1970's. Initially, actions to alleviate pollution were concentrated in the industrialized market economy countries. Increased processing of minerals in developing countries and the subsequent aggravation of pollution problems made priority tasks of analysing the situation and the environmental effects of mining there. Rich mineral resource countries (Malesia, Indonesia, Chile, Thailand, Bolivia, etc) undertook comprehensive methods to safeguard the environment as early as the beginning of the 1980's. Governments and mineral enterprises from the large metals consuming countries had and still have special responsibility for ensuring that new environmental damage is kept to a minimum.

Western European governments have made clear their profound concern about pollution caused by mining operations in the CIS. It can also be expected that the knowledge of the immense costs of pollution as a result of smelting and refining operations in the area, increases the concern of CIS mining enterprises with regard to this problem. Table 21, included in an UNCTAD study regarding the environmental impact of mining in developing countries in the late 1970's, can be adapted to the present situation in the CIS countries. The effects detailed in the list are a concrete reality in CIS mining and could become more serious in the future if rapid measures are not taken by the whole international community.

Table 21. Environmental Effects of Mineral's Processing

		Non-ferrous metals, smelting and refining	
Area of environmental impact	Iron- and steel-making	Copper, nickel, lead, zinc and others	Aluminium
<u>Man</u>			
Pollutants	Dust, SO_2, CO, Hydrocarbon, derivatives, heat, noise, acid waste.	Smelting: SO_2, gases heavy metals, particulates, noise, lead fumes. Refining: acid mist fumes, NH_3, nickel carbonyl.	Smelting: particulates, gases (fluorides), noise, heat, high electro-magnetic fields.
Effects	Possible respiratory effects and lethal accidents. Cancer.	Respiratory diseases, cancer.	Possible respiratory and other diseases. Effect of magnetic fields unknown.
<u>Land</u>			
Pollutants	Accumulated slag and metallic oxide, dust, sulphide leaching of slag.	SO_2 and particulate rain from stack plumes, slag heaps.	Miscellaneous waste materials.
Effects	Contamination by leaching. Aesthetic effects of waste dumps and areas.	Aesthetics. Burning of trees and vegetation, soil contamination by heavy metals. Corrosion of materials.	Aesthetics.

Area of environmental impact	Iron- and steel-making	Non-ferrous metals, smelting and refining: Copper, nickel, lead, zinc and others	Non-ferrous metals, smelting and refining: Aluminium
Water			
Pollutants	Pickling, acids, sludges, ether solubdes. Suspended solids, bod, phenols, cyanides, heavy metals, phosphates. Heat pollution, NH_3 leaching from slag.	Smelting: Suspended solids from slag, leaching, acid rain, mercury. Refining: Suspended solids, pH, toxicity, leaching and electrolytic waste solutions, heavy metals, leaching solutions.	Suspended solids, fluorides, ether solubles.
Effects	Harmful to aquatic life, possible pollution of potable water supply.	Harmful to aquatic life, acid build-up in lakes and other toxic substances, e.g., heavy metals. Can affect potability of water.	Harmful to aquatic life.
Air			
Pollutants	Coke ovens: SO_2, particulates, hydrocarbons, (corrosive gases, dust), airborne dust (noxious gases and dust). Blast furnaces: H_2S from slagging, particulates. Smeelmaking: particulates, fluorides, Cd, CO, acid fumes, hydrocarbons. SO_2.	Smelting: SO_2, particulates, heavy metals (As, Cd, Hg, Pb, Zn). Lead: lead fumes, mercury. Refining: particulates, fumes. Zinc: Acid fumes, $ZnSO_4$ fumes. Nickel hydrometallurgy: NH_3	Smelting: particulates, fluorides hydrocarbons SO_2. Refining: particulates, Cl; SO_2 (drying fuel).
Effects	Corrosion of metal surfaces and building facades, blackening, paint deterioration.	Respiratory diseases, transport of SO_2 pollution, vegetation damage.	Fluorides toxic to some vegetation, direct effect on humans, food-chain accumulation of fluorides.

Source: Minerals and the Environment: Current Problems and Policies, Metal Bulletin MR 163 (Ottawa, Energy, Mines and Resources Canada, 1976); Cited in United Nations; Committee on Natural Resources, Sixth Session, Turkey, June 1979; E/C.7/97.

In the case of the CIS mining industry, the environmental impact of mineral operations along the whole production chaim should be emphasized: exploration, development, extraction, concentration, smelting, further processing and abandonment. All these stages produce some form of pollution of differing intensity from mineral to mineral and location to location. Data on pollution control costs are non-existent in the CIS countries. They have to be derived from similar operations already implemented in industrialized and developing countries. Pollution control technology used in developing countries may also be properly utilized in future environmental control measures in the CIS due to more or less similar infrastructural conditions. However, to meet international environmental standards of mining operations in the CIS countries requires far larger investments and much more time, since the over-all pollution levels in this area are clearly more serious than they were in developing countries. The international community should help in providing an environmental legislation and the so hardly needed mechanisms for the CIS mining and metal industries, before the environmental damage becomes irreversible from a worlwide perspective.

7 THE RELEVANCE OF CIS MINING INDUSTRY FOR FINLAND

Finland's mineral resources are relatively modest in the world scale. However, compared to the mineral resource base of Europe, it can be argued that Finland is well endowed with some important minerals.

Table 22. Mineral Reserves in Western Europe, 1990, (million tonnes of metal content)

	Bauxite	Copper	Lead	Zinc	Iron	Nickel	Chromium	Cobalt	Titanium
Finland	0	1.00	0.01	1.00	27.00	0.08	8.90	0.02	1.40
(percentage)	*0*	*4.3*	*0.1*	*3.8*	*0.8*	*9.2*	*79.5*	*100*	*4.2*
France	30.00	..	0.10	1.00	900.00	0	0	0	0
Greece	600.00	0	0.50	1.00	12.00	0.45	0.40	0	0
Ireland	0	0	0.70	5.00	0	0	0	0	0
Norway	0	1.00	0.04	0.18	200.00	..	0	0	32.00
Portugal	0	3.00	0	2.00	0	0	0	0	0
Germany	2.00	..	0.10	1.00	35.00	..	0	0	0
Spain	5.00	1.00	1.70	5.00	230.00	0	0	0	0
Sweden	0	1.00	1.00	1.00	1,600.00	0	0	0	0
Austria	0	0	0.02	0.19	30.00	0	0	0	0
United Kingdom	0	..	0.13	0.07	14.00	0	0	0	0
Total	**1,342**	**23.00**	**9.69**	**26.00**	**3,214.00**	**0.87**	**11.20**	**0.02**	**33.40**

.. = not available
0 = zero or less than half the unit of measure

Sources: World Resources 1992 - 1993; a Report by the World Resources Institute; based on data from the U.S. Bureau of Mines and UNESCO.

Mineral reserves are directly related to physical, technological, economic and even political conditions. Figures for Finland in Table 22, include sub-economic resources (Fe, Co, Ti) which are not being exploited at the moment. For example, the fact that Finland has 100 per cent of cobalt - an important strategic metal - reserves in Western Europe, does not mean good news for the national mining industry. Since cobalt is primarily a by-product of copper and nickel, its economic exploitation is affected by the declining domestic production of those two major metals. After the closure of Keretti and Vuonos the only potential resources as a subproduct of gold, are at Juomasuo (see Figure 19).

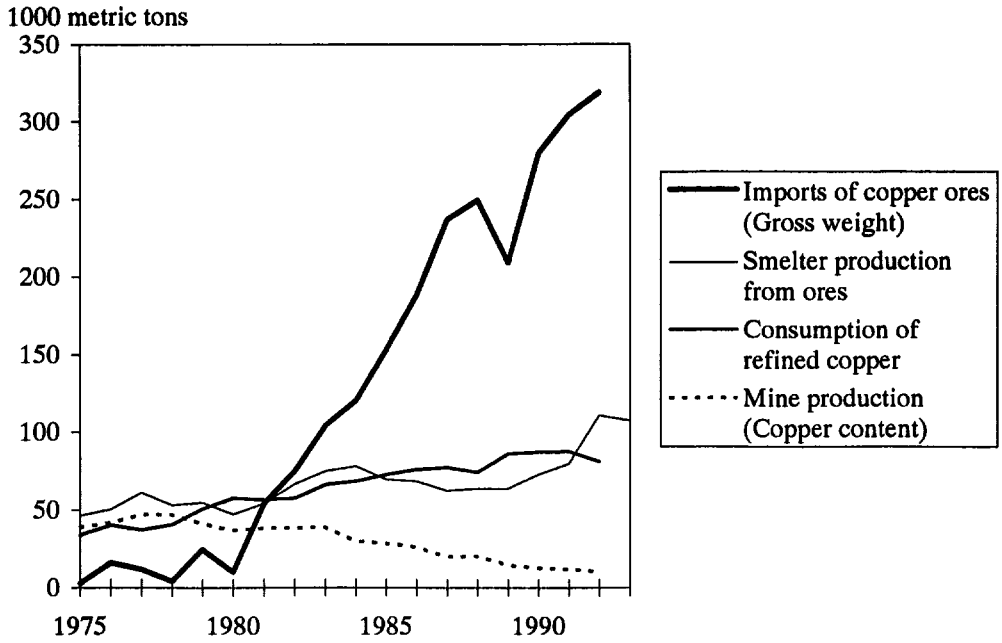
In the 1980's, the gold potential of Finland was greatly expanded and exploration has led to the discovery of several deposits with economic interest. According to specialists, gold mining will become an essential part of the mining industry in Finland (92). In September 1994, the world mining industry was surprised with the discovery of a diamond deposit in Finland. According to an executive of the company that made the find, the basic geology in Finland is promising for the discovery of an economic diamond deposit. The exploration areas are close to high infrastructure and the prospects for commercial deposits are considered to be high (93).

7.1. Increasing dependence on mineral raw materials imports

A significant factor for mining and metallurgical industries operations, is that Finland does not possess within its territory, sufficient mineral resources compared with the needs of the national smelting capacity and steel industry. In 1992 Finland's share of the world smelter production from ores was 1,1 per cent, in copper, in nickel 1,8 per cent and in zinc 2,5 per cent. The gradual exhaustion of economic mineral reserves and the corresponding decrease of the domestic mine production has been covered by a growing dependence on external supplies, with the exception of chromite.

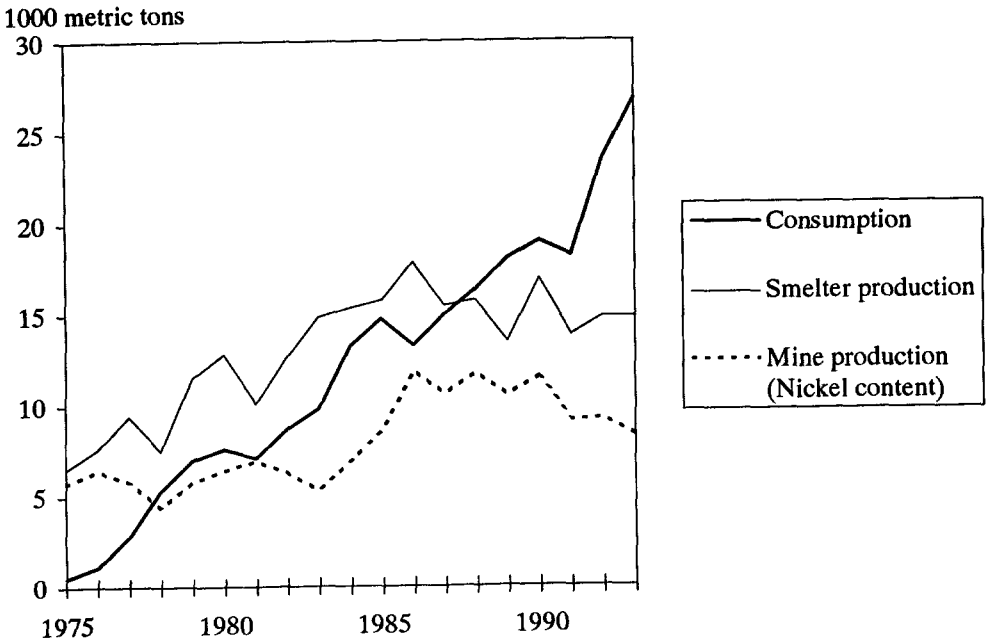
In 1972, the production of concentrates from national mines accounted for around 84 per cent of copper and 62 per cent of zinc. In 1992 only one tenth of copper and around one fifth of zinc concentrates were mined locally. Foreign supplies have increased in the case of iron, copper, nickel and zinc (see Figures 16-18). This trend does not only affect the situation regarding the supply of concentrates for the installed smelting capacity but also increases the import dependence with regard to national consumption of metals.

Figure 16. Copper Production and Consumption in Finland 1975 - 1993



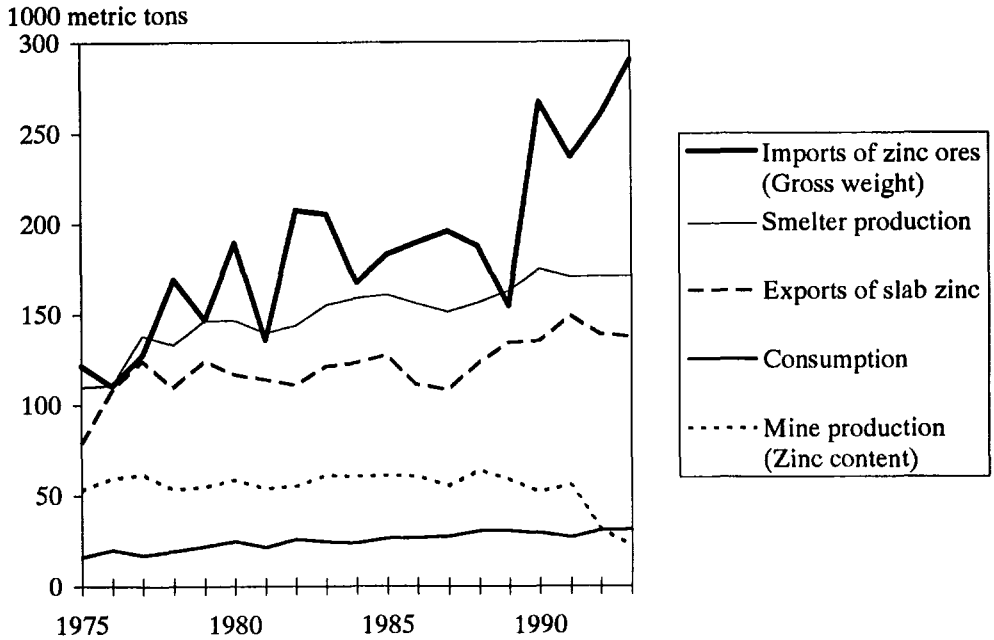
Sources: Metallgesellschaft: Metalstatistics various issues, Frankfurt AM, 1975 and 1992
Outokumpu Oy: Annual Report 1993.

Figure 17. Nickel Production and Consumption in Finland 1975 - 1993



Sources: Metallgesellschaft: Metalstatistics various issues, Frankfurt AM, 1975 and 1992 Outokumpu Oy: Annual Report 1993; INSG: World Nickel Statistics, Monthly Bulletin, October 1994.

Figure 18. Zinc Production and Consumption in Finland 1975 - 1993

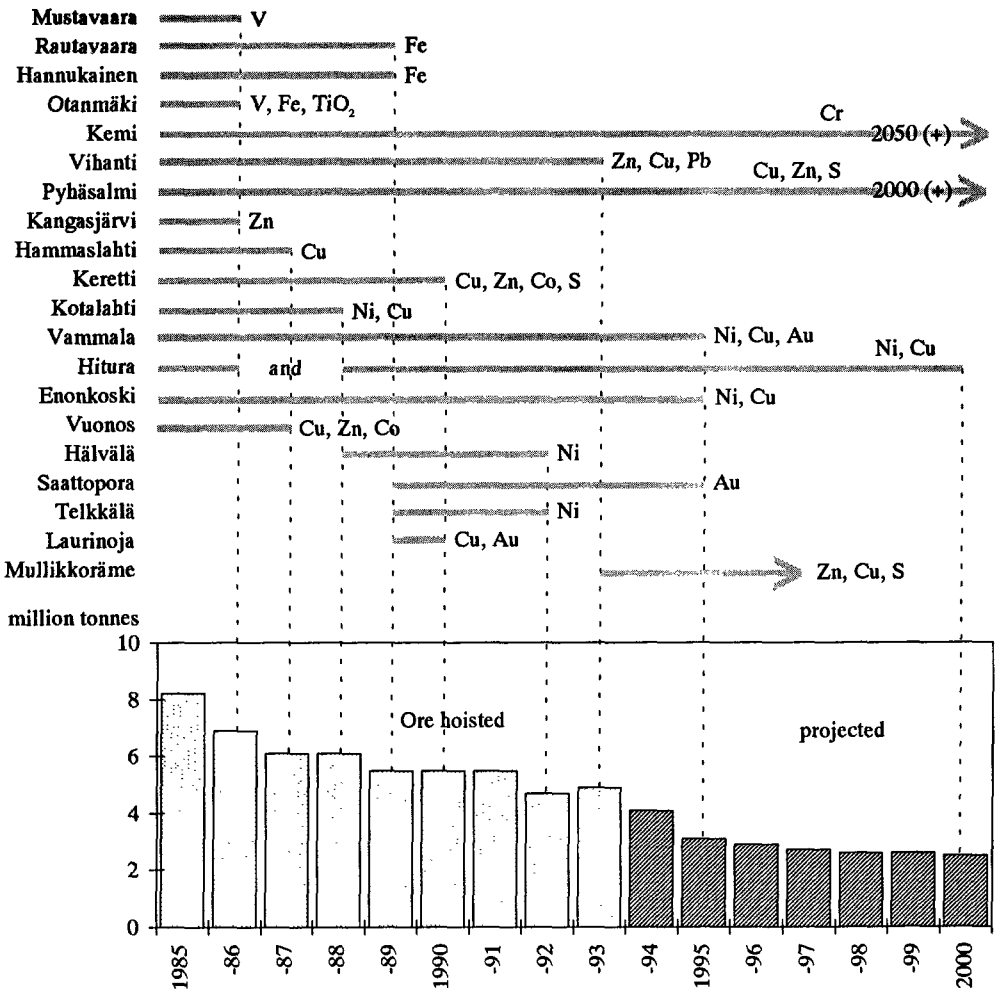


Sources: Metallgesellschaft: Metalstatistics various issues, Frankfurt AM, 1975 and 1992 Outokumpu Oy: Annual Report 1993; ILZSG: Lead and Zinc Statistics, Monthly Bulletin, September 1994.

The metal industries in Finland as in most highly industrialized countries depend on imports of mineral products of different processing stages. The unavailability of certain metals may seriously hamper production in essential industries even though the physical amount and value of a particular metal in total output may be negligible.

Prospects up to the year 2000, for the mining of metallic ores in Finland indicate further decline. In 1993, there were six mining operations in the national territory: Kemi (Cr), Pyhäsalmi (Zn, Cu), Hitura (Ni, Cu), Enonkoski (Ni, Cu), Vammala (Ni, Cu) and Saattopora (Au). During 1994-1995 three mines will be closed: the Vammala and Enonkoski nickel mines and the Saattopora gold mine, due to depletion of reserves. Of the mines with large but poor quality resources, Mustavaara (V) and Rautuvaara (Fe) were already closed in the mid-1980's (see Figure 19).

Figure 19. Finland's Mineral Production and Life Cycle of Mining Operations



New discoveries and potential deposits	
Koitelainen, Sodankylä	Cr
Talvivaara, Sotkamo	Ni, Zn, Cu
Pahtavaara, Sodankylä	Au
Rauhala, Ylivieska	Zn, Cu
Juomasuo, Kuusamo	Au, Co
Osikonmäki, Rantasalmi	Au
Keivitsa, Sodankylä	Ni, Cu, Au, Pt
Ward, Ilomantsi	Au

New operations and preparation works	
Mullikkoräme 1993	Zn, Cu, S
Pahtovuoma 1992 - 1993	Cu
Orivesi 1994	Au

Sources: 1985 - 1993, ore production volumes, U. Salo, Ministry of Trade and Industry; Mining operations cycle, interviews in Outokumpu and the Geological Survey of Finland; New discoveries, P. Nurmi, GSF; and VATT estimates.

7.2. Prospects of the Finnish mining activity

Finland's largest mining company is the Outokumpu Group. The company traces its origins to the discovery of a rich copper deposit at Outokumpu, eastern Finland, in 1910. Mining operations started in 1913 and at the end of the 1920's the mine was modernized. The State acquired majority shares in the company in 1932 (94).

Table 23. Mineral Reserves of Outokumpu's Mines, 1993

Proven and probable ore reserves		Million tonnes	Ni %	Cu %	Zn %	Pb %	S %	Au g/t	Ag g/t
Mines									
Finland	Enonkoski	0.61	0.37	0.10					
	Hitura	1.54	0.66						
	Pyhäsalmi	6.4		0.9	2.01		38.8	0.4	14
	Saattopora	0.1		0.23				2.9	
	Vammala	0.33	0.56	0.35					
Australia	Forrestania	4.52	2.03						
	Thalanga 25 %	0.82		1.74	9.01	2.73		0.5	79
Ireland	Tara	25.4			8.6	2.5			
Norway	Grong	3.0		1.65	1.88				
Sweden	Viscaria	1.3		2.52				0.3	
Mine projects									
Finland	Kutemajärvi	0.43						7.2	
Australia	Lady Loretta 24 %	1.33			16.9	8.3			122
Chile	Zaldivar 50 %	157.9		0.89					

The table presents Outokumpu Metals & Resources' share in tonnes. Unless indicated otherwise, Outokumpu's share of the mine or mining project is 100 %.

In addition to the ore reserves indicated above, there are substantial levels of measured, indicated and inferred mineral resources at the Tara mine (15.9 million tonnes, 5.6 % Zn and 2.4 % Pb), at the Forrestania mine (7.2 million tonnes, 1.68 % Ni), at the Hitura mine (4.47 million tonnes, 0.81 % Ni) and the Zaldivar mine project (Outokumpu's share 79.4 million tonnes, 0.50 % Cu).

Source: Outokumpu Annual Report, 1993.

A present, Outokumpu is an international group which operates in the mining, smelting and refining of copper, zinc and nickel, chromium, stainless steel, copper products and relevant technology. As a result of two share offerings in 1993, Outokumpu's ownership base became increasingly international. The Finnish State's shareholding fell to 50.1 per cent and it will probably decline further in the coming years (95). The share issue at the end of 1993 brought the Group a significant amount of international capital.

Copper

In the period 1992-2005, world consumption of refined copper is forecast to grow at 2.2 per cent compared with the 1.6 per cent experienced in 1980-1991 (96). World mine production of copper will follow refined metal consumption growth so that it will increase during the same period at a rate sufficient to keep an approximate balance between supply and demand. In the medium-term outlook of around five years, developing countries' mine production growth will balance copper concentrates supply to the installed smelting capacity in Western Europe. Long-term perspectives may reflect some tightness in the concentrates market as a result of the planned smelting and refining production expansion in large copper-mining countries, especially Mexico, Peru, Chile, Zaire and Poland.

It seems very improbable that potential low-grade copper ores can be exploited in the medium-term run in Finland. World copper reserves have increased dramatically during the past two decades, while Finland's traditional rich copper deposits will be exhausted in the 1990's. Finland's copper smelting prospects are, however, better than those in the 1980's as a result of the expansion of copper mine production, particularly in Chile, where Outokumpu operates. Together with a Canadian enterprise, Outokumpu owns a very large copper mine at Zaldivar (see table 23) in northern Chile, with an initially calculated life span of 17 years. The mine is under construction and will start production in 1995. Output has been projected at 120 000 tonnes of cathode copper per year (97).

Finland's copper metal production is centred at Harjavalta, while the refining plant is in Pori, both in the western part of the country. According to Outokumpu's investment programme for metal production expansion, smelting capacity will increase from 100.000 tonnes to 160.000 tonnes and cathode copper capacity of the electrolytic refinery will increase from 70.000 tonnes to 125.000 tonnes per year. The increased production capacity will come on stream in 1995-1996. The supply of copper concentrates for the smelting works relies almost entirely on the production of Outokumpu's own mines abroad, long-term purchase agreements and possible additional copper raw materials imports.

Table 24. Finland's Copper Industry 1980 - 2000

	Finland's share in Western countries, %			Distribution of capacity, % In Finland			Abroad		
	1980	1990	2000	1980	1990	2000	1980	1990	2000
Mining	0.8	0.6	0.8	69.0	26.3	7.1	31.0	73.7	92.9
Smelting	0.7	1.0	1.1	97.4	100.0	100.0	2.6	0.0	0.0
Refining	0.5	0.7	1.0	96.8	84.6	53.1	3.2	15.4	46.9

Sources: Based on UNCTAD: A review of major developments in the world copper market and industry from 1980 to 1992 and future prospects; a Report by the UNCTAD Secretariat/COM/37, 8 February 1994, p. 67 - 72.

Zinc

World demand for zinc is projected to grow at an average annual rate of 1,5 - 2,0 per cent over the 1992-2005 period (98). There are a large number of undeveloped and potential new zinc mine projects throughout the world which should be sufficient to meet demand increases until the year 2000 and beyond. In the first years of the 1990's there were around 120 undeveloped projects with reserves of 90-100 million tonnes of zinc. The trend towards increased smelting of domestically produced zinc concentrates is expected to continue in developing countries.

Regarding zinc mine production in Finland it seems (as in the case of copper) that potential low grade deposits cannot be exploited in the future. A decisive factor in developing the local zinc industry in Finland was the exploitation of the large Vihanti zinc-copper deposit which was closed in 1993. The zinc smelter is located at Kokkola, western Finland. Its present smelting capacity (around 180 000 tonnes per year) is already operating with two thirds of imported concentrates in addition to the Pyhäsalmi zinc ores production. The supply needs are covered in the medium-term period. Outokumpu also owns the Tara mine in Ireland, the largest zinc mine in Europe and the fourth in the world (see Table 23), with a production capacity of 190.000 tonnes of zinc-in-concentrates yearly. Finland's highly modern zinc smelting plants will be able to operate in the long run on the basis of foreign concentrates, particularly from Australia, Ireland and Spain - countries where the Outokumpu Group has focused its zinc exploration and mining activities.

The development of a new energy and environmentally friendly zinc production process in Finland makes this sector's prospects much more satisfactory than those in a number of industrialized countries, where smelting plants have been

closed due to environmental regulations and problems in the supply of concentrates.

Nickel

Compared with most other base metals, nickel mining is clearly more concentrated in a few large companies, which, at the same time are vertically integrated from mining to refining. These large enterprises own some important nickel mines or have established joint ventures in developing countries. During the past three decades, the geographical pattern of nickel production has changed substantially, with developing countries increasing their share in world output from 15 per cent in 1961 to 41 per cent in 1992. This has been, however, at the expense of industrialized market economy countries whose nickel mine production share fell from 60 per cent to 34 per cent during the same period.

Stainless steel accounts for about half of all intermediate nickel uses, followed by nickel plating and high nickel alloys. Growth rates for nickel use in stainless steel and electroplating have been considerably higher than those of other uses. Stainless steel contains from 5 to 20 per cent nickel in addition to other alloying metals such as chromium, tungsten, molybdenium, manganese and cobalt (99).

During the 1980's, the evolution of the nickel market resembled that of stainless steel. The long-term prospects for the growth of nickel demand are very strong. Compared with other base metals, nickel has special properties which make its use indispensable in end products such as stainless steel. It also has an important application in environmental protection programmes. The World Bank estimates that the worldwide outlook for nickel consumption over the period 1993-2005 will be around 2,0 per cent annual growth. Worldwide nickel production capacity is expected to increase by at least the same rate as nickel demand in the period 1993-2005. Most of the expansions will occur in Australia, Brazil, Cuba and Colombia.

To cover supply needs due to the decreasing production of concentrates from local mines, Finland's nickel smelting and refinery plants mostly use raw materials from Australia. Concentrates are smelted in the Outokumpu flash furnace and Pierce-Smith convertors and refined by electrowinning in the Harjavalta smelter-refinery. The present annual capacity is 18,000 tonnes of nickel in refined cathode. Outokumpu's investment programme for the period 1993-1996 at Harjavalta, will increase nickel production capacity to 32 000 tonnes per year.

The nickel and nickel-copper sulphide mines of Enonkoski and Vammala have recently been closed due to ore depletion. The Hitura mine, which was

temporarily closed in 1985 and reopened in 1988, is expected to continue its underground operations until around the year 2000. The ores are concentrated by flotation at the mine and processed into nickel oxides and salts at the Kokkola works.

The long-term prospects for the world supply of nickel ores emphasizes the role of rich deposits in developing countries. It is estimated that nearly 100,000 tonnes of annual production capacity was unused worldwide in the exceptionally low price period of 1993. In Finland, prospects for exploiting the large but low grade Sotkamo deposit are very weak. Furthermore, the outlook for the Vuonos open-pit deposit is poor until new and more competitive ore dressing and metallurgical techniques are developed in Finland. This picture could change if further studies and evaluation of the presumably large nickel-copper deposits of Keivitsa, in northern Finland, permit profitable operations of this seemingly potential resource.

The programme for the expansion and renovation of existing smelter-refinery capacity of nickel in Finland was based on ores and concentrates also being available in the long-term. Most of the nickel raw materials will come from Australia. The main sources are the Australian Outokumpu's own mine Forrestania, about 8000 tonnes of nickel-in-concentrates over the period 1992-2002, and from the Mounth Keith nickel mine of the Western Mining company in western Australia, which is scheduled for operation in early 1995, under a long term concentrate purchase agreement of around 14,000 tonnes of nickel-in-concentrates over the period 1995-2004. The expansion and renovation of the Harjavalta plants will increase the competitiveness of copper and nickel production in Finland (100)

Chromium

World steel consumption and production is expected to increase by only 1 per cent during the period 1992-2005, with almost all the increase occurring in developing countries. Compared to the prospective poor growth of total steel consumption, estimated world consumption growth of 3,0 per cent for stainless steel over the same period is clearly positive (101).

Stainless steel production of nearly 11,6 million tones (1993) accounted for 2,2 per cent of total steel output in the western world. However in monetary terms, its share represented more than 10 per cent. Stainless steel accounted for well over half the total chromium consumption. Its demand prospects directly determine the demand outlook for both chromite concentrates and the metallurgical intermediate product, ferrochrome. Since stainless steel consumption is expected to increase more rapidly than steel consumption, the

share of chromium used for stainless steel will increase to around 75 per cent of total chromium consumption. There is no known chromium substitute in stainless steel; stainless steel can be made without nickel but not without chromium.

During 1986-1991 chromite producing countries expanded production capacity of ferrochrome plants, resulting in a significant world overcapacity. Increased local processing caused a temporary shortage of chromium ores for the ferrochromium plants situated in some major industrialized market economy countries.

In Finland, mining of chromium ores will continue far beyond the year 2050. Outokumpu's Kemi mine is one of the most important chromium deposits in the world. Proven and probable ore reserves are about 65 million tonnes, and additional potential reserves amount to 80 million tonnes. The reserves are estimated to last for over 100 years at the current rate of exploitation (102).

Metallurgical capacity is fully utilized and prospects for production of ferrochrome and stainless steel based on chromium ores from the Kemi mine are highly satisfactory. Production is vertically integrated from chromite mining to semi-finished products in the Kemi-Tornio area in northern Finland. This is a very important characteristic and a strong advantage for stainless steel production in the country. However, the outlook for medium and long-term stainless steel consumption differs greatly from region to region. The clear trend of the 1990's will continue with overproportional growth rates of production and consumption in the newly industrialized countries of Asia and Latin America, and practically a saturation of the industrialized countries demand. Western Europe has been the traditional market for Finnish stainless steel.

7.3. Cooperation with the CIS mining industry

For a long time, Finland has played an active role in Soviet Union /Western European relations, reconciling the sometimes conflicting views of both sides. Due to her geopolitical situation, Finland had special ties with the Soviet Union. As a member of the OECD Finland belongs to the industrialized market economies. This special situation gave Finland an increased insight into the sphere of interests of the Soviet Union. There are, obviously, many different perceptions of what positive or negative aspects this situation represented. In any case, the experience remains fundamental for Finland's approach to finding effective, less rhetoric and more business-like attitudes and relations with the CIS countries.

The approach to Finnish cooperation issues in the CIS mining sectors has to be seen as a result of the analysis of the situation for individual minerals and metals. The objective in general terms should be to secure the appropriate balance of supply of ferrous and non-ferrous concentrates for an efficient longer-run functioning of Finland's smelting and refining plants. In particular, this will secure a further technological development of the Finnish mining know-how regarding the specific conditions of the CIS mining sector.

The extremely diverse nature of the CIS mining situation makes it rather difficult to identify and assess mineral investment problems in the sharply changing circumstances of the area. However, the possible national (Finnish) or multinational approach to this question should include the examination of both, temporary and structural aspects. The former refers to cyclical conditions which may affect investment decision by a weak or strong market situation; metals price levels and fluctuations, size of stocks, supply or demand shortages, etc. Economic, financial and political issues are more important in the long-term.

Economic and financial issues

The Finnish mineral companies have worldwide experience in mineral investment issues. Each one of the international projects and joint ventures is the result of a unique process. The reactions of the host countries mineral companies, public and private investors, banks and other financial institutions, local authorities, international institutions, public opinion, etc. might be useful to adapt experiences for improving investments in Russia and other CIS republics. Some recurrent issues which might be explored and assessed are:

- estimated profitability of the potential mineral venture/project, as compared to mineral investments in other regions of the world, both industrialized and developing countries, e.g. the current and future role of foreign mineral investment in Latin America and South Africa;
- the relations and objectives of mineral investors, financial institutions and CIS republics' governments might differ fundamentally form those experienced during the Soviet Union system;
- the role and attitude of international banks and institutions to participate in the financing of mineral projects and the efforts to develop and strengthen international co-operation for international investment in the sector;
- of particular importance in the case of the CIS mining industry are the prospects of increasing costs of energy and energy constraints, transport and labour and other variable costs;
- the lack of funds and declining self-financing capacity of mineral enterprises in the host country will make their participation with capital outlays for

exploration and mining/processing projects, including infrastructure, very difficult;

- perhaps the most important single consideration in mining ventures in the CIS area is the environmental effect of the project; the development of appropiate legislation to protect the environment from existing and future mining ventures and the level of the environmental protection costs;
- foreign mining enterprises should have a clear risk perception for capital investments regarding inflation, fluctuating exchange rates, guaranteed sales of minerals or metals, profits repatriation and the length of typical gestation periods for new mining and processing projects;
- there are alternative forms of mineral investment to be considered in negotiations with the CIS countries: consortia of mineral enterprises and banks, participation of international financial institutions, joint ventures with equity participation by the mineral host country and/or local private enterprises and foreign investors, service contracts without foreign equity participation, management contracts, etc.

Political issues

This category includes the strongest potential obstacles to mineral joint ventures and projects in the CIS region. Potential problems for investment by Finnish enterprises in the CIS countries are obviously common to all foreign mineral enterprises. The difficulties stem from either the CIS republics' political uncertainties in general, or from geographically limited locations. Some factors which might be considered regarding this issue are:

- the CIS' lack of experience regarding treatment of foreign mineral investors and the unpredictable changes in their legal mining decrees and laws;
- mining operations may become difficult as a result of military or civil disturbances. This includes labour problems, which can occur in national enterprises in the CIS republics, or in joint ventures or enterprises owned by foreigners;
- the question of nationalities is very delicate from the foreign investor perspective; endless claims of ownership of mineral resources by diverse groups are not easy to solve, at least in the short-term;
- in the particular case of the CIS countries, the question about the role of governments and the role of market forces to give the adequate answer to mineral investment activities needs to be clearly defined;
- in the particular case of the CIS countries, an impediment to foreign investment in mining and/or processing industries might be due to

protectionist policies of metals consuming countries; (e.g. European Union's tariff escalations or import shares).

The cautious attitude of Finnish mineral enterprises towards mineral investment in the CIS countries is not an exception. Reactions of mineral enterprises in Western Europe have also been relativeley slow. An increasing awareness of the problems described above is going to affect the intensity of investments in the near future, too. Nevertheless, there are important differences regarding potential advantages of Finnish/CIS joint-ventures due to the geographical location of mining projects. Two regions are of particular importance from the Finnish perspective; the Republic of Karelia and the northwestern region of Russia.

Mineral Resources of Karelia

After the disintegration of the Soviet Union, authorities in the Republic of Karelia have become increasingly interested in the mineral resources of the area. Traditionally the economy of the area has been dependent on the forest and wood processing industry. The intensive exploitation of forests puts, however, a limit for further expansion of this branch. Minerals are now seen as an alternative sector of economic activity.

According to specialists working in the area, Karelia's potential minerals resource base includes nickel, chromium, iron, titanium, vanadium, uranium, tungsten, tin, silver, gold and platinium group metals. Geological work has been done only at the prospecting or prospecting-evaluation stage. The nonexistence of state funds for financing further investigation makes it imperative to seek financing from foreign sources. Cooperation is needed for geological work in those areas which have indeed been explored but still require further research in order to be developed. There are also a number of exploited deposits which need new geological data to evaluate the re-initiation of mining activities there.

Favourable prospects are specially related to gold, platinium, diamonds, nickel and chromium. One of the few programmes being developed is that of exploration for gold. The Karelian Geological Survey (Karelsgeokom) plans to develop similar programmes related to other minerals in cooperation with local and foreign institutes (103). The Geological Survey of Finland estimates that cooperation projects in Karelia and the Barents region will become more significant in the future (see Annex 1).

North-west region of Russia

The north-west region of Russia includes the large structures of the eastern European form and eastern Baltic shield in the Kola Peninsula and Karelia, and the north-west margins of the Russian Plate. Important deposits of sulfide copper-nickel ores have been developed for a long time.

Regional officers (104) estimate that the north-west region of Russia is one of the most favourable areas in the country for mining ventures. Its geographic position, developed infrastructure and its high mineral potential are seen as positive factors to attract foreign investment. The diverse alternatives offered to national and foreign investors include:

- participation in joint production of the developed deposits, the explored raw materials base of which, allows increasing ore production,
- acquisition of the right to produce and process ores at the deposits which have been explored but are not yet exploited,
- acquisition of licences for additional exploration and its subsequent development,
- acquisition of licences for the right to geological studies of potential areas with the subsequent production objectives.

7.4. Cooperation prospects

Finnish private and public mineral investors must be prepared to adapt themselves to the drastic changes in the CIS Republics. At the same time the Finnish Government should provide support by bilateral or international agreements on the responsibilities and rights of Finnish investors. This support should include the creation of bilateral insurance arrangements, the use of the international forum for compulsory arbitration of investment disputes, unilateral changes in tax structures or income transfer reductions.

Finland's mineral enterprises have adopted a more selective approach to mineral investment abroad. This is due to the general improvement in the investment climate in mineral rich countries and to past experience. The Government of Finland encouraged national mineral enterprises, giving them maximun opportunities to participate in mining ventures, both in industrialized and developing countries. The result is a Finnish mining industry able to fulfill a remarkable national and international role.

Finland's mining industry is capital intensive and must compete in world markets. The national mineral enterprises and institutions can cooperate with the CIS mining industry only under conditions where costs and benefits are

realistically balanced. Investments in mining are exceptionally long-term and sources of capital will not be adequate unless there is a reasonable stability in government mining policy, legislation and taxes.

Regarding the CIS mining industry, the international mining group Outokumpu is following the CIS mining situation very closely and considering a number of potential ventures (105). The Kola nickel clean-up plans are the most important target from the Finnish perspective. Renovation of the Pechanga nickel smelter, one of the biggest polluters in the world, and the development of related infrastructure cannot depend solely on the Russian financial problems. A special effort has to be made.

The strongest advantage of the Finnish mineral enterprises is high level of technology. The design, construction and start-up of mines and smelting plants, as well as development and production of machines and equipment for the mining industry are issues where Finland can compete to some advantage in the restructure of the CIS mining. A mining industry in nearby areas, committed to the protection of the environmen through responsible operations is of maximum interest to Finland.

In spite of the very restrictive political and economic conditions in the CIS area, continuous evaluation of mineral investment proposals must be made. Twenty years ago, the Economic Planning Centre of that time considered of prime importance to: "encourage the setting up of Finnish joint-venture mining enterprises in developing countries" (106). In those days the idea was considered "rather extravagant". Time has demonstrated that expansion in that direction was imperative for a strong domestic mining industry, and essential to the long-term security and economic health of Finland. The CIS mineral potential is too great to be ignored.

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Annex 1

Geologian tutkimuskeskus
GSF International
/21.9.1994/Pentti Noras

ASPECTS ON THE CO-OPERATION BETWEEN THE GEOLOGICAL SURVEY OF FINLAND AND RELATED ORGANIZATIONS OF RUSSIA AND THE CIS REPUBLICS

1) The CIS mining sector from the GSF point of view

The breakup of the USSR resulted to serious declines of all present CIS-country societies. The Moscow-centered Soviet framework of geological surveying and research, and the apparently well organized regional administration deteriorated, too. This largely resulted from a certain loss of the esteem and status which the geological science used to enjoy in the former superpower. According to our information, the function of all geo-scientific organizations is seriously suffering from deficiencies in resources irregularities in paying monthly salaries, shortened working weeks, etc. Other research institutions, in order to survive, have had to change over to rapid business, such as production of dimension stone, fishing and fish smoking and renting out their own premises. Extensive extravagance and misuse of human resources is now a prevailing practice in Russia and other CIS countries.

Launching of investment promotion, mineral exploration and deposit development programmes would be of paramount importance to Russia and other CIS republics, as well as creating a transparent system for raw materials management. International co-operation should involve both major investment programmes and the transfer of modern technology and business management. Structural changes in production are necessary to resolve some dependencies on raw-material import.

The scientific level of the former Soviet geology is fairly high, but lacked indispensable instrument and data processing technologies. A combination of modern European and American exploration technologies with local professional knowledge would accelerate solutions for many of the crucial problems in the raw materials base of the federation and republics. The GSF should be in a position to participate in the transfer of exploration technology, eg., structural geology, geophysics, geochemistry, laboratory techniques and data integration.

2) Co-operation projects with the Soviet Union

From 1972, the GSF has participated in the co-operation of geology sector under the auspices of Finnish-Soviet Commission for Science and Technology Co-operation ("TT co-operation"). This co-operation focused primarily on exchange of data concerning methodologies, correlation of Precambrian and Quatemary formations, and on joint symposia and publications on related topics. As a result, the co-operation offered important opportunities to Russian scientists to visit western countries. Finnish geologists were given valuable opportunities were opened to visit and study extensions of interesting formations and to become familiar with the Soviet geological establishment. Person-to-person co-operation, relatively narrow objectives, frequent visits and bureaucratic arrangements were typical. The efforts produced some impressive binational maps and compilation of publications, too. Nevertheless, the overall benefits-to cost ratio of the co-operation, especially concerning the considerable input of manpower, may be considered low. It may be noteworthy that those Russian organizations which were involved in exploration, were normally not named as counterparts.

3) Present status of co-operation projects between of GSF and CIS republics

Traditionally the counterpart organizations and persons have been Russian (esp. from St. Petersburg), Karelian and Baltics; contacts with southern republics have been exceptional but only on a hospitality level only.

In spite of the changes, the TT Commission for Russia still remains and is placed in the Ministry of Foreign Affairs, in contrast to other of respective co-operation with the former East Europe, that were reorganized and taken over by the Ministry of Education (CIMO). Many of the earlier agreed joint efforts have just continued, and new initiatives have been established in the field of geology, by following old guidelines. More emphasis has been given to cooperation in Karelia and the Barents Region than earlier. The TT facility supports the geology co-operation with around FIM 150 000; the total annual cost of this co-operation for GSF is estimated at FIM 1 million. Rather than in funding, the significance of the facility seems to be in taking excellent care of the necessary administration, communication and border formalities.

Nordic co-operation with Kola is underway and started studying ecogeo-chemistry of northernmost Europe. Other, often Finnis-Russian-Estonian efforts, have agreed to study environmental, engineering geological and marine geological issues in the region of the Gulf of Finland.

Up till now, no internationally funded projects have been launched in Russia nor in CIS republics.

4) Future possibilities to develop co-operation with Russia

A central problem of developing co-operation is the ongoing reorganization of the Russian/CIS counterpart bodies: new organizations and enterprises are being created, new responsible parties and persons are frequently nominated, the economies of the organizations have been ruined, etc. However, most of these obstacles should be considered provisional and attention paid to future possibilities. Another problem is the recession combined with frigid attitudes in Finland: very limited Finnish funding is available for the development of projects in the sector of geology and mineral raw-materials. This may result in loosing our traditional positions to other Nordic and Central European geo-organizations. It seems that the latter have understood future possibilities and strive to maintain and establish new co-operation relations despite the current problems in the CIS.

Future needs for the development of the Finnish-CIS co-operation in the sector of geology remain:

- compilation of (too) numerous and narrow-scoped objectives to more comprehensive projects
- identification of relevant problems and project opportunities both with Russia and other CIS republics (only Russian Federation has been considered eg., in "TT agreement")
- identification of solid funding for the projects (WB, EBRD, other European and Nordic facilities)
- agreement of co-operation at ministerial level which are responsible for mineral raw materials management (discussion is presently going on with Mr. Orlov, Chairman, Russian Federation Committee of Geology and Use of Mineral Resources, RESCOMNEDRA)
- possibilities to establish triform projects (CIS enterprise-GSF-third party) will be studied
- participation in technical assistance projects (eg., institutional building in the areas of mineral potential assessment, exploration technology, integrated use of geodata, etc.)
- environmental issues, esp. mining environment, are important topics for co-operation
- more than for the GSF, perhaps, the TT facility should remain valuable for the universities to develop co-operation with Russian geoscientific organizations.

In the future, the co-operation between the GSF and the Russian and the CIS-based geological organizations will rely on international funding and be more active than at present. However, contacts acquired during 20 years or more should not be allowed to disappear.

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