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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

FIRST CONSULTATION ON THE NON-FERROUS METALS INDUSTRY

Budapest, Hungary

30 November–4 December 1987

REPORT

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PREFACE

The Second General Conference of the United Nations Industrial Development Organization (UNIDO), held at Lima, Peru, in March 1975, recommended in paragraph 66 of the Lima Declaration and Plan of Action on Industrial Development and Co-operation 1/ that UNIDO should include among its activities a system of continuing consultations between developed and developing countries, with the object of raising the developing countries' share in world industrial output through increased international co-operation. The General Assembly, at its seventh special session in September 1975, endorsed the recommendation and requested UNIDO to implement it under the guidance of the Industrial Development Board.

At its fourteenth session, in May 1980, the Industrial Development Board decided to establish the System of Consultations on a permanent basis. 2/ At its sixteenth session, in May 1982, the Board adopted the rules of procedure 3/ according to which the System of Consultations was to operate, together with its principles, objectives and characteristics (ID/B/258, annex). Notably:

The System of Consultations shall be an instrument through which UNIDO is to serve as a forum for developed and developing countries in their contacts and consultations directed towards the industrialization of developing countries;

The System of Consultations would also permit negotiations among interested parties at their request, at the same time as or after consultations;

Participants of each member country should include representatives of Governments, industry, labour, consumer groups and others, as deemed appropriate by each Government;

Each Consultation meeting shall formulate a report, which shall include conclusions and recommendations agreed upon by consensus and also other significant views expressed during the discussions.

Thirty-two consultations have been convened since 1977, covering the following industries and topics: capital goods, agricultural machinery, iron and steel, fertilizers, petrochemicals, pharmaceuticals, leather and leather products, vegetable oils and fats, food-processing, industrial financing, training of industrial manpower, wood and wood products, building materials, and fisheries.

1/ See Report of the Second General Conference of the United Nations Industrial Development Organization (ID/CONF.3/31), chap. IV.

2/ Report of the Industrial Development Board on its fourteenth session (Official Records of the General Assembly, Thirty-fifth Session, Supplement No. 16 (A/35/16)), vol. II, chap. XI, para. 153.

3/ Report of the Industrial Development Board on its sixteenth session (Official Records of the General Assembly, Thirty-seventh Session, Supplement No. 16 (A/37/16)), chap. IV, para. 46.

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INTRODUCTION

1. The First Consultation on the Non-Ferrous Metals Industry was held at Budapest, Hungary, from 30 November to 4 December 1987. The Consultation was attended by 161 participants from 52 countries and 10 international and other organizations (see annex I).
2. The Consultation was organized by the United Nations Industrial Development Organization (UNIDO) and hosted by the Government of Hungary.

Background to the First Consultation

3. The Industrial Development Board, at its nineteenth session, held in May 1985, discussed the activities of the System of Consultations and decided that the First Consultation on the Non-Ferrous Metals Industry should be held during the biennium 1986-1987.^{1/}
4. An Expert Group Meeting was held at Vienna, Austria, from 18 to 21 March 1985, to identify non-ferrous metals to be considered, and priority areas to be taken into account, in the formulation of the possible issues to be discussed at the Consultation. Areas identified included strategies of development, technological alternatives, and new forms of investment and finance.
5. A Regional Expert Group Meeting on Alternative Strategies for Non-Ferrous Metals in Latin America was held at Caracas, Venezuela, from 23 to 26 February 1987. It was organized in close co-operation with the Sistema Económico Latinoamericano (SELA). The objectives of the meeting were:
 - (a) To discuss the situation of the non-ferrous metals industry in the region and its potential for expansion through a more integrated development among the different producers of the region;
 - (b) To identify common and particular constraints that hampered the development of the industry in the region;
 - (c) To examine and propose ways and means of promoting regional co-operation and action needed to overcome identified constraints;
 - (d) To select some possible issues for further discussion at a global preparatory meeting and for possible submission to the First Consultation on the Non-ferrous Metals Industry.

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^{1/} Report of the Industrial Development Board on the work of its nineteenth session (Official Records of the General Assembly, Fortieth Session, Supplement No. 16 (A/40/16)), chap. VIII, para. 89.

6. The Global Preparatory Meeting on the Non-Ferrous Metals Industry was held at Lisbon, Portugal, from 22 to 25 June 1987 to establish priorities concerning possible issues to be submitted to the First Consultation on the Non-Ferrous Metals Industry. The main topics covered various aspects of strategies and policies for the development of non-ferrous metals, including technological alternatives for production, and new forms of investment and finance for the industry. Taking note of the complexity and diversity of all these aspects, the Global Preparatory Meeting recommended that the following two issues should be submitted to the First Consultation on the Non-Ferrous Metals Industry for its consideration:

(a) Strategies of development and financial implications on the non-ferrous metals industry;

(b) Technological alternatives in the non-ferrous metals industry.

7. A number of studies and reports on the restructuring of, and prospects for, the non-ferrous metals industry, with special emphasis on technological alternatives and their financial implications, have been prepared by the UNIDO Secretariat. The environmental problems arising from pollution caused by the non-ferrous metals industry have been dealt with in a separate study (see annex II).

AGREED CONCLUSIONS AND RECOMMENDATIONS

General considerations

8. It would seem important to emphasize the major phenomena that condition mining and metallurgical development, the neglect of which would lead to serious difficulties.

9. An examination of the projects that have been implemented during the last decade in certain regions of the world reveals that the criterion of viability has not always been considered with sufficient rigour.

10. In the context of the current world economy, with inter alia frequent fluctuations in the price of raw materials, it seems essential to guarantee all the technical, economic and institutional conditions that might ensure access to financing and the harmonious development of mining and processing industry projects.

11. Whether in a national, regional or international context, it is desirable that projects should be integrated into a multi-sectoral development strategy. Within this framework and taking into account the diversity of non-ferrous metals and the heterogeneous nature of the industries processing these metals, decisions should be taken on the basis of an analysis of projects case by case.

Recommendations

Issue 1. Strategies of development and financial implications on the non-ferrous metals industry

12. Under issue 1, the Consultation made the following recommendations:

To Governments

(a) Whenever appropriate, Governments of developing countries should give priority to establishing closer links between mining operations and metallurgical processing, as well as with other sectors of the economy, when it leads to reducing external economic vulnerability. In order to achieve this objective, medium- and long-term development plans should be formulated for the various stages of processing non-ferrous metals. Furthermore, it is suggested that basic information on national plans for the development of the sector be exchanged and discussed at a regional level in order to enhance regional co-operation;

(b) In their efforts to develop the non-ferrous metals sector, Governments are invited to take due account of the diversity of the sector as well as of the need to create a favourable investment climate;

(c) Governments, in co-operation with industry, international institutions and professional organizations, should promote training policies. Training needs should be carefully defined and suitable programmes implemented so that continuous and comprehensive training can be assured. This would result in the acquisition of required skills at all appropriate levels. Particular attention should be paid to improving employment opportunities, working conditions and also to mastering technological change within the sector. The implementation and enforcement of adequate occupational safety and health standards will be an important factor in achieving these objectives;

(d) Governments of developing countries should take steps towards formulating and reinforcing, as appropriate, policies in the areas of their fundamental and applied research in order to master the main technological processes related to the sector. This task can be enhanced by continued co-operation between developing and developed countries, as well as by co-operation between developing countries already competent in this sphere and the less developed countries;

(e) In the development of the non-ferrous metals industry, Governments should make efforts to ensure the proper utilization of natural resources and the protection of physical and working environments within the framework of international agreements and/or national legislation;

(f) While continuing their trade links with developed countries, Governments of developing countries should reinforce trade between themselves in non-ferrous metals products as well as inputs needed by the sector;

(g) Within the framework of the ongoing Uruguay Round of Multilateral Trade Negotiations, the Contracting Parties to GATT, taking into account the provision for special and preferential treatment granted to developing countries under this Agreement, should aim at achieving the fullest liberalization of world trade in the non-ferrous metals sector in order to permit developed and developing countries to achieve the efficient utilization of existing production capacities in this sector;

(h) In the context of the problems facing the non-ferrous metals sector and the major debt problems of the developing countries, appropriate methods of financing should be developed in order to promote feasible projects. This objective could be achieved by:

(i) Increasing the raising of funds internally;

(ii) Obtaining better terms from existing financial institutions;

(iii) Establishing regional and interregional mechanisms of finance within the framework of economic co-operation among developing countries (ECDC);

(iv) Exploring possibilities of new ways of co-operating with the centrally planned economy countries as well as with the developed market economy countries;

(v) Associating financial institutions in the preparation of feasibility studies;

(i) The capacity to generate internal funds in developing countries to promote the development of the non-ferrous metals industry, which is a capital-intensive one, would be greatly facilitated if it were possible in the near future to find a solution to the problem of foreign debt. Therefore the importance of activities being undertaken by international financial institutions and debtor and creditor countries, using the resolutions adopted by UNCTAD, UNIDO and other international organizations concerned to solve the debt problem of the developing countries is underlined.

To public and private enterprises

(j) Existing mining and, where appropriate, metallurgical industries that have economically viable operations, but which have suffered from the slump in prices and from insufficient maintenance of the basic infrastructure, should be preserved and maintained to safeguard the possibility of reactivation or restructuring;

(k) In the field of mining exploration, the priorities of industry should be based on the criterion of economic feasibility. In this context, attention should also be given to small deposits offering opportunities for the development of rural areas;

(l) Industry should be encouraged by the use of processes such as beneficiation of by-products and recycling to avoid waste, thereby increasing the present levels of profitability;

(m) Industries in developing countries seeking to produce semi-finished and finished products of non-ferrous metals in economically viable plants should base their first stage of development primarily on local and regional needs;

(n) Dialogue should be encouraged between the operators at all steps of the production and distribution of non-ferrous metals with a view to developing mutual strong points and complementarities in order to achieve the optimization of the whole cycle;

(o) Industries in developing countries should duly consider local conditions and needs in their formulation of training programmes at all levels;

(p) Industries in developing countries should be encouraged to forge links with national, regional and international centres of research and universities in order to increase their level of productivity and to find new uses for their products;

(q) All possible efforts should be deployed to enlarge existing markets and to identify new markets and new fields of application for non-ferrous metals in order to encourage their increased utilization and the creation of effective mechanisms of co-operation for this purpose among enterprises;

(r) Industries should take initiatives to protect the physical environment and conditions of work within the framework of national and/or international legislation and agreements.

To international organizations

(s) UNIDO should play a co-ordinating role in the evaluation and utilization of existing studies on the complementarity of production of non-ferrous metals in the different regions of developing countries and in the compilation of an inventory on them and, if necessary, propose the preparation of supplementary studies. It would be particularly necessary to have available analyses and studies for the identification of capital goods that could be produced for the non-ferrous metals industry;

(t) At the request of interested countries, UNIDO should assist them in identifying potential investors and subsequently promote or undertake feasibility studies for the rehabilitation of existing facilities, as well as for the creation of new ones in the non-ferrous metals sector;

(u) UNIDO, in co-operation with pertinent organizations, should promote training programmes at different levels oriented mainly towards newcomers into the sector;

(v) ILO, UNEP and UNIDO should develop studies and programmes for continued improvement of the protection of the physical and working environments of the non-ferrous metals industry;

Issue 2. Technological alternatives in the non-ferrous metals industry

13. Under issue 2, the Consultation made the following recommendations:

To Governments

(a) Governments of developing countries are called upon to support through, inter alia, the inward-oriented development of the non-ferrous metals industry the adoption of suitable technological policies to promote the establishment of small-scale units for the production of semi-finished and finished non-ferrous metal products for the domestic and/or subregional markets;

(b) The recycling of non-ferrous metals should be promoted owing to the nature of this activity characterized by low unit investment. Scrap collection is an important factor for the success of the operation. Governments of developing countries are called upon to provide assistance to facilitate scrap collection.

To public and private enterprises

(c) The selection of metallurgical processes for a specific project should be based on the actual results of investigations carried out by research and development centres in developing countries in collaboration with corresponding centres in developed countries as appropriate. Sufficient flexibility should be allowed for in the process flow-sheet while minimizing potential risks, and a mechanism for sustained dialogue between the different operators in the flow-sheet should be established from the time of project inception;

(d) Progressive project feasibility assessments should be carried out during project implementation and use made of the availability of computer-based tools for feasibility studies, such as the COMFAR programme developed by UNIDO;

(e) Appropriate training and technical information requirements should be formulated for all mining and metallurgical projects from their initial conception;

(f) For all industrial projects, adequate provision should be made for maintenance including detailed information on maintenance schedules and instructions. Access to spare parts for the economic lifetime of the equipment under normal conditions should be guaranteed and personnel should be adequately trained to carry out maintenance.

To international organizations

(g) International organizations, like UNIDO, are requested to organize to the extent possible training programmes for developing countries in an environment similar to the one in which trainees will function in their respective countries. The training of trainers should be further emphasized with a view to bridging the gap between top- and intermediate-level training programmes. To facilitate these objectives, international organizations are called upon to support the establishment in developing countries of regional and/or subregional metallurgical training institutes;

(h) To reduce the capital costs of projects, international organizations, including UNIDO, are invited to offer advice to developing countries, upon their request, on the acquisition of up-to-date second-hand equipment. Such advice could include the preparation of guidelines and check-lists of elements to be included in the purchasing contract, as well as information on potential vendors;

(i) Considering the multiplier effect of non-ferrous metal projects, multilateral, international and regional financial institutions are called upon to support the continued development of the mining and metallurgical sectors through the establishment of separate provisions for the financing of the infrastructural development associated with these projects;

(j) UNIDO is requested to support the creation of technical information centres in order to facilitate the preparation of feasibility studies to encourage the production and use of different non-ferrous metals in developing countries;

(k) UNIDO is invited to organize follow-up activities aimed at the implementation of the recommendations of the Consultation.

I. ORGANIZATION OF THE CONSULTATION

Opening of the Consultation

Statement on behalf of the Minister of Industry of Hungary

14. The Deputy Minister of Industry of Hungary, opening the meeting on behalf of the Minister of Industry, described the status of, and prospects for, non-ferrous metals in the economy of Hungary. The significant development of the Hungarian aluminium industry in the course of the last 50 years was clearly demonstrated by the fact that, although Hungarians constituted only 0.25 per cent of the world population, Hungary produced 2 per cent of the world's total aluminium output, and aluminium production per capita was nearly five times that of the world average. He noted that the basic need in restructuring Hungarian industry was to shift the balance from extracting to processing in order to realize domestic potential and keep pace with international trends.

15. The objectives of research and development were aimed at forming new products with technologies that consumed less energy and that produced less waste. New structural materials - alloys, microalloys, ceramics - were being sought. Another objective was to enhance the processing of bauxite and non-ferrous metal ores in order to increase value added, thus offsetting the impact of the fall in the world market price of metals and metallurgical products.

16. The Deputy Minister stated that Hungary primarily exported machinery and industrial semi-products connected with the development of infrastructure, and was well placed to provide the products and services that developing countries required for the implementation of their economic programmes. Hungary could play its part in the non-ferrous metals industry field by the joint manufacturing of new products, joint ventures and technology transfer.

Statement on behalf of the Director-General of the Hungarian Aluminium Corporation

17. On behalf of the Director-General of the Hungarian Aluminium Corporation (HUNGALU), the Deputy Director-General described the activities of HUNGALU in the aluminium sector. He said that half the production of HUNGALU was exported and that HUNGALU met 95 per cent of the domestic demand for aluminium products. According to studies, domestic reserves of bauxite were sufficient to provide a firm base for viable aluminium production for the next 40 years.

18. A major goal of HUNGALU was to maintain and strengthen its competitive advantage in world markets and to satisfy domestic demand. Some measures already taken included expanding existing bauxite mines, opening new ones, reconstructing smelters to improve productivity and working conditions, and increasing the quality, quantity and range of processed alumina products.

Statement on behalf of the Director-General of UNIDO

19. The Deputy Director-General, Department for Industrial Promotion, Consultations and Technology of UNIDO, in a statement presented on behalf of the Director-General of UNIDO, said that, in many developing countries, the production of non-ferrous metals was essential to the normal operation of the economy as a whole, in view of the fact that the export of ores or metals was a principal source of foreign exchange. Producers had, however, become victims

of the major structural constraints in the non-ferrous metals industry sector, resulting in a downward trend in consumption and prices. He noted, however, that by improving quality and devoting more attention to the final phases of the manufacturing process, developing countries could aim at maximizing their manufacturing value added in the sector. He pointed out that, in order to achieve that aim, alternative development strategies for non-ferrous metals industries had to be identified. That would require the development of technologies that were commensurate with the resources of, and appropriate to the socio-economic conditions of, developing countries. He concluded that the future development of the non-ferrous metals industry in developing countries could not be achieved without international co-operation. In the absence of such co-operation, the developing countries would, in the medium term, face a drop in capacity utilization, and could find themselves unable to develop a more cohesive productive system through the manufacture of semi-finished and finished products. It was against that background that the First Consultation on the Non-Ferrous Metals Industry was being held.

Statement by the Director of the System of Consultations Division, UNIDO

20. The Director of the System of Consultations Division, UNIDO, pointed out that one of the objectives of the consultation meetings was to promote the industrialization of developing countries by looking at specific sectors, or topics common to all industrial sectors, in order to identify constraints and to make recommendations on policies that would remove those constraints. He also recalled that the System of Consultations was unique in that it offered representatives of Governments, industries, co-operatives and trade unions an opportunity of identifying problems that hampered industries and of proposing solutions. The Consultation meetings also provided a forum for developing countries to explain their needs for assistance and technical co-operation and to initiate informal discussions with other developing countries, developed countries, aid agencies and representatives of industry.

21. With respect to the non-ferrous metals industry, he pointed out that many developing countries found themselves faced with the necessity of either increasing their exports to generate foreign exchange or of introducing structural and far-reaching shifts in their metallurgical industries to improve a situation that was steadily deteriorating. Many developing countries were discovering the advantages of an inward-oriented pattern of development to reinforce the linkages of the non-ferrous metals industry with other sectors of the economy, particularly capital goods, construction, transport and energy. Limitations of domestic markets, however, created serious obstacles, which could be alleviated through regional approaches.

22. As regards technological alternatives, the Director of the System of Consultations Division underlined the necessity of applying proper criteria for the determination of key aspects, such as size of the plant, taking due consideration of the development strategy and socio-economic realities. He concluded by expressing the wish that the Consultation meeting would contribute to the formulation of strategies for the development of the non-ferrous metals industry, as well as to the identification of criteria for the selection of technologies and innovative and appropriate schemes of financing.

Election of officers

23. The following officers were elected:

- Chairman: Gyoergy Dobos (Hungary), former Director-General of the Hungarian Aluminium Corporation, and former Adviser to the Deputy Executive Director of UNIDO
- Rapporteur: He Boquan (China), Vice-President, The Non-ferrous Metals Society of China, Beijing
- Vice-Chairmen: Alberto Casal (Chile), Adviser to the Minister, Ministry of Mining, Santiago
- Jacques A. de Cuyper (Belgium), Professeur, Université Catholique de Louvain, 1960 Sterrebeek
- Moussa Sagno (Guinea), Director, Division of Industries, Ministry of Industry, Conakry
- Alexander S. Yaroslavtsev (USSR), Head of the Department of Foreign Relations, Ministry of Non-ferrous Metallurgy, Moscow

Statement by the Chairman of the Consultation

24. The Chairman thanked participants for his election. In his statement, he said that the demand for non-ferrous metals might be increased by the development of new fields of utilization of non-ferrous metals and the more intense activity of advisory services and their adaptation to local conditions. Obviously, different forms of co-operation between countries and companies should be established to distribute the tasks, costs and possible revenues involved. He said there was a need for developing countries to optimize the scale of operations for a specific process or technology, in accordance with their national requirements and possibilities, and that in this connection particular attention should be paid to semi-finished products.

Adoption of the agenda

25. The Consultation adopted the following agenda:

1. Opening of the Consultation
2. Election of Chairman, Vice-Chairmen and Rapporteur
3. Adoption of the agenda and organization of the work
4. Presentation of the issues by the Secretariat

5. Discussion of the issues:

Issue 1: Strategies of development and financial implications on the non-ferrous metals industry

Issue 2: Technological alternatives in the non-ferrous metals industry

6. Conclusions and recommendations

7. Adoption of the report of the meeting

Establishment of working groups

26. The Consultation established two working groups to discuss the issues and to propose conclusions and recommendations for consideration at the final plenary. Antonio Delgado Rodriguez (Cuba) chaired the working group on issue 1, and Gilbert Trolly (France) chaired the working group on issue 2.

Adoption of the report

27. The report of the First Consultation on the Non-Ferrous Metals Industry was adopted by consensus at the final plenary on 4 December 1987.

Documentation

28. The documents issued prior to the Consultation are listed in annex II.

II. REPORT OF THE PLENARY SESSIONS

Presentation of the issues

Issue 1. Strategies of development and financial implications on the non-ferrous metals industry

29. Issue 1 was introduced by a representative of the UNIDO Secretariat. He said that, during the past five years, important structural changes in patterns of consumption and ownership and control had taken place. Future progress would depend on the experience of the past ten years being analysed by all concerned so that it could form the basis for new development strategies.

30. With regard to consumption, he said that demand had stagnated mainly on account of the global economic recession and a decreased intensity of use of traditional metals. The service sectors, which were enjoying high growth rates, had a low materials content, and in branches of the economy where the materials content was higher there had been a shift towards non-metallic materials.

31. In order to cope with the new situation, Governments of developing countries had increased their participation, either directly or indirectly, in their mining and metallurgical sectors.

32. He said that, between 1975 and 1984, state-controlled mineral production had risen from 15 to 18 per cent of the total value of the production of all non-fuel minerals in market economy countries. The private-sector mining companies that would survive would be stronger economically, technologically and in terms of their information resources than the companies already existing. Yet, the pace of the restructuring process in the private sector was fast: between 1975 and 1984, the ten largest transnational corporations in mining had increased from 25 to 32 per cent their share of the value of all non-fuel mineral production in market economy countries.

33. Turning to strategy, he said that most developing countries had practised a development strategy based only on export promotion and/or import substitution. A few countries had, however, developed their mining and metallurgical industries within the context of the basic needs of the population and a more balanced relationship between the industrial and the agricultural sectors. The main objective of that alternative development strategy was to orient the non-ferrous metals industry towards the production of the machinery and equipment that was needed to upgrade the agricultural, transport, energy and construction sectors. The strategy that each country chose, however, would be based on its socio-economic conditions and the possibilities for subregional and regional co-operation.

34. As for financing, developing countries needed to explore new sources of funds and to generate more funds internally. International agencies would continue to play an important role, primarily as catalysts for larger loans and for establishing co-financing schemes. Financing from the centrally planned economy countries could grow in importance. Fiscal policies and the general investment climate would continue to be of prime importance.

Issue 2. Technological alternatives in the non-ferrous metals industry

35. Issue 2 was introduced by a representative of the UNIDO Secretariat. He said that, under the right circumstances, small-scale projects in non-ferrous

metals had many advantages. Those included the short lead time for production; the rapid conversion of mineral resources into financial benefits; the greater chance of successful exploration; the use of domestic capital; and local control of the operation.

36. He referred to several fields in which developing countries might need to upgrade their activities. One of these was the location of undiscovered mineral resources. Another was the introduction of high productivity mining techniques, such as the introduction of the Vertical Crater Retreat method of shaft sinking, and of improved methods of ore extraction that ensured maximum recovery and minimum dilution of the ore.

37. With regard to energy saving technologies, he referred to autogenous and semi-autogenous grinding mills, hydrometallurgical processes and the possibility of retrofitting aluminium smelters with new pot-lines.

38. With regard to technologies for smaller-scale operations, he drew attention to the segregation process. Oxygen enrichment (Outokumpu process) was also an attractive alternative for developing countries as it could cut the cost of production and enhance the capacity of the plant without too much investment. He also referred to tin and nickel smelting. The upgrading of beneficiation and smelting processes was essential to the survival of the tin industry. Ammoniacal leaching, solvent extraction and electrowinning were also important for the extraction of nickel in view of the crisis that that industry was facing. He concluded his presentation by discussing semi-finished products, mentioning continuous casting and the use of scrap for the production of copper.

Summary of discussion

39. A member of the UNIDO Secretariat described the technical assistance activities of UNIDO in the non-ferrous metals industry. He said that, in 1986, about 150 technical assistance projects were being implemented by the Metallurgical Industries Branch. UNIDO was currently handling 39 technical assistance projects in the non-ferrous metals field in various regions of the world. After describing some of the projects, he said that the expansion and establishment of non-ferrous metal semi-fabrication plants would continue to be important in developing countries. The semi-production industry could achieve a number of goals simultaneously, such as providing additional direct or indirect employment, decreasing the value of imports and increasing the value of exports in countries that exported primary metals. Such countries should aim at gradually establishing a chain of low-capacity industrial plants and at economically producing essential non-ferrous semi-finished products and finished products. The establishment of national and regional metallurgical research and development centres could also be considered, in view of the importance of the centres that were operating in major international metallurgical companies.

40. A representative of the United Nations Conference on Trade and Development (UNCTAD) observed that, at the seventh session of UNCTAD held in July 1987, it was agreed that meetings to strengthen producer-consumer operations on individual commodities not covered by international agreements should be held. Those commodities included bauxite and copper. Furthermore, it was hoped that the Common Fund for Commodities could start its operations in 1988. Through its Second Account, the Fund would finance commodity development measures, including research and development, productivity improvement, marketing, and measures designed to assist vertical diversification. Finally, UNCTAD had

recently held a meeting at which it had been agreed that an intergovernmental producer-consumer forum for copper should be established. The forum would, inter alia, study different aspects of the world copper economy and how statistics for copper could be improved. It could also play a role in market development for the promotion of copper consumption.

41. A representative of the United Nations Environment Programme (UNEP) summarized the activities of UNEP in the non-ferrous metals industry. UNEP had held several meetings and published articles, technical review documents and guidelines on the environmental aspects of copper production, non-ferrous metals ore mining, aluminium smelting, alumina production, nickel production and selected non-ferrous metals industries. He observed that top management should have a sound policy regarding the protection of the environment and the health and safety of workers. That policy should be integrated into the activities of the whole work-force with an appropriate allocation of resources. Before plant facilities were designed, a target or standard for environmental control should be developed jointly by the Government or control authority with the senior management of the company, according to the characteristics of the non-ferrous metal works and specific local environmental conditions of the plant site.

42. A representative of the International Labour Office observed that the non-ferrous metals industry provided a bridge between basic industries and the high technology industries that were rapidly being developed. The two issues that were being discussed at the Consultation had implications that would considerably affect the mining industry. At a time when all sections of the non-ferrous metals industry were trying to improve their competitiveness, a healthy mining sector was essential. The International Labour Office was well placed to help developing countries to maintain and improve standards and conditions of work in that sector.

43. A representative of the General Agreement on Tariffs and Trade (GATT) observed that, notwithstanding the significant trade concessions that had been exchanged in previous negotiations, international trade still suffered from a variety of restrictive and other trade-distorting measures. Those measures inhibited economic adjustment processes in the industries concerned and the possibilities for developing processing further in countries that possessed natural resources, many of which were developing countries. There were still high or prohibitive tariffs and also a variety of non-tariff measures, such as quotas, discriminating licensing, embargoes, double-pricing practices, certain government procurement practices and subsidies. He hoped that the negotiating efforts that were under way would not only help to identify problems besetting producers and exporters, but also lead to the adoption of policies and measures that would result in further trade liberalization and a better trading climate for non-ferrous metals.

44. A representative of the International Trade Centre (UNCTAD/GATT) said that, in the face of growing competition from new and advanced materials, countries that depended primarily on the export of traditional metals should pay attention to developing the markets for those metals. At the request of a number of developing countries, the Centre had started a research and development project on the marketing of products manufactured from copper and ways of increasing consumption. Under the project, the Centre would be providing marketing assistance to several copper-producing countries.

45. A representative of the International Lead and Zinc Study Group observed that the markets for lead and zinc were expanding more rapidly in developing countries than in developed countries. He said that there were not only advances in metal smelting and refining technology, but also in the application of metals, for instance, the use of lead in radiation shielding, in expanding the life of asphalt on roads or in special types of lead-acid batteries. There were also new uses of zinc, for instance, in the new methods of die-casting, in mini-galvanizing lines for the production of galvanized sheet, and new types of zinc coatings for corrosion protection, and new alloys.

46. A number of participants from developed countries described their experience in the non-ferrous metals industry and offered the insights so gained for the benefit of participants from developing countries so that rational investment decisions could be taken. Participants from developed countries also acknowledged the relevance of the System of Consultations in general and of the convening of the Consultation on the Non-Ferrous Metals Industry in particular at a time when that industry was experiencing structural readjustment. Some participants from developed countries described the co-operative arrangements they had concluded with developing countries in the non-ferrous metals sector and expressed their willingness to expand such co-operation to other countries.

47. One participant pointed out that the non-ferrous metals industry was one that required few workers: compared with the high investment required, only a small number of jobs were created. Infrastructure was also essential, particularly in the fields of transport, maintenance and repair. The production of semi-manufactures, however, offered developing countries possibilities for setting up smaller production capacities geared to local or regional needs, the capital available and production volume required. He drew attention to the importance of training at all stages of the production and processing of non-ferrous metals. He then presented a compilation of concrete measures for promoting the non-ferrous metals industry in developing countries for the consideration of the working groups of the Consultation. A participant from the same country provided a technical paper containing a list of criteria for the choice of technology in the non-ferrous metals industry.

48. Another participant observed that the share of developing countries in the total global consumption of non-ferrous metals had increased markedly over the past 10 years. Both the demand for qualitative improvements in the non-ferrous metals industry and increased competition from other materials meant that know-how and new technologies should be developed as a matter of urgency for the production and processing stages of the industry. Furthermore, the possibilities for combining non-ferrous metals either with each other or with other materials were increasing. The trend in the production of consumer goods, however, was towards miniaturization and minimization. In his opinion, the criterion for investment in the non-ferrous metals industry ought to be profitability.

49. Another participant suggested that there should be an exchange of information on successful projects in order that similar ones could be promoted. Studies on project feasibility or on the adaptation of operations carried out by consultants independent of the major international consultancy firms should also be made available. Developing countries should be enabled to carry out rapid diagnostic studies of their investment requirements or of procedures for improving their industrial activities. Underused human resources

should be redeployed and trained so that developing countries could acquire more specialists in mining, minerals processing and metallurgy. Strategies for the maintenance of plant and equipment should also be reviewed periodically.

Closing remarks

50. Many participants expressed their appreciation to the Government of Hungary for having acted as host to the Consultation and to the UNIDO Secretariat for having convened it. The Consultation had enabled them to acquire a better understanding of the forces at work in the non-ferrous metals industry, which would enable them to take future decisions in a wider context on the basis of the insights so gained. A participant thanked everyone for their co-operation and complimented the Secretariat on the successful outcome of the meeting. He said that, despite not knowing each other beforehand, participants had been able to agree on many proposals. Another participant said that he would like to see concrete action between the First Consultation and the next one.

51. At the closing session, statements were also made by the chairmen of the working groups, by the Director of the System of Consultations Division of UNIDO and by the Chairman of the First Consultation on the Non-ferrous Metals Industry. The statements emphasized the relevance and the usefulness of such Consultation meetings. In this context, the attention of the participants was drawn to the fact that the process of consultations, as conceived by UNIDO, was a continuous and long-term development, hence the importance of the agreed conclusions and recommendations, which provided the necessary impetus for follow-up activities. The present meeting constituted only one element in the long chain of industrial development in the non-ferrous metals sector in order to realize the economic aspirations of the developing countries. Therefore the spirit of co-operation and cordiality that had prevailed throughout the Consultation, testifying to the genuine interest of all concerned in identifying possible solutions to the problems encountered by the developing countries, was particularly gratifying.

52. One participant, after congratulating the Secretariat on its preparatory activities and on the quality of documentation in support of the Consultation meeting, stated that it was precisely through such channels that industrial policies gained in realism and effectiveness, which in the final analysis benefited both the developing and the developed countries. He therefore reiterated his strong support and continued commitment to the System of Consultations of UNIDO in the light of its current business-like orientation.

53. Participants expressed their satisfaction with the deliberations of the Consultation and thanked the Chairman for his efforts, which had greatly contributed to the success of the meeting.

54. The Government of Argentina offered to host a second Consultation or a regional meeting for the further exchange of information. This proposal was much appreciated by the participants.

III. REPORT OF THE WORKING GROUP ON ISSUE 1:
STRATEGIES OF DEVELOPMENT AND FINANCIAL IMPLICATIONS
ON THE NON-FERROUS METALS INDUSTRY

55. A number of participants emphasized that the non-ferrous metals industry was complex and sophisticated and therefore a careful examination of the prerequisites required to develop it was needed. Those prerequisites would include energy resources, geological qualities of ore bodies, availability of infrastructure, training and development of human resources, and appropriate technology. The industry was both technology- and energy-intensive.

56. Some participants felt that the utmost flexibility was needed when considering strategies to develop the sector. What was needed was a two-tier strategy for the generation of exports and of foreign exchange, coupled with efforts to develop the domestic base and hence the industrial structure of the country thereby creating appropriate internal linkages and fulfilling local demands.

57. Several participants touched upon the difficulties experienced in obtaining favourable financing, while others pointed out that financing could be obtained if projects were viable.

58. Several participants expressed the view that, owing to current structural changes affecting the sector in developed countries, regional co-operation between developing countries should be promoted to ease the effects of the constraints. Such co-operation was considered by many to be a key factor in the development of the sector, enabling new markets to be found and different financing schemes to be explored.

59. Several participants emphasized the long-term need for developing countries to change from being mere producers of raw materials to manufacturers of finished products.

60. Several participants underlined the importance of adopting an integrated approach to developing the sector through horizontal and vertical integration; internal linkages could thus be created and strengthened for a wider usage of non-ferrous metals in other branches of the economy.

61. Some participants considered that UNIDO should continue carrying out studies on the pattern of demand for non-ferrous metals and identify constraints. These would be helpful to developing countries planning to develop their non-ferrous metals sector.

62. On the subject of protectionism, two points of view were expressed. One was that protectionism in various markets was a major constraint impeding the growth and development of the non-ferrous metals industry on a global scale. The other point of view attributed the lack of access to certain markets in the developed countries to reasons other than tariff or non-tariff barriers.

63. Participants expressed a wish for information exchange and assessment in several areas, such as: small-scale and appropriate local technology, which could support the development strategy chosen; innovative financing possibilities; research on and development of suitable products for local markets; and geological surveys of reserves.

64. The subject of international co-operation and its contribution to the development of the sector was also raised. It was considered that small and medium-sized plants and the areas of maintenance, rehabilitation and modernization could benefit from international co-operation.

65. Considerable concern was voiced regarding the financing problems facing the sector and the urgent need to implement new investment schemes in developing countries. In that context, reference was made to the severe debt problems of many developing countries.

66. Speaking on sources of financing for the industrialization of developing countries, one participant referred to the resolution on disarmament and development (General Conference resolution GC.2/Dec 10), which had been adopted by the second session of the General Conference of UNIDO held at Bangkok from 9 to 13 November 1987 ^{2/}. He expressed strong support for that resolution because enormous resources, saved as a result of disarmament, could be channelled into the industrialization of developing countries in general and the metallurgical industry in particular.

67. With regard to the prevailing situation and problems arising from the recession, many participants stressed the need to maintain existing capacity. Finance would have to be found to keep pumps working and power generated so that mines could quickly be brought back into use. Greater integration between the mining and metallurgical sectors should be encouraged and the existing interrelationships between those sectors recognized. Trade and the exchange of complementary resources should be stimulated between developing countries to counter the defensive action of developed countries that had responded to the recession by cutting imports. Participants emphasized the need for developing countries to obtain an adequate share of the earnings from exports. Trade between developing countries, as well as between developed and developing countries, would also stimulate local non-ferrous metals industries.

68. The need to transfer the best available technology for local needs was seen by many participants as being of the utmost importance. Technological co-operation would enhance progress. One participant gave an example of a research institute that had been set up with United Nations funding and with expertise from abroad. The heterogeneity of the non-ferrous metals industry made a case-by-case approach necessary but did not detract from the overall importance of co-operation in technical development. In some cases, particular enterprises could co-operate on a bilateral level; in other cases, they could co-operate on a multilateral level. The needs of small enterprises should not be overlooked. At an international and regional level, studies should be undertaken under the aegis of UNIDO to examine complementarity. It was proposed that regional meetings should be held in Africa, Asia and Latin America followed by an interregional meeting. The need to prevent overlap was also mentioned, as was the need to use existing data bases where pertinent.

69. Many participants pointed to the need to establish new institutions or to strengthen existing institutions to carry out research on new uses of non-ferrous metals. Research on new markets for existing uses of non-ferrous metals was also stressed by some participants as being especially important for developing countries. There was also a need for a better promotion of products within developing countries. Joint co-operative research arrangements involving all levels of the non-ferrous metals industry should be encouraged.

^{2/} "Decisions and resolutions of the General Conference: Second regular session, Bangkok, Thailand, 9 to 13 November 1987" (GC.2/INF.4).

70. Several participants said that training needs should be carefully defined and policies and programmes for training implemented through collaboration between Governments, employers, workers and international organizations. In that way, continuous comprehensive training could be assured, resulting in the acquisition of the required skills at the management, technical and all other levels.

71. In establishing new installations, or in expanding the activities of existing ones, a participant said that particular attention should be paid to improving employment opportunities and working conditions and to managing technological change. The implementation and enforcement of adequate occupational safety and health standards would be important factors in achieving those objectives. It was suggested that legislation on environmental protection should be at a regional and international level, as well as at a national level, in order to broaden its scope. National legislation, however, should be formulated in countries where it did not exist.

72. Some participants suggested that the impact of the non-ferrous metals sector on a country's entire economy should be examined. In that context exclusive dependence on one metal should be avoided whenever possible. Diversification, based especially on the strong points of the economy, could provide a means to this end. The value added of the mining, refining and processing stages should be compared, and the amount of the investment set against the number of work-places that the investment would be expected to yield. The investment climate for private financing should be examined and improved if necessary, taking into account the interdependence of the industrial markets for metals and metal products. Special risk factors or lack of infrastructure should also be taken into account in order to ensure that investment was profitable.

73. Vertical integration should be encouraged where it would be beneficial. Regional co-operation could help to overcome problems, such as lack of refining facilities.

74. Participants stressed international industrial co-operation as being the most important factor at all levels. In preparing sectoral plans, countries should take into consideration regional and international aspects, which might provide market opportunities, and encourage the development of linkages. There should be continued co-operation between developing and developed countries. Co-operation between developing countries was also felt to be especially important because many developing countries possessed expertise and competence that could significantly help less developed countries. Less developed countries needed support from and co-operation with both developing countries and interested developed countries. It was stressed that non-ferrous metals co-operation required a "metal-by-metal" approach. At the international level, it was suggested by one participant that tariff barriers should be reduced through current multilateral discussions to increase the production capacity of developing countries.

75. Debt was seen by participants as being a fundamental problem. The net outflow of capital from developing countries affected the financing of potentially viable projects. Financing for the development of the non-ferrous metals sector should take account of the rescheduling mechanisms that were being developed. The present system, based on convertible currencies, needed to be balanced by other mechanisms for funding. Participants considered that

a lasting solution, which was both correct and just, must be sought to what was not purely an accountancy matter. Existing systems, such as Stabex and Sysmin, mitigated but did not eliminate debt problems. It was crucial to find national and regional funding for new plant. One participant proposed that a new special fund should be created. The possibilities of converting debt into equity were also discussed by participants as possible new ways of co-operating with centrally planned economy countries as well as with developed market economy countries.

IV. REPORT OF THE WORKING GROUP ON ISSUE 2:
TECHNOLOGICAL ALTERNATIVES IN THE NON-FERROUS
METALS INDUSTRY

76. In discussing the design of non-ferrous metal projects in developing countries, participants stressed the importance of considering the local conditions and unique characteristics of each project. The dimensions of new projects relating to the manufacture of semi-finished or finished products should be tailored to the actual domestic or subregional demand. Another important consideration in the field of mining was the determination, to the extent possible, of the characteristics of the ores and ore bodies.

77. Several participants drew attention to the technological developments that had occurred in recent years and the resulting new specifications of raw materials for the non-ferrous metals industry. The case of bauxite was discussed in detail as exemplifying technological developments that allowed for the economic exploitation of ores that had previously proved uneconomic. Technological advances in the mining and metallurgical processing of massive complex polymetallic sulphides and in the state of the art for the treatment of nickel lateritic ores based on hydrometallurgical processes were outlined.

78. The urgent need for diversification of economies that were based on exports of a single metal product was pointed out by some participants. It was suggested that Governments should adopt contingency measures to protect their national economies from adverse market fluctuations. It was important for countries to obtain an overview of their mining potential and to plan accordingly for its exploitation, taking into account socio-economic and technological considerations.

79. Several participants said that the development of small mines should be encouraged. Such mines could lead to high levels of employment in certain countries. Specific factors associated with the development of small mines included simpler and safer mining techniques, flexibility of the ore dressing flow-sheet and the suitability of the infrastructure both for mineral products and the chemicals required in processing.

80. Most participants considered that scrap collection could play a major role in the development of metallurgical industries in many developing countries. The need for an effective scrap collection and sorting system was emphasized, however, as this had a direct bearing on the economics of the industry. One participant described a scrap collection system in his country, which had led to the establishment of several processing units. The potential environmental and occupational hazards associated with scrap and scrap collection were discussed, particularly in relation to scrap from lead batteries. The need to institute effective countermeasures against possible adverse consequences was stressed.

81. A number of new technological processes were described by participants. It was, however, stressed that such new processes should be offered to developing countries only after they had been tested on an industrial scale. In offering processes to developing countries, local conditions and the specific characteristics of the ore in the purchasing country should be taken into account. Regarding the optimization of processes, the whole set of operations in a mining-metallurgical activity should be taken into consideration even though such overall optimization might lead to some losses at individual processing stages. Optimization of individual processes should also allow sufficient flexibility in the overall flow.

82. One participant described a smelting process that had been developed and tested in his country. He said that his country was willing to carry out investigations for developing countries, through UNIDO, on the viability of their processes upon receiving information on the chemical and mineralogical composition and grain size of the ores used. The carrying out of investigations through UNIDO must be extended to all countries willing to make their technologies available to developing countries.

83. The capital intensity of metallurgical projects was regarded by some participants as a constraint to the development of small-scale metallurgical units that were adapted to market requirements at the national and subregional levels. Although no overall definitive solutions to that problem were at hand, some technological developments suitable for small-scale copper smelting units were noted.

84. Several participants expressed their views regarding the use of second-hand equipment as a way of reducing the capital cost of metallurgical projects. It was pointed out that, partly as a result of several mining and metallurgical plants having closed down, a considerable amount of second-hand but up-to-date equipment was available on the market. Many participants emphasized the need to ensure the quality of the equipment, as well as the availability of spare parts, and its adaptability to the specifications of the project in question. Some suppliers were willing to recondition and retrofit their equipment. In all cases, however, a guarantee should be obtained for a reasonable period, which should include the provision of spare parts and training of personnel for the operation and maintenance of the equipment. Participants considered that, through the preparation of guidelines, check-lists and relevant elements to be considered in drawing-up contractual arrangements, UNIDO could play an effective role in guiding developing countries in the purchase of second-hand equipment. It was also suggested that UNIDO could maintain a list of potential vendors for the supply of such equipment.

85. Participants stressed the need to establish appropriate systems for maintenance. The development of maintenance skills could be an effective way of transferring technology. At the time of purchasing equipment, developing countries should take into account the maintenance skills that would be required to maintain that equipment. The training of personnel for maintenance and the assurance of access to spares for the economic lifetime of the plant were considered to be of paramount importance.

86. Research and development activities were considered by many participants to be vital to the development of the non-ferrous metal industry in developing countries. Participants pointed out, however, that in many developing countries there was little, if any, linkage between the research activities carried out by research and development centres and the problems faced by the industry. In some countries, the prevailing industrial policy contributed to that aberration. In cases where the industrial sector was dominated by transnational corporations, some of them were less willing to utilize the services of local research and development centres. In other countries, research and development centres could be encouraged to become self-financing by providing consultancy services to industry as a way of ensuring that their work was of direct relevance to it. Attention was called to the financial problems faced by some research and development centres, which had found it necessary to confine their work to the adaptation of proven applied technologies rather than to the development of indigenous technologies. Participants drew attention to the role

of research and development institutions in general and their contribution to reducing the North-South technological gap in particular and, in that connection, the role of UNIDO was emphasized. It was considered that a permanent dialogue between research and development centres and industry, as well as universities, should be established.

87. Downstream problems connected with non-ferrous metals activities also included the need to apply intensive research and development efforts at the marketing stage. New applications of non-ferrous metals should be developed, taking into consideration emerging new materials and techniques.

88. Environmental and occupational health issues were mentioned by several participants as being essential at both the mining and metallurgical stages of non-ferrous metals processing. Post-mining problems should also be taken into account.

89. One participant described the development of an industry for the production of semi-finished products and finished products and stated the willingness of his country to share that experience with other developing countries. The production of semi-finished products and finished products enhanced the value added of non-ferrous metal products and could lead to significant savings in the importation of such products.

90. There was an exchange of ideas regarding the merits and constraints of pyrometallurgical and hydrometallurgical processes. Many participants considered that choosing one process in preference to another, or a combination of both processes, depended on the characteristics of the ore and ore bodies and the need to optimize the whole set of operations.

91. Several participants emphasized the necessity for countries importing technology to make adequate arrangements for the training of personnel. Training schemes should form an integral part of a project and should be specified and planned for when negotiating the contract. Such training should commence immediately at the project implementation stage and the technology supplier could undertake to train personnel in all aspects of plant operation. Training in inventory control, financial planning and control, as well as in contracting practices (including the preparation of tender documents and bidding procedures) should be part of the training schemes.

92. The advantages of training personnel from developing countries in a situation similar to that in which they would be working after their training were recognized. Such training minimized the impact of the adjustment problems faced by trainees who received their training in developed countries. Participants called upon UNIDO to support the establishment of regional and subregional training facilities in the metallurgical sector.

93. Some participants pointed out that, in their countries, there was a gap related to training programmes. While training programmes had been arranged for higher-level managers, similar programmes were lacking for middle-level managers. Other participants, however, felt that the higher-level managers who had been trained should be encouraged to train their staff, including middle-level managers.

94. It was considered that training in mining should be carried out at a general level as well to meet the diverse human resource requirements of the non-ferrous metals industry. A distinction was made between craftsmanship training and technical training. In one developed country, trained craftsmen had lost their jobs as a result of technological developments. The need to include a certain degree of technical training for craftsmen was therefore stressed by participants.

95. One participant said that in many countries, great significance was attached to issuing diplomas. Yet there were still difficulties in drawing up a common standard for evaluating diplomas offered by different countries. Participants called upon international organizations to examine that problem and to draw up guidelines.

96. In discussing feasibility studies, participants considered that a feasibility study should evaluate the economic, technical, financial, social and training aspects of a project. The computer model for feasibility analysis and reporting (COMFAR) of UNIDO was recommended as a useful tool for developing countries and an example given of its successful application. In view of their financial implications, progressive feasibility assessments should, as a general rule, be undertaken.

97. To ensure the continued development of the mining sector in several developing countries, participants called upon financial institutions to make separate provisions for financing the development of the necessary infrastructure associated with mining projects. The multiplier effect of infrastructure development was emphasized.

Annex I

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Annex II

LIST OF DOCUMENTS

Issue papers

- Issue 1: Strategies of development and financial implications on the non-ferrous metals industry ID/WG.470/7
- Issue 2: Technological alternatives in the non-ferrous metals industry ID/WG.470/8

Background documents

- Mining and mineral processing in developing countries ID/WG.470/1(SPEC.)
- Financial aspects of the copper and aluminium industry ID/WG.470/2
- Pollution problems and solutions in the non-ferrous metals industry ID/WG.470/3
- Technological alternatives in the aluminium industry ID/WG.470/4
- Technological alternatives for copper, lead, zinc and tin in developing countries ID/WG.470/5
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- Strengthening metallurgical research and development competency of developing countries ID/WG.470/9
- Technological alternatives in the nickel industry ID/WG.470/10(SPEC.)

Information documents

- Report. Expert Group Meeting on the Restructuring of the Non-ferrous Metals Industries, Vienna, Austria, 18-21 March 1985 ID/WG.436/5
- Report. Regional Expert Group Meeting on Alternative Development Strategies of the Non-Ferrous Metals in Latin America Caracas, Venezuela, 23-26 February 1987 IPCT.21(SPEC.)
- Report. Global Preparatory Meeting on the Non-ferrous Metals Industries, Lisbon, Portugal, 22-25 June 1987 IPCT.28(SPEC.)

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