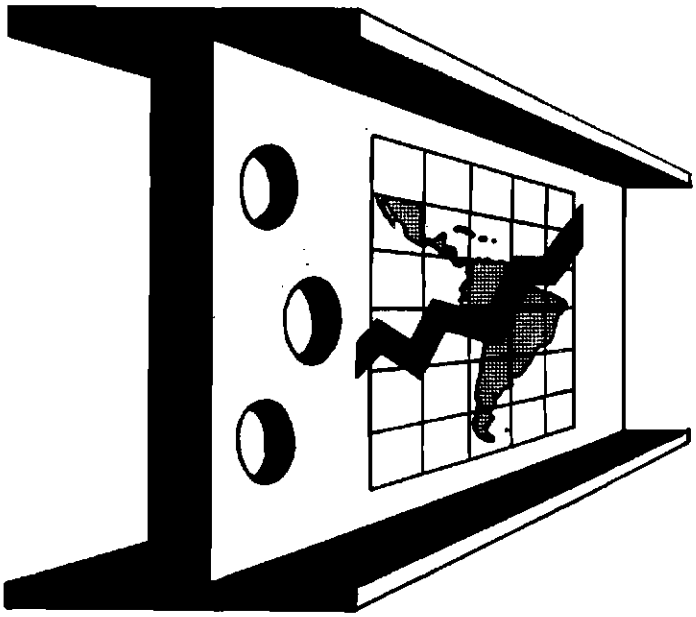
Problems of the Steel Making and Transforming Industries in Latin America



VOLUME 1

Report of the São Paulo Meeting

UNITED NATIONS

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PROBLEMS OF THE STEEL MAKING AND TRANSFORMING INDUSTRIES IN LATIN AMERICA

I. Report of the Latin American Meeting of Experts on Steel Making and Transforming Industries

Sponsored by the secretariats of the *Economic Commission for Latin America* and of the *Technical Assistance Administration,* in collaboration with the *Associação Brasileira de Metais*

UNITED NATIONS
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TABLE OF CONTENTS

PREFATORY NOTE

This study is divided into several volumes. The first one contains the Report of the São Paulo Meeting. The others will reproduce in full the texts—slightly abridged at times—of the papers presented at the meeting by the various experts, together with a summary of the resultant discussions.

The report of the meeting included in this first volume of the study has four annexes: the first covers the addresses delivered at the inaugural meeting; annex II provides a list of participants at the meeting, together with those experts or entities which contributed papers but were not present; annex III lists all the papers presented, whereas IV is a study prepared after the meeting by the secretariat with the collaboration of some Brazilian experts; this study, which was specifically requested at the meeting, is an expanded report of that section dealing with the motor vehicle industry, in which certain more recent data have been included.

EXPLANATION OF SYMBOLS

The following symbols have been used throughout this report:

Three dots (. . .) indicate that data are not available or are not separately reported

A dash (—) indicates that the amount is nil or negligible

A minus sign (—) indicates a deficit or decrease

A full stop (.) is used to indicate decimals

A comma (,) is used to distinguish thousands and millions

A slash (/) indicates a crop year or fiscal year, e.g., 1954/55

Use of a hyphen (-) between dates representing years, e.g., 1950-54, normally signifies an annual average for the calendar years involved, including the beginning and end years. "To" between the years indicates the full period, e.g., 1950 to 1954 means 1950 to 1954, inclusive

References to "tons" indicate metric tons, and to "dollars" United States dollars, unless otherwise stated

The term "billion" signifies a thousand million

Details and percentages in tables do not necessarily add up to totals, because of rounding

INTRODUCTION

1. This report reviews the proceedings of the Latin American Meeting of Experts on Steel Making and Transforming Industries. It was held at São Paulo, Brazil, at the kind invitation of the Government of Brazil, from 15 to 28 October 1956, under the joint auspices of the United Nations Economic Commission for Latin America and Technical Assistance Administration and of the Associação Brasileira de Metais.

2. Brief mention should first be made of the various developments which led to the meeting, and which constitute its background. These might be summarized as follows:

(*a*) *June 1951.* At its fourth session, held in Mexico, the Economic Commission for Latin America adopted resolution 10 (IV). This resolution, after taking note with satisfaction of the first industrial study presented by the secretariat,[1] recommended that other special industry studies should be undertaken, including one on steel. The resolution further authorized the Executive Secretary to call meetings of "industrial experts to examine, on their personal responsibility, the conclusions and recommendations contained in each study before submitting them to the Commission".[2]

(*b*) *July 1951-October 1952.* In accordance with that resolution, the secretariat proceeded to prepare various studies on the steel making industry, and to organize the meeting of experts described in paragraph (*c*).

(*c*) *October-November 1952.* At the invitation of the Colombian Government, and in collaboration with the United Nations Technical Assistance Administration (UNTAA), which had taken a deep interest in the problem, the Commission convened the Expert Working Group on Iron and Steel Industry in Latin America, which met at Bogotá, Colombia. There were 117 participants, and 83 papers were presented.

(*d*) *November 1952-April 1953.* The secretariat gathered together the results of the Bogotá Meeting in a document (E/CN.12/293) which was submitted to the Commission's fifth session held at Rio de Janeiro, Brazil, in April 1953. At that time resolution 57 (V) was adopted whereby, after expressing its satisfaction with the report and the work of the Bogotá Meeting, the Commission recommended that the secretariat should continue its studies on the steel making industry, extending the scope of such research to include the steel transforming industries, and should organize a new meeting of experts from Latin America and other countries to study the problems outlined in the text of the resolution.

(*e*) *May 1953-September 1955.* The secretariat proceeded with its studies, first revising the report of the Bogotá Meeting and preparing a final version which appeared in print in the early months of 1955,[3] and commenced the new series of studies with which it had been charged. As a result of this work, a report was presented at the sixth session in Colombia in August-September 1955.[4] The Commission then approved resolution 96 (VI), in which it was recommended that preparations for the present São Paulo Meeting should be advanced.

(*f*) *September 1955-October 1956.* With the active co-operation of the Technical Assistance Administration, and the efficient and enthusiastic assistance of the Associação Brasileira de Metais, the secretariat prepared the São Paulo Meeting. Originally planned for June 1956, it was later postponed to October. In addition to its own studies, the secretariat revised and published for presentation at the meeting 96 studies sent by experts from various countries, and from international and private organizations.

3. This report is divided into four parts. Part I gives the composition of the Meeting and the attendance at it, and describes the manner in which the work was organized; it also includes the agenda to which the meeting worked. Part II reviews the activities of the meeting, and emphasizes its significance for industrial development in terms of the economic development of Latin America. Part III provides the reports of the different sections and reflects the discussions which took place. Finally, part IV summarizes those of the meeting's recommendations which require action on the part of the United Nations.

[1] *Labour Productivity of the Cotton Textile Industry in Five Latin American countries* (E/CN.12/219), United Nations Publication, Sales No. 1951. II.G.2.

[2] See ECLA *Annual Report* (E/2021 and E/CN.12/266).

[3] *Study of the Iron and Steel Industry in Latin America* (E/CN.12/293/Rev.1, United Nations Publication, Sales No. 1954, II.G.3. (The English edition is in two volumes.)

[4] *Iron and Steel Transforming Industries in Selected Latin American countries* (E/CN.12/377).

PART I

ORGANIZATION OF THE MEETING

A. Composition, attendance and organization of the work

1. Opening and closing sessions

4. The opening session of the meeting was held in the Salão Nobre of the Associação Brasileira de Metais, at the Palacio Mauá, São Paulo, Brazil, on 15 October, 1956. Mr. Tharcisio de Souza Santos represented the Governor of the State of São Paulo. The opening address was made by Mr. Luiz Dumont Villares, the President of the Associação Brasileira de Metais. (See annex I.) During the course of this session, speeches were made by Mr. Carlos Prieto of Mexico, President of the Compañía Fundidora de Fierro y Acero de Monterrey on behalf of the Latin American experts present, Mr. Enzo Giacchero, Minister of the High Authority of the European Coal and Steel Community, for the experts from other countries, and Dr. Raul Prebisch, Executive Secretary of the Economic Commission for Latin America and representative of the Secretary-General of the United Nations and of the Director General of Technical Assistance Administration. (See annex I.)

5. On 24 October, the eleventh anniversary of the adoption of the United Nations Charter, the meeting held a special commemorative ceremony. Speeches were made by Messrs. Joseph Hein, Executive Chairman of the meeting, Adriano Marchini, Director-Secretary of the Associação Brasileira de Metais, Mario Marceletti, Sub-Director of the Field Office for Latin America of the International Labour Office, Eduardo Albertal, from the Office of the Representative in Brazil of the Technical Assistance Board, and Bruno Leuschner, Chief of the Latin American Regional Office of Technical Assistance Administration.

6. During the final plenary session, the meeting heard a statement by the Rapporteur, Mr. H. W. A. Waring, and approved the provisional report on the work accomplished; the secretariat was authorized to prepare it in its final form, and to introduce any changes which might be necessary in order to make it as complete as possible. During this closing session, on 27 October 1956, which was also celebrated in the Salão Nobre of the Associação Brasileira de Metais, speeches were made by the following: Mr. Luiz Dumont Villares, President of the Associação Brasileira de Metais, Mr. Luciano Romanutti, of Attos Hornos de Zaplá, Argentina, on behalf of the Latin American experts, P. Bernardo Abrera, General Manager, National Shipyards and Steel Corporation, Manila, on behalf of experts from other countries, Carlos Quintana, Director of the meeting and Chief, Industry and Mining Division, Economic Commission for Latin America, and Lucas Lopes, Honorary Chairman of the meeting, who declared the meeting closed.

2. Composition and attendance

7. The meeting was attended by 214 experts from the following Latin American countries: Argentina, Brazil, Chile, Colombia, Cuba, Guatemala, Mexico, Peru, Uruguay and Venezuela. Moreover, a total of 58 experts attended from Austria, Belgium, Czechoslovakia, the Federal Republic of Germany, France, Italy, Japan, Luxembourg, Norway, Philippines, Sweden, the United Kingdom and the United States.

8. In addition to the United Nations organizations sponsoring the meeting, the following international organizations were represented: International Labour Organisation, Intergovernmental Committee for European Migration, and the High Authority of the European Coal and Steel Community. The complete list of participants, together with the names of the representatives of the international organizations, are given in annex II of this report.

3. Organization of the work

(a) *Direction of the work*

9. Mr. Luiz Dumont Villares, President of the Associação Brasileira de Metais, acted as Chairman at the opening session. The meeting afterwards appointed two Executive Chairmen: for the first week Mr. Robert N. Jafet, and for the second Mr. Joseph Hein.

10. General Edmundo de Macedo Soares e Silva and Mr. Lucas Lopes were elected Honorary Chairmen, and filled these posts during the first and second weeks respectively.

11. The meeting was serviced by the following secretariat:

Director

Carlos Quintana, for the United Nations Economic Commission for Latin America (ECLA), and Technical Assistance Administration (UNTAA).

Technical Advisers

Stefan Podgorski (ECLA)
Nuno F. de Figueiredo (ECLA)
Roberto Matthews (ECLA)

Special Consultants

Fritz Riekeberg
Alexandre Stakhovitch[5]
Hector Canguilhem
Max Nolff

[5] Loaned to the secretariat by the High Authority of the European Coal and Steel Community.

Conference Officer

Monica Barnett (ECLA)

Editorial Section

Francisco Giner de los Ríos, Chief Editor (ECLA)

Cesar de Madariaga, Spanish Technical Editor (ECLA consultant)

John Parker, English Technical Editor (ECLA consultant)

Administrative Officer

Francis Shomaly (ECLA)

12. The Associação Brasileira de Metais, in order to co-ordinate the work of the meeting with the secretariat named by the United Nations, and after prior discussions with General Macedo Soares e Silva, and more recently with the late Mr. Albert Scharlé, appointed a Committee which collaborated in ensuring the successful functioning of the meeting. This Committee consisted of Messrs. Luiz Dumont Villares, Robert N. Jafet, Adriano Marchini, João Gustavo Haenel, Amaro Lanari Jr., Luiz C. Correa da Silva, Eduardo P. Lozano and Fernando Toledo Piza.

13. Mr. H. W. A. Waring (United Kingdom) was named Rapporteur.

(b) *Discussion leaders*

14. The following discussion leaders were appointed for the various sections of the agenda:[6]

Marc Allard (France), Section A I: *Reduction furnaces.*

Hector Canguilhem (Chile), Section A II: *Use of oxygen in steel making.*

Jean Desvallées (France), Section A III: *Rolling mills and finishing.*

Pierre Coheur (Belgium), Section A IV: *Non-current steels.*

Italo Bologna (Brazil), Part C: *Training of personnel for the Latin American steel transforming industries.*

H. Opitz (Germany), Section B III: *Economic and technical aspects of machining.*

Eugene C. Clarke (United States), Section B I: *Economic and technical aspects of forging.*

Joaquín Prieto Isaza (Colombia), Section B II: *Economic and technical aspects of casting.*

João Gustavo Haenel (Brazil), Section D I: *Raw material requirements.*

Amaro Lanari Jr. (Brazil), Section D II: *Machine-tool manufacture in Latin America.*

Alberto Pereira de Castro (Brazil), Section D III: *Motor vehicle manufacture in Latin America.*

Roberto de Oliveira Campos (Brazil), Section D IV: *Integration of industrial resources and development problems of other mechanical industries.*

15. Two secretaries were also named for each of these sections, as follows:[7]

Section A I: Alexandre Stakhovitch (European Coal and Steel Community) and Luiz Coelho Correa da Silva (Brazil).

Section A II: Alexandre Stakhovitch (European Coal and Steel Community) and José Bonifacio da Silva Jardim (Brazil).

Section A III: Bruno Leuschner (United Nations Technical Assistance Administration) and Jorge da Costa Lino (Brazil).

Section A IV: Fritz Riekeberg (Germany) and Teodoro Niemeyer (Brazil).

Part C: Vicente Chiaverini (Brazil) and Max Nolff (Chile).

Section B III: Jordão Vecchiatti (Brazil) and Roberto Matthews (ECLA).

Section B I: João Mendes França (Brazil) and Stefan Podgorski (ECLA).

Section B II: Roberto Matthews (ECLA) and Miguel Siegel (Brazil).

Section D I: Alexandre Stakhovitch (European Coal and Steel Community) and Antonio Dias Leite (Brazil).

Section D II: Mario Mendivil (Argentina) and Fermino Rocha de Freitas (Brazil).

Section D III: Mauricio Grinberg (Brazil) and Nuno de Figueiredo (ECLA).

Section D IV: Carlos Quintana (ECLA) and Jorge Rezende (Brazil).

(c) *Committees*

16. Committees were formed for some sections of the agenda, and the meeting nominated the following experts to serve on them:

Committee on desulphurization: Messrs. Canguilhem, Barbosa and Suarez. Messrs. Allard, Coheur and Kalling acted as advisers.

Committee on training problems: Messrs. Hartwig, Robles, Santos and Sozio.[8]

Committee on economic evaluation of steel transforming processes: Messrs. Krebs, Shaw, Waring, Ivanyi, Leme, Wiley, Correa Lima, Orosco and Novinsky.

Committee on raw materials: Messrs. Haenel, Leite, Aramburu and Stakhovitch.

Committee on motor vehicle manufacture in Latin America: Messrs. Rezende, Pereira de Castro, Grinberg and Orosco.

17. In addition a consulting group was formed to examine problems relating to non-current steels. It was composed of Messrs. Albuquerque, Capocasale, Coheur, Fitterer, Niemeyer, Schneider and Suarez. The group did not meet during the meeting because it decided to work by correspondence afterwards. When it completes the work entrusted to it, it will send the results to the secretariat.

[6] See part I, section B hereunder for the general titles of the agenda. In that part, and here, the items are given in the order in which they were discussed. See ST/ECLA/CONF.4/L.2/Rev.4.

[7] The sections are arranged in order of discussion of the various items.

[8] This Committee did not meet because the ECLA secretariat suggested that, since employer-worker relations fell outside its own terms of reference, the matter should be referred to the International Labour Office.

18. Apart from the committees mentioned above, a round table meeting was held on 18 October to discuss rolling problems, in order to expand the discussion on this item. Those who attended the meeting included Mr. Homes (Belgium) (in the Chair), Messrs. De Beco, Savage, Visconti, Haenel, Taam, Schlesinger, Lozano, Cartwright, Dowding, Costa Lino, Pujals, Wilms, Fouassin, Toepfer, Larrabure and Desvallées.

B. Agenda

19. The meeting adopted the following agenda for its working sessions:

Part A. *Iron and steel making*

- Section I: Reduction furnaces
- Section II: Use of oxygen in steel making
- Section III: Rolling mills and finishing
- Section IV: Non-current steels

Part B. *Iron and steel transformnig processes*

- Section I: Economic and technical aspects of forging
- Section II: Economic and technical aspects of casting
- Section III: Economic and technical aspects of machining
- Section IV: Economic evaluation of steel transforming processes in Latin America

Part C. *Training of personnel for the Latin American steel transforming industries*

Part D. *Development problems of Latin America's mechanical and metallurgical industries*

- Section I: Raw material requirements
- Section II: Machine-tool manufacture in Latin America
- Section III: Motor vehicle manufacture in Latin America
- Section IV. Integration of industrial resources and development problems of other mechanical industries

20. A different order was followed in the working sessions: part C was discussed before part B, and within this, sections III and IV preceded sections I and II. For the dates of the meetings and the papers presented at them see annex III of this report.

PART II

SUMMARY OF PROCEEDINGS[9]

1. Procedure adopted and general comments

21. In this part of the report an attempt has been made to summarize briefly the results of the meeting. In a document of this character it is clearly impossible to go into detail, but it may serve to draw attention to the salient points.

22. At the opening session a statement was made by Dr. R. Prebisch, the Executive Secretary of ECLA, which set out very clearly the reasons why the expansion of Latin American steel transforming industries is essential.

23. Clearly, the expansion of Latin America's steel production and steel transforming industries is an economic necessity, and the vital questions which the meeting has considered are what methods of production and what technical improvements will give the best results, together with some attempt at an economic evaluation of the effects of this expansion.

24. As regards steel production, Latin American countries are, in the main, handicapped by lack of suitable coal; on the other hand they have considerable advantages in the availability of high-class ore. In an expanding economy, scrap is always liable to be short and therefore the demand for iron ore and coke will be high, which involves the provision of adequate coke-oven and blast-furnace capacity.

25. The complexity of the steel transforming industries makes consideration of this subject and the drawing of valid conclusions particularly difficult, but a start has been made. At the first meeting of this type held in Bogotá in 1952, particular attention was paid to steel making, but in this meeting only specific aspects of special interest have been covered, whilst a substantial portion of the meeting has been devoted to a first approach to the technical and economic aspects of the transforming industries.

26. The meeting discussed various methods of iron and steel making comprising sections on: reduction furnaces; the use of oxygen in steel making; rolling mills and non-current steels. It then considered the training of personnel for the Latin American steel transforming industries, a subject of vital interest in view of the rapid expansion taking place and the need for an enormous increase in the quantity of skilled labour required.

27. The second part of the meeting, which was a new departure in Latin America, was concerned with the economic and technical aspects of machining; the economic evaluation of steel transforming processes and the economic and technical aspects of forging and casting. Attention was then given to raw material requirements; this was followed by consideration of machine-tool manufacture and motor vehicle manufacture. The meeting concluded by discussing the integration of industrial resources and development problems of other mechanical industries.

28. The problems of highly industrialized countries and those which are in the course of a greater or lesser degree of industrial development are naturally somewhat different. In the industrialized countries a pattern of production has been evolved over the course of years but this has grown up somewhat haphazardly. The Latin American countries can benefit from the experience of the industrialized countries, not only as regards the technical and economic aspects of various types of processes employed, but also by learning lessons from the errors committed in the past in the industrial planning of countries outside Latin America. The consideration and the free discussion of these problems are among the major reasons underlying the calling of this meeting.

29. No doubt, each of the countries present—and in fact each of the individual representatives of these countries—will, to a certain extent, draw their own conclusions from this meeting and apply them when considering present and future planning in the industries with which they are primarily concerned.

30. In view of the widely different conditions which prevail from country to country, even a simple summary of the findings of the meeting is difficult, but in the following paragraphs a number of points have been drawn from the draft reports prepared by the discussion leaders and secretaries of the groups referred to above.

[9] A general summary of the proceedings and discussions as presented by the Rapporteur of the meeting, Mr. H. W. A. Waring, on 27 October 1956.

2. Principal points from reports of discussion leaders and group secretaries

A. IRON AND STEEL MAKING

SECTION A I: (A) DESULPHURIZATION

31. The elimination of sulphur from pig iron is a subject of major interest in Latin America, as the majority of indigenous coal has a somewhat high sulphur content.

32. Elimination of sulphur from pig iron can be carried out:

(*a*) In the blast furnace;

(*b*) In the course of intermediate operation between the blast furnace and the steel furnaces;

(*c*) In the steel making furnaces.

33. Although the choice of the actual method to be adopted is a matter to be decided by each individual, country and company, it should be emphasized that the documents presented all drew attention to the fact that it is possible to increase the output of blast furnaces by operating with a minimum of slag and a lower basicity index, which also results in saving coke. The resulting pig iron would, however, have a higher sulphur content than when operating with a large slag volume and a high basicity index.

34. Various methods of desulphurization by intermediate operations were considered. The extent to which these should be used in any particular plant must depend on consideration of output versus cost.

35. It was emphasized that only processes which have been tried and proved industrially should be adopted, even if less well known processes might appear less costly. On the other hand, in certain cases, in view of the necessity for maximum production from the blast furnaces, even if desulphurization outside the furnace should prove more expensive, it may be advisable to adopt it.

Section A I: (b) Furnaces

36. The development of electric low-shaft furnaces for pig-iron smelting, the international low-shaft blast furnace, and electric arc furnaces were discussed.

37. In the field of pig-iron production, it appeared that while the electric low-shaft furnace had been commercially developed, and could be used with either a mixture of coal and anthracite or with charcoal as a reducing agent, certain limitations still existed as to the size of the unit. Development work on other types of low-shaft blast furnace appeared to have been mainly directed towards the use of low-grade ores and poor-quality fuels.

38. Electric melting furnaces of various types were also discussed and attention was drawn to the benefits of making special and alloy steels in these types of furnaces.

Section A II: Use of oxygen in steel making

39. The advantages of the use of oxygen in steel making were generally accepted, but it was felt that a systematic study of the cost of production of oxygen was necessary, and it was suggested that this should be undertaken by ECLA, in conjunction with experts in this field.

40. As regards the different uses of oxygen in steel making, it was not possible to formulate any general rules as to the advisability of adopting one process as opposed to another. In each case this would have to be studied in the light of the phosphorus content of the iron process and the percentage of other metalloids present, and in the light of conditions prevailing or likely to prevail in any given plant.

41. It was felt that when the cost of oxygen production in Latin America, in varying quantities, had been satisfactorily established it would be possible to benefit from and interpret more fully the documents presented.

Section A III: Rolling mills and finishing

42. The problem of steel rolling in Latin America was formulated in a document prepared by General Edmundo de Macedo Soares e Silva (Brazil) and this met with general acceptance. The main points that were emphasized were:

(*a*) The necessity of providing for successive expansions and of thinking generally in terms of an expanding market;

(*b*) The rejection of cheap installations which might have certain preliminary advantages but would soon have detrimental effects;

(*c*) Since complete specialization of mills is not normally possible, it was necessary to establish programmes which, without placing too heavy a burden on the initial investment, would allow for the purchase of a primary mill which could provide for future needs;

(*d*) Installations should be selected from those already tested, bearing in mind that untrained personnel would be operating the mill in the earlier stages.

43. It was also emphasized that as quantity demand is satisfied, quality requirements become higher and so equipment must be adequate from this angle also.

44. Since the investment cost of rolling mills per ton capacity in an integrated steel plant represents more than half of the total investment, any error in the selection of rolling-mill equipment will be costly. Since, in the main, larger units are sturdier than small ones, this may have a bearing on the cost of down time and maintenance and repair, which may represent a large percentage of total rolling cost.

45. Continuous casting was considered, and the potential advantages for smaller Latin American plants were obvious. In addition continuous casting might assist the production of a primary mill which had become too small to cope with the supply of ingots of normal size.

46. The economic advantages of the process both as regards capital and production costs were outlined. It was felt that while developments in continuous casting should be closely followed, it might be preferable for Latin America to await further progress in other parts of the world, particularly if it were wished to use the process for mild steel as distinct from special steels.

Section A IV: Non-current steels

47. A number of Latin American countries are in a favourable position to produce non-current steels, owing to their exceptionally pure iron ores and the existence locally of alloying elements. With rising production, it is necessary that:

(*a*) The number of types produced should be limited to the minimum possible; in order to achieve this the problem of definition and classification has to be solved, and it was felt that work in this field should be continued;

(*b*) The number of types produced should be spread over the smallest possible number of mills and a wide

common planning of production programmes was thus urgently necessary.

48. As may be seen from part IV of this report, the meeting recommended action on these subjects on the part of the United Nations.

B. IRON AND STEEL TRANSFORMING PROCESSES

Section B I: Economic and technical aspects of forging

49. The emphasis in the papers prepared was on what had been achieved technically in industrialized countries in the field of forging. Included in this was consideration, for drop-forging, of cost factors and investment and the minimum market demand necessary to justify the installation of the process.

50. In a transition period, account had to be taken not only of the length of runs but also of the effect of the existence of the installation on future demand. During this transitional period normal operational methods might be uneconomic, and processes would have to be adapted to allow for this.

51. The meeting considered that the evaluation presented for drop forging should be extended to machine forging and press forging. The possibilities held out by the most modern developments in cold forging should also be explored, particularly in view of the savings in raw material consumption which might be achieved, and the substitution of cold forging for machining.

Section B II: Economic and technical aspects of casting

52. Consideration was given to technical and economic problems of both steel and iron casting. From the technical angle considerable interest was expressed in the manufacture of nodular cast iron and it was felt that further study should be given to this subject.

53. Foundry mechanization appears to be an urgent problem, particularly because of its influence on costs, and it was felt that the advantages in the saving in man hours more than compensate for the cost of installation.

54. In the main, data on the casting industry was incomplete and it was suggested that studies in this field should continue in order to obtain more knowledge of the capacity and conditions of foundries in Latin America. The development of the industry in recent years has been considerable, and it is considered that the subject is of major current interest due to the number of enterprises which are modernizing their methods of production and because of the trend towards the setting up of numerous new enterprises in this field.

Section B III: Economic and technical aspects of machining

55. The papers considered in this section dealt partly with technical and partly with technico-economic problems. As regards the economic aspects, this was the first time in ECLA and TAA meetings that an approach had been made in this field and the first objective was to devise means of studying it.

56. The meeting felt that the provisional approach adopted by the secretariat, particularly in the two papers it had prepared, was on the right lines, and should be extended to a full scale study covering selection of types of equipment suitable for Latin American conditions.

57. It was felt that particular attention should be paid to considerations relating to the substitution of human skill by mechanization.

Section B IV: Economic evaluation of steel transforming processes in Latin America

58. Rational application of investments is of critical importance when resources available for industrialization are limited, but inadequate statistical data, particularly as regards economic factors and technological coefficients, may limit the development of rational policies within manufacturing enterprises or the carrying out of industrial studies and economic planning.

59. A proposal for a new technique of evaluation was presented to the meeting and discussed. The technique discards the notion of sectors or products and penetrates more deeply into the economic structure by evaluating basic processes. The evaluation of products is in fact reduced to determining the composition of the materials employed and their subsequent processing.

60. The technique offers sufficient elasticity corresponding to the required degree of accuracy. Since evaluation of processes includes complete requirements for input of resources per unit of weight or time, as well as determination of unit costs, rapid predictions can then be made for varying degrees of manufacturing integration. In planning the manufacture of a new product, therefore, estimates could rapidly be made covering anything from an entirely integrated operation from basic materials to final products through cases when manufacturing was complemented by the purchase of semi products and industrial services from outside suppliers.

61. In all cases a reliable forecast could be made of the total resources required, such as man power, materials, investment in plant and working capital as well as unit costs, level of selling prices, profitability rate at various levels of capacity utilization, growth rate requirements, and the competitive position as regards imported products.

62. During the discussion, the economists present expressed the view that the proposed technique of evaluation:

(*a*) Was potentially a useful tool in the group of devices employed by planners and business executives, when attempting to predict the possible performance of new or enlarged industries;

(*b*) Was applicable to situations where an economic evaluation would result in implementation or rejection of a proposed development project;

(*c*) Represented a substantial implementation of input-output methods and constituted a valuable instrument for linear programming in some economic sectors.

63. The industrialists taking part in the discussion agreed with the advantages of applying this method of evaluation to economic control of enterprises and pointed

out its originality in the use of costing as a means for predicting capital structure.

64. As will be seen from part IV of this report, the meeting recommended that development work on the technique described should continue and that its usefulness should be tested in pilot studies.

C. TRAINING OF PERSONNEL

65. From the studies presented and the discussions which took place, it was clear that there were serious labour training problems at all levels in the Latin American steel transforming industries.

66. The urgency of the problem justified the proposal that ECLA and UNTAA should be asked to make a wide examination of the situation in Latin America in order to determine the extent of the skilled labour deficit.

67. It was felt that in the case of engineers, the following steps might be advisable:

(*a*) Formation of a Latin American specialization centre, making full use of existing institutions;

(*b*) Amplification of the scholarship and fellowship systems and post-graduate courses.

68. With regard to section (*a*) of the preceding paragraph, the meeting considered that co-operation from ECLA and UNTAA would be necessary.

69. Measures which might be taken into consideration to alleviate the shortage of technicians were:

(*a*) The setting up of technical schools in areas where steel transforming industries were established, which would give preference to the training of technicians in metallurgy, machine construction, and electro-technology;

(*b*) More extensive use of training within industry;

(*c*) Selected immigration of technicians.

70. With regard to skilled workers, the following points were suggested:

(*a*) The development of industrial apprenticeship systems in co-operation with specialized organizations;

(*b*) Intensive training of additional workers in special courses and the wide use of T.W.I.;

(*c*) The encouragement of skilled labour by means of adequate promotion systems;

(*d*) Selected immigration.

71. The need for instructors led to the following suggestions:

(*a*) There should be an interchange of instructors between various countries both in order to increase their knowledge of various types of industry and by training within schools in the countries visited;

(*b*) The establishment of an instructor training centre for all Latin America by expanding that run by SENAI in Brazil.

72. It was considered that the collaboration of the ILO would be very useful in connexion with section (*b*) of the preceding paragraph.

73. In general it was also suggested that the implementation of ECLA's technical glossary project would be advantageous for all Latin American countries.

D. DEVELOPMENT PROBLEMS OF LATIN AMERICA'S MECHANICAL AND METALLURGICAL INDUSTRIES

Section D I: Raw material requirements

74. It is expected that Latin American steel production will be doubled within 5 years, although consumption will increase by only 46 per cent during the same period. This rate of increase of production, which is much larger than the increase in consumption, is typical of the development of many less industrialized countries. The discrepancy is, however, especially pronounced in Latin America, as a result of the excellent development prospects for steel industries in the majority of Latin American countries.

75. The development of the mechanical engineering industry in Latin America raises the problem of increased production of non-current steels. It was felt that as capacity of the large integrated plants increases, smaller plants could turn to both special qualities and shapes, although this would necessitate additional investment and additions to their technical staff.

76. In the course of the discussion of the papers it was clear that more information should be sought and ECLA was therefore requested, with the assistance of specialized organizations, to make a study on the following lines:

(*a*) Consideration of the policy of amortization which should be followed by the iron and steel making and transforming industries, suitable for the economic necessities of Latin American countries;

(*b*) A study of the most effective methods of compilation, presentation and publication of statistics of production, consumption and trade in steel products in Latin America, together with other types of information on the steel industry;

(*c*) A study of the probable market for iron and steel products with a view to preparing projections of the demand for steel. This would involve consideration of methods to be adopted taking into consideration: (i) elasticity of demand in relation to income; (ii) elasticity of demand in relation to industrial production; (iii) input-output ratios.

Section D II: Machine-tool manufacture in Latin America

77. The relative size of enterprises in Latin America and in other countries was considered together with the types of machines which should be manufactured in Latin America. No clear conclusions could be drawn as to the comparative advantages of large and small organizations but, as regards production, it was considered that the production of heavy special products, highly automatic machines, those with intricate operating mechanisms, and very large heavy or complex machines only manufactured in highly developed countries was not advisable.

78. No doubt the larger and more complicated machines would eventually be made, and it was considered that this could be facilitated by the economic integration of Latin American countries, which would increase the size of the market.

79. Production would be facilitated if agreements were concluded with foreign manufacturers in order to obtain not only designs but also adequate technical

assistance. This could be complemented by the interchange of technicians and could be extended to the sales organizations of the various firms. The establishment of standards and the selection of suitable types of steel for various forms of production was also necessary. Finally, Latin American producers might complement their own production by using components made more economically by either domestic or foreign manufacturers.

80. The ownership of patents and trade marks presented a difficult problem but it was felt that the way could be smoothed by the co-operation of the local machine-tool manufacturers' associations, which should not encourage the introduction of prototypes of machines without a prior manufacturing agreement with the foreign firm concerned.

81. Technical improvements in machine tools made machines obsolete in a period much shorter than had previously been considered normal and the depreciation policy followed should be such as to adequately cover the replacement of the asset within a reasonable period.

82. In many Latin American countries the rates allowed by the taxation authorities did not conform with reality and it was felt that the competent international organizations should undertake a study of this problem and advise on suitable depreciation rates.

Section D III: Motor vehicle manufacture

83. Discussion centred around the general problems relating to motor vehicle manufacture in under-developed economies.

84. It was recognized that the installation of such new and complex industries, so much related to other important sectors of the economy, could only take place if there were deliberate measures tending to foster such development.

85. Although conditions differed substantially from country to country, in the main it appeared that in the case of light and heavy lorries and tractors and jeeps, the market in Brazil and Argentina appeared to be sufficiently large to favour production at reasonable cost, although in the main cost comparisons and methods of evaluation generally were somewhat inadequate for a proper appraisal to be made. On the other hand, passenger car production would seem to merit special caution, since this branch of the automotive industry requires a considerably broader market and much greater facilities in the way of auxiliary mechanical industries.

86. A further important problem was that relating to the difficulties of reconciling the steadiness of design of vehicles over a long period of manufacture in Latin America with annual changes in the same designs in the foreign parent companies. Because of dependence on imported components this question was serious.

87. Finally there were problems relating to raw material supplies. The creation of an automotive industry implies additional supplies of raw materials and finished product, mainly made of steel. The steel industry and the manufacturers of parts and pieces probably will not create production facilities, with related high investments, before large-scale automotive manufacture has begun.

88. As a result of the foregoing, the meeting recommended that the United Nations, in co-operation with other institutions should undertake:

(*a*) A survey of the motor vehicle market of Latin America both from national and regional points of view, with special reference to the elasticity of supply. This work would contribute to the setting up of more uniform criteria on the subject and would also serve as a basis for an examination of the problem of integration of the regional motor vehicle market;

(*b*) A study of the motor vehicle industry in Brazil, using the evaluation method proposed in the paper entitled *Economic evaluation of the iron and steel transforming processes in Latin America.* The work would be useful in determining the impact of the programme for the development of the motor vehicle industry on that country's economy and at the same time would help in the examination and improvement of the techniques of analysis proposed in that paper. The study should be extended afterwards to other countries, in conjunction with nominated experts.

Section D IV: Integration of industrial resources

89. It was considered that some countries had achieved such a degree of progress in industrialization that a new step of a different kind should be taken by pooling up resources represented by existing installations, in order to enter into the manufacture of heavy equipment such as that required for steel making, pulp and paper, mining and the manufacture of heavy chemicals. The economic advantages would be savings in foreign exchange and better utilization of existing facilities.

90. Considering that this kind of grouping of industries constitutes an important factor in economic development, it was suggested that development banks and institutions should help and encourage integration. These agencies in turn, might request technical assistance from the United Nations.

91. Medium and long term financing on the basis of credits to be obtained from the development and banking institutions was considered. It was however essential that, if this credit were to be granted, the locally produced material should be of good quality.

92. The meeting considered the possibilities of Latin American integration at the regional level, on the basis of a survey prepared by ECLA. The trade committee of ECLA would be meeting in November in Santiago and the working group preparing this meeting had come to the conclusion that the problem should be tackled on the basis of supra-national or multi-national markets, at least for those products which cannot be manufactured economically on the basis of the demand of a single nation.

93. The meeting recommended that ECLA should undertake the study of industrial integration possibilities as a first step towards the preparation of specific projects.

94. It was considered that in order to achieve Latin American integration it would first be necessary to standardize and rationalize specifications for steel and for products made from iron and steel, and agree on certain tolerances. It was recommended that ECLA, in conjunction with other national and international agencies, should study this project, including the standardization of nomenclature for tariff purposes.

PART III

SECTIONAL REPORTS

A. Iron and steel making

Section A I. Reduction furnaces

95. The world iron and steel industry, as it exists today, is based on the reduction of iron ores by coke, in the conventional blast furnace. In this process, as well as in most other special methods developed for extracting iron from its ore, many of the impurities present in the raw materials are to a greater or lesser extent also present in the metal produced. Sulphur is one of them, and its presence in steel has to be carefully limited to low values, for most applications of that metal.

96. In Europe, the problem of sulphur elimination is gradually becoming more pressing since the sources of choice raw materials have been or are being quickly exhausted and since the requirements of quality have been gradually raised.

97. In Latin America, the problem is already present, even though its iron and steel industry is in its infancy, because most of the available coal has a high sulphur content (see proceedings of the Bogotá Meeting).[10]

98. The elimination of sulphur from pig iron down to levels acceptable for steelmaking can be carried out (*a*) at the blast furnace; (*b*) by some intermediate operation between blast furnace and steel furnaces. The choice between the above alternatives will have to be made after balancing the respective advantages and disadvantages. Of the papers presented at the São Paulo meeting, two were concerned with the first possibility and four with the second.

99. The first mentioned (ST/ECLA/CONF.4/A I-5) had special significance during the discussions since it was a careful presentation of operational data obtained at Huachipato (Chile). It suggests a method for judging to what extent desulphurization should be carried out inside the blast furnace and/or by the processes described in other documents.[11]

100. On the basis of the document mentioned, the meeting considered the sulphur contents and the coke rates resulting from operation with different values of the slag basicity index and of slag volume. As an illustration, it was shown that in order to obtain a low sulphur content (0.05 per cent) in the pig iron, Huachipato had to use either a higher basicity index (1.3) which allowed operation with a minimum amount of slag (453 kg/ton) or a basicity index 1 which required an enormous amount of slag (1,443 kg/ton).

101. The first alternative was obviously preferable if it had been decided to carry desulphurization to 0.05 per cent sulphur *in the blast furnace.*

102. However, it was also shown that when using a basicity index 1 the furnace would operate with a minimum of slag (392 kg/ton) and a minimum of coke consumption (756 kg/ton), but the sulphur content would be 0.116 per cent. Then, of course, there would have to be a separate desulphurization operation, after the blast furnace, but the capacity of the latter would have been increased appreciably.

103. The meeting considered that the method used in gathering and presenting those data was objective and thorough, and should be recommended to other plants wishing to gather their own operational data on the same question.

104. Another paper (ST/ECLA/CONF.4/L.A I-4) explained the general theory of desulphurization by slags within the blast furnace itself, and those desulphurization processes that take place in the ladle and within the mixer. It provides an excellent guide for a clear understanding of the specific problems involved.

105. The meeting also considered the soda-ash process[12] which is well known and has been in wide use for a long time. Its range of applicability is limited to the removal of moderate amounts of sulphur (40 to 82 per cent yield, depending on the initial sulphur). Three possible ways of applying this treatment were considered: (*a*) single treatment in the transfer ladle; (*b*) double treatment in the blast furnace ladle and in the transfer ladle; (*c*) treatment using 2 teapot ladles in cascade.

106. The reagent used (sodium carbonate) is a secondary raw material (produced industrially) and relatively expensive compared with a primary raw material like lime.

107. Typical of the method is a reduction of 0.100 per cent initial to about 0.050 per cent final sulphur. For the range mentioned an amount varying from about 6 kg/ton (single treatment) to 2 kg/ton (2 teapot ladles treatment) is required. No special heavy equipment is needed except in case (*c*), when 2 teapot ladles are necessary. No extra time is required beyond 1 to 2 minutes for skimming the slag.

108. Temperature losses are small (1.5° C/kg of soda ash/ton) in cases (*a*) and (*b*), while in case (*c*) an actual advantage is claimed over normal practice since the operation is rapid, does not require any rabbling and because there is a very substantial iron recovery.

[10] See *A Study of the Iron and Steel Industry in Latin America, op. cit.* vol. 1, Chapter III.

[11] See ST/ECLA/CONF.4/L.A I-1, 2, 3 and 6.

[12] See ST/ECLA/CONF.4/L.A I-1.

109. Consideration was given to the fact that the soda ash process, besides its limited range of sulphur elimination, has two disadvantages: soda is corrosive to the refractory linings of ladles and furnaces; the reliability of the process is only average in cases (*a*) and (*b*) although it is good in case (*c*). Occasional rejects might be expected due to incomplete desulphurization resulting from interfering factors (presence of oxidized slag, incomplete removal of soda slag, etc.). The process is widely used and proved industrially (Arbed, Corby, Paz del Rio and many other plants). It is flexible and can be used whenever and wherever required without important extra equipment and without deviating much from proven plant practices. It is also adapted to large scale production.

110. The meeting paid particular attention to the Kalling process[13] which has a remarkable capacity for sulphur removal, from 0.50 or even 1.00 per cent initial down to around 0.005 per cent final sulphur. The reagent used is good quality lime ground to below 0.5 mm, an addition of 1 to 3 per cent soda ash being helpful. The quantity required varies from 12 to 6 times the amount of sulphur to be removed, the efficiency being higher with a higher initial sulphur content.

111. In a typical application, 15 kg of lime will reduce the sulphur from 0.150 down to 0.010 per cent. The process does require special equipment, in the form of refractory lined bottle-shaped vessels of 25 to 30 tons capacity, to be rotated on a special motorized stand at some 30 r.p.m. However, mixers and/or transfer ladles might become unnecessary, the net investment in a new plant being thus reduced. Some 10 to 20 minutes rotation time is enough for complete sulphur removal. The loss in temperature varies from 10° to 25° C., depending on the practice chosen (with or without mixer, with or without use of transfer ladles). The iron losses appear to be particularly small.

112. The process has been proven industrially, and is in use in a few plants in Europe. However, no vessel of capacity larger than 30 tons has been built so far. This capacity may yield an output of some 48 to 60 tons/hour or some 360,000 tons/year; this, it was thought, could satisfy many Latin American plants but would be insufficient to cope with the requirements of the open hearths of such a plant as Volta Redonda or others to be similarly equipped. Some experts remarked that such installations would require much higher hourly deliveries of pig iron to the steel furnaces leading to multiple vessels and rotary stands, and to plant practices apparently not fully tested yet. Expert and reliable crane operation would seem essential in order to manoeuvre the heavy vessels on to and out from the rotary stands without damage to the equipment.

113. However, several experts were of the opinion that the high efficiency of sulphur removal and the already successful industrial use on a moderate scale seems to warrant careful attention being paid to the present and future possibilities of the Kalling process. Its excellent reliability seems to ensure repeated and total removal of sulphur, leading to better quality and, it is claimed, to appreciably higher yields at the rolling mills.

114. Small to medium sized Latin American plants making tonnage steels and faced with a serious sulphur problem might do well to consider the Kalling process. This process seems also particularly recommended for high quality steels.

115. The IRSID process was also examined,[14] a novel method in which desulphurization is also accomplished with lime. The range of sulphur removal seems to be about the same as in the Kalling process, but even lower sulphur contents can be reached more easily and faster (0.003 per cent when blowing with nitrogen).

116. The process consists in blowing a suspension of finely ground lime (90 per cent below 0.250 mm) in compressed nitrogen or air through immersed tuyères placed at the bottom of a converter-shaped vessel. The quantity of lime in suspension is around 35 kg/cubic metres, and to lower the sulphur from about 0.100 per cent to 0.010 per cent the blowing of some 1.2 per cent is sufficient.

117. The time of blowing is only 3 to 5 minutes. As for equipment, besides the special converter-like vessel, a fluidizing apparatus, ball mills, screens and compressed nitrogen or air installations are required.

118. The temperature losses in the operation itself seem to be of the order of 15° C. The same vessel can now be used for transfer of the liquid pig iron and for desulphurization, thus avoiding other temperature losses.

119. The iron loss is claimed to be only 0.1 per cent when the used lime is processed so as to recover iron content.

120. The operation with nitrogen has the disadvantage of requiring a supply of this gas, not always available. The use of compressed air seems also to lead to low final sulphur contents in the iron.

121. The IRSID process, although new, is promising, but no industrial use has yet been reported. The use of 12 to 15 ton vessels is now being developed and larger ones will be tested in the near future. The reliability of the process seems to be excellent, ensuring almost complete sulphur removal.

122. Since lime is relatively cheap, the Kalling and IRSID processes are advantageous where high amounts of sulphur have to be removed.

123. The treatment of pig iron or steel with synthetic desulphurizing slags (Perrin process) was considered when the meeting discussed the corresponding document.[15] The range of applicability seems limited: from 0.100 down to 0.030 per cent sulphur for pig iron and from 0.040 down to 0.010 for steels.

124. The process requires special equipment and additional labour for preparing a synthetic slag (a mixture of lime and fluorspar for pig iron and of lime and alumina for steel). This slag is used in amounts varying from 2.5 by weight for pig iron to some 3 to 4.5 per cent for steel.

125. Considerable handling seems to be called for. Besides, the day-to-day preparation and handling of molten slags of the types required might prove quite difficult and requires a perfect control of shop operations.

126. No industrial use was indicated for the process in the case of pig iron. For steels the process is in

[13] See ST/ECLA/CONF.4/L.A I-2.

[14] See ST/ECLA/CONF.4/L.A I-6.

[15] See ST/ECLA/CONF.4/L.A I-3.

use at Ugine (for special steels and limited sulphur removal) and at Cokerill-Liège (for steel castings). Better steel quality was claimed to result from the action of the aluminous slag in the direct treatment of steels.

127. The meeting noted that all documents presented drew attention to one very important point: *it is possible to increase greatly the output of the blast furnace by using less slag and a lower basicity index, and having at the same time a lower coke rate.* The resulting pig iron, having a higher sulphur content, can be desulphurized afterwards by one of the methods described. The extent to which this should be done depends on considerations of output versus cost. Among these considerations the participants thought the following worthy of mention:

(*a*) As an insurance for its capital, it seems particularly advisable that Latin American plants, whenever possible, should adopt equipment and processes which are well proven industrially. In other words, cost considerations alone, when they favour a new and unproven process, should not lead to a decision in favour of that process;

(*b*) In the Latin American area, production needs are so great that any increase in output of equipment such as blast furnaces should be considered even when the final cost is a little higher.

128. The meeting agreed that the following preliminary conclusions could be drawn from the discussion on desulphurization:

(i) Latin American plants might do well to try to increase their blast-furnace output by resorting to a lower slag basicity index, thus using less slag and saving coke;

(ii) If the resulting initial sulphur content of the pig iron is moderate (around 0.15 per cent) and a final content of up to 0.04 or 0.05 per cent is acceptable, the soda ash method of desulphurization could probably be used satisfactorily;

(iii) If the sulphur content of the pig iron is higher, or if a very low sulphur is desired, the Kalling process or a development of the IRSID process should be considered, although at this date the latter process is still at the experimental stage.

Note on electric and low-shaft furnaces

129. The further development of Latin American pig-iron and steel production has produced a number of technical problems requiring careful study. In the field of pig-iron production, the meeting considered papers on the low-shaft blast furnace and the electric pig-iron furnace.[16] Both types possess inherent features which are of particular significance for Latin American conditions.

130. The development of the International Low-Shaft Blast Furnace at Ougrée, Belgium, is directed towards the liberation of low-grade ores and fuels. Results achieved to date indicate that this type of furnace might have interesting possibilities for Latin America.

131. The electric pig-iron furnace at present appears to be suited for certain well-defined economic conditions. Opinions were noted in respect of the use of charcoal which appears to be entirely satisfactory from a technical point of view. Further advances in the size of available units—at present of about 200 metric tons per day—appear technically feasible but may yet take some time to develop.

[16] See ST/ECLA/CONF.4/L.A I-7 to 9.

SECTION A II. USE OF OXYGEN IN STEEL MAKING

132. The iron and steel industry is universally based on the reduction of iron ore in the conventional blast furnace. Once the pig iron has been obtained, it is transformed into steel by the elimination and/or reduction of the various elements introduced into it through oxidation, mainly the oxygen contained in the air.

133. At the meeting, several documents were presented relating to the new techniques that have been developed to replace air by oxygen of varying degrees of purity, according to each particular case.

134. The use of oxygen increases productivity and improves the thermal balance of the steel-making furnace because nitrogen, which is a detrimental charge, is not introduced or is introduced in smaller quantities.

135. The meeting examined the problem from a general angle, as well as from the scientific and technical aspects of the use of oxygen for making steel.[17] Its use in methods of obtaining steel by blowing permits a broad range of pig-iron composition. In other words, pig iron can be used which could not be used with air blowing. Moreover, as there is a better head recovery, a greater amount of scrap can be used. From another angle, oxygen blowing results in the production of satisfactory steel which seems, in some cases, to be even better than that obtained by conventional methods. If the oxygen is used in a Siemens Martin furnace, the same general advantages apply.

136. During the last five years surface blowing with oxygen in a furnace similar in shape to the conventional converter has acquired particular importance. It is known for short as the LD process and was described to the meeting in detail.[18]

137. It is clear from the discussion on this document that the method has been used for pig irons containing a maximum of 0.2 to 0.3 per cent phosphorus, a minimum of 1.2 per cent manganese and a maximum of 0.05 per cent sulphur. Recent research has shown that the phosphorus content can rise to 0.5 per cent providing two slags are used (with the corresponding increase in cost), while the manganese content of the pig iron can be regulated at will by adding manganese ore to the blast-furnace burden. Should the sulphur in the pig iron exceed the acceptable limit for applying the LD process, it could be reduced beforehand to an acceptable level by one of the processes discussed earlier in the meeting.[19]

138. The quality of the steel is considered to be the same as, and in some cases even better than, Siemens-Martin steel.

139. The meeting also examined a special document[20] dealing with the method of blowing with oxygen

[17] See ST/ECLA/CONF.4/L.A II-1.
[18] See ST/ECLA/CONF.4/L.A II-3.
[19] See the preceding section A I, paragraphs 95, *et seq.*
[20] See ST/ECLA/CONF.4/L.A II-6.

on the surface of the metal bath in a tilting rotating "converter"; this method has been applied to phosphorus or Thomas pig iron with a phosphorus content of 1.8 per cent and 0.2 per cent Si. According to experience to date, this process is easy to control, has a high heat recovery and does not produce fumes, which are relatively costly to eliminate. Moreover since the blowing takes place at reduced pressures, oxygen of a relatively low degree of purity can be used.

140. As with any new process, the duration of the total operating cycle, that is, the time which elapses between two heats has to be specified and/or improved; furthermore the consumption of refractory material seems to be quite high.

141. From the Latin American point of view, it is advisable to await the results obtained when this process is applied to pig irons with a higher Si content than is the case at present, that is by increasing it to around 1 per cent.

142. The meeting also studied the technical and economic aspects of the use of oxygen in converters, open-hearth furnaces and electric furnaces.[21] Interesting data are included in each case, but in order to interpret their technical and economic aspects a systematic study is required of the cost of producing oxygen. The possibility was explored of this study being undertaken by ECLA as soon as possible, in collaboration with several of the experts who attended the meeting.

143. There was also an examination of the quality of the steel made on the basis of the various techniques of oxygen blowing in comparison with Siemens Martin steel. When the relevant document[22] was discussed, there was a general concensus of opinion that the steel quality was acceptable even if the nitrogen content was not as low as about 0.002 per cent.

144. On the other hand, the meeting agreed that the conventional Thomas process, with or without oxygen-enriched air, is still a simple and cheap method of obtaining good quality steel. In the case of the Thomas converter with oxygen-enriched air, that is up to 40 per cent, the process is more flexible and also the nitrogen content can be reduced to limits of the order of 0.03 per cent.

145. The numerous studies, both theoretical and practical, which are currently being undertaken in Europe, show that the conventional Thomas process continues to be very important for treating pig irons with P contents of the order of 1.8 per cent. This is a particularly interesting conclusion in the case of Colombia.

146. In examining all the documents presented and the discussions relating to them, the meeting reached the following general conclusions:

(i) To make steel having up to 0.20 per cent carbon, surface blowing with oxygen in the converter (LD) results in a good quality of steel and is economic provided that the cost of oxygen is acceptable;

(ii) When selecting a process to be used, the guiding principle should be the phosphorus content. If this is at a maximum of 0.3 per cent, the adoption of surface blowing with oxygen in the converter should be studied more thoroughly and the results compared with those of the conventional open-hearth process. This comparison should in fact be made in all possible cases;

(iii) When the phosphorus in the pig iron lies between 0.3 and 1.8 per cent, oxygen blowing in the rotary converter can be explored. In any case, however, the results of this process should be awaited since it has only recently been tried out on an industrial scale;

(iv) If the phosphorus is about 1.8 per cent, the conventional Thomas process can be used (air blowing) or any of its variations such as with O_2 H_2O (steam), O_2-CO_2 or blowing with oxygen-enriched air,[23]

(v) From the standpoint of quality, all the processes involving the use of oxygen result in steel of acceptable quality, always providing that they are applied in accordance with the appropriate working practice or technique for each one;

(vi) From the cost standpoint, the choice should be based on such important factors as the price of oxygen and the end use of the steel;

(vii) As for the cost of producing and using oxygen, it was proposed that ECLA should make a detailed study of the problem, to be published as soon as possible, on the basis of the data appearing in the various documents presented to the meeting;

(viii) Once the cost of oxygen is known for the various Latin American countries, a much more accurate interpretation can be made of the documents presented.

147. Finally, the meeting also discussed two papers[24] describing the use of electric arc furnaces for steel production in Europe and the United States.

Section A III: Rolling mills and finishing

148. Two basic considerations and some of slightly less importance were in the minds of the experts who participated in this section's debates. The two basic ones were:

(*a*) That rolling mills, taking together those for roughing and finishing, usually represent about 50 per cent or more of the total investment in an integrated steel works; the full importance of this can be understood when it is remembered that capital is, as a rule, very scarce in the Latin American countries;

(*b*) That steel demand in Latin America is rapidly expanding and accelerates very speedily as soon as a local steel plant is put into operation. Under these circumstances, it is extremely important that there should be careful selection of the type of rolling-mill equipment to be installed in a plant in order to avoid losses through premature obsolence or through lack of space for expansion facilities once the original ones prove insufficient to meet demand.

149. The problems posed to designers of Latin American rolling-mill equipment are further complicated by the large number of different shapes which have to be produced, especially if the mill in question

[21] See ST/ECLA/CONF.4/L.A II-2.

[22] See ST/ECLA/CONF.4/L.A II-5.

[23] Moreover, some experts at the meeting sustained the view that the Thomas process using oxygen-enriched air can also be applied to pig iron containing 0.1-0.2 per cent phosphorus.

[24] See ST/ECLA/CONF.4/L.A I-10 and A II-10.

is the only one in a country, so that there is no possibility of specialization.

150. The meeting considered the various aspects to be taken into account when designing a rolling mill for a Latin American country, and the first document[25] discussed several solutions for the problems posed to the designer under different conditions. This provided an excellent introduction to the general problem.

151. Other papers presented to the meeting described specific aspects of rolling-mill problems which will be discussed later on. One of them[26] specifically described the expansion plans of an old-established plant, the *Compañía Fundidora de Fierro y Acero de Monterrey,* Mexico. This plant was built at the beginning of the century, principally for rolling rails and medium weight construction shapes, plus merchant bars and light sections. The expansion consists of a new merchant bar rolling mill, with an annual capacity of some 150,000 tons, and a new blooming mill with a maximum capacity of 1 million tons, to produce blooms and billets. Any excess over the plant's finishing capacity is intended for sale to rolling mills currently based on steel made from scrap smelting.

152. Three more documents[27] covered specific types of rolling mills, namely, blooming mills, the rolling of flat products and the rolling of bars, shapes and structures. During the discussions it was noted that, unfortunately, none of the documents covered the equally important aspect of rolling blooms to billets, nor blooms to large structures and rails. Another paper[28] referred to the replacement of the expensive blooming mills by forges and presses, which can be an economic solution for expanding a small works up to a capacity of 80,000 tons a year. Moreover, the latest progress in continuous casting of steel was examined.[29] This process, once fully developed, may facilitate elimination of the heavier types of blooming mills through the continuous production of a smooth, smaller ingot which can be rolled into final shape, without impairing the structure of the steel, with a small reduction from its original to its final section. Finally, reference was made to a mill of special design[30] for cold rolling of flat products; this mill requires less investment than standard equivalent equipment, and provides some interesting features.

153. As the outlines submitted by the secretariat to the authors had requested discussion of equipment for various sizes of plants ranging from very small annual tonnages to a maximum of 1 million tons a year, the main papers[31] may be divided into two types: first of all, there were the two papers relating to blooming mills and the rolling of flat stock, where units of the most modern type are capable of handling one million tons and more per year; various types and sizes of equipment were described, with indications in each case of the range considered advisable by the author, together with suggestions for possible limited expansion; secondly, there was the paper dealing with merchant bar and rail mills. In this case, units do not usually exceed a capacity of 250,000 tons a year, but expansion is achieved by adding more units. The paper describes a few small size units and several specialized larger mills with an annual capacity of 250,000 tons. The three documents mentioned supply, in addition to brief descriptions of the units proposed, considerable information of an economic character, such as investment cost, annual capacity, requirements for labour, maintenance services, power and supplies, either in money values or in physical units.

154. During the discussion of the paper relating to blooming mills, the main interest of the participants centred round the question of how the author proposed to expand capacity, passing from the lower output solutions to the larger ones without scrapping any equipment at all, or scrapping only the minimum. For a wide range of productive capacity these questions were satisfactorily answered, but it became evident that, in order to provide for future expansion, at almost every stage of the plant's development, some idle capacity has to be installed, thus increasing amortization costs and similar charges.

155. The same type of questions were asked in relation to the rolling of flat products, but in addition there was thorough discussion of the question of quality of the product, in particular the possibility of producing plate and sheet of even thickness, adequate for deep drawing work, such as road vehicle bodies. The lack of uniformity of the sheet produced in small scale hand operation was unanimously accepted.

156. Conversely there was no general agreement concerning uniformity of plate and sheet produced in two-high or four-high reversing mills (Steckel). This type of flat products mill had been considered in the paper,[32] and the authors expressed clearly that they were not in favour of it, due to lack of uniformity of the product. The economic advantages or disadvantages within an adequate size range for this type of mill were not discussed. It therefore appears clear that, in addition to excess capacity due to the need to provide for future expansion, quality considerations may lead to the temporary installation of units which are larger than necessary for the supply of a Latin American market.

157. The meeting also discussed the rolling of structural shapes on three-high mills versus two-high reversing mills. While a number of European plants are equipped with the latter type of mill, the North American practice favours the three-high mill, especially when the roughing unit is a separate two-high mill.

158. For structural mills of medium capacity, however, it would hardly be justifiable to instal the separate roughing mill. Under these conditions, which are those prevailing in Latin America, the two-high reversing mill, with several stands in line, seems to be preferable to the more rigid three-high mill.

159. Other questions raised referred to the problem of training personnel. The various authors expressed the views that the more mechanized the units were, the less skill was necessary from the workers, except for the maintenance crews, which should comprise expert specialists.

160. Finally, part of the discussion centred around technical matters, as for instance: advantages and disadvantages of individual motor or gear-box drives for

[25] See ST/ECLA/CONF.4/L.A III-1.
[26] See ST/ECLA/CONF.4/L.A III-9.
[27] See ST/ECLA/CONF.4/L.A III-2, 3, and 4.
[28] See ST/ECLA/CONF.4/L.A III-5.
[29] See ST/ECLA/CONF.4/L.A III-6.
[30] See ST/ECLA/CONF.4/L.A III-7.
[31] See ST/ECLA/CONF.4/L.A III-2, 3 and 4.
[32] See ST/ECLA/CONF.4/L.A III-3.

multi-stand mills; lubricants and coolants for various types of products in cold strip mills, etc.

161. The main conclusions reached, or the points on which most of the participants agreed, are the following:

(i) Utmost care should be exercised in planning a rolling mill in order to leave sufficient space for future expansion. For example, if the next step in increasing the capacity of a two-high blooming mill is to add behind it a smaller unit to handle billet reduction, adequate space should be reserved when designing the original plant;

(ii) When designing a plant which will expand with growing demand, initial over-investment cannot be avoided. The general view in this connexion was that even under the most favourable conditions, few plants operating in a country with little or no industrial tradition could expect to reach full capacity immediately, but would probably have to operate at lower rates for some three to four years;

(iii) Conversely, it was stated that experience in operating hand mills does not, as a rule, facilitate the worker's adaptation to highly mechanized units;

(iv) In connexion with the quality of flat rolled products, especially for deep drawing operations, only the continuous or semi-continuous strip mills are currently considered to be entirely satisfactory. Commercial tinplate, cold and hot rolled sheets of satisfactory quality for certain purposes can, however, be obtained on a Steckel mill; one case was also reported of a planetary mill making hot rolled strip under favourable conditions. The latest advances with this type of mill indicate that it might possibly be developed into a useful and not too expensive mill for flat products in medium-sized plants;

(v) Four finishing stands were considered as the minimum to give satisfactory quality in a semi-continuous hot strip mill;

(vi) Progress in the field of continuous casting has been extraordinary in recent years, but it was felt that from the point of view of continuity of operations it cannot, at the present stage of its development, be recommended for steel plants in Latin America in complete substitution of standard type blooming mills.

Section A IV. Non-current steels

162. The need to produce non-current steels in Latin America has become more acute since several countries in the area have entered upon the production of machines and road vehicles.

163. The main problems involved in the production of those steels are the multiple types and relatively small size of domestic markets. Both problems tend to make production uneconomic save for certain specific cases.

164. The first attempts to establish classifications for non-current steels were made by the High Authority of the European Coal and Steel Community for purely statistical purposes, but as yet these have not been finalized. Since some form of classification is essential in order to approach the problem of non-current steels, the meeting recommended that advantage should be taken of the work already done by the High Authority, dividing these steels into two groups: (*a*) special steels and (*b*) quality steels, which does not in any way prejudice a subsequent detailed classification.

165. All high-value non-current steels will be considered to be special steels, and quality steels those which are used in large quantities, but which require less precision than the first group.

166. There is a favourable basis for a non-current steel industry in all Latin American countries, since all have good quality iron ores on which the developing steel industries must depend when there is a great shortage of scrap, such as exists at present in all countries.

167. Brazil, for instance, has excellent ores in Minas Gerais, which are smelted with charcoal, thus placing the country in a situation as good as that of Sweden, the classical producer of high-value steel. The Latin American countries are also rich in ores of all metals essential to the making of steel alloys.

168. The other working factors are not so favourable—particularly electric power. In all the countries in question there is a shortage of power, and therefore this point must be cleared before establishing any non-current steel plant.

169. The meeting also considered that other working elements such as refractories, liquid fuel for the furnaces, etc., present less difficulties. The most difficult question will be that of personnel, since without highly skilled workers and technicians the establishment of a non-current steel—and above all special steel—plant cannot be considered. The selection of personnel must be not only based on technical ability and intelligence, but also on character and sense of responsibility. The slightest negligence in a metallurgical process has far graver consequences than in machining, since in this latter case the error can be seen immediately, whereas in steelmaking it can only be detected after all the production costs have been incurred.

170. As a result of the Second World War, Brazil became the first Latin American country to commence production of non-current steels. The papers presented to the meeting on that country[33] show the present and future consumption and production prospects. Two plants make special steels, and four make quality steels. Production at present covers 26 per cent of the demand for special steels, and 60 per cent of quality steels. Current or projected expansions should improve these percentages to 59 and 87 respectively. In some groups, the demand will have to be met by imports, since they are items used in only small quantities, or those which, for technical reasons, will not be produced until 1962.

171. In the highly industrialized countries the average percentages, compared to total raw steel production (ingots) are 8-9 for special and 15-16 for non-current steels. In Brazil, the figures in relation to production are 1 per cent for special steels and 5.5 for non-current steels. These figures indicate the state of industrial development in Brazil, as compared with highly industrialized countries.

172. As an example of the problem in a small country, a paper on Chile[34] revealed that the situation as regards development was very similar to that of

[33] See ST/ECLA/CONF.4/L.A IV-1 and 2.
[34] See ST/ECLA/CONF.4/L.A IV-3.

Brazil. Relative and absolute technical developments are in a lesser degree, and this reflects in the consumption figures. The only group of quality steels which shows a large consumption is one arising from the Chilean copper industry—that of mill balls and bars, which gives an anticipated consumption of 20,000 tons for 1962. This and other quality steels will be supplied by the Huachipato plant, so that only a small part of the demand will remain to be covered by imports. These consist of such varied types and qualities that it is economically impossible to set up domestic manufacture.

173. Given the continuing economic development of the majority of Latin American countries, the meeting considered that sooner or later several of them must undertake the making of non-current steels.

174. In a separate document[35] the meeting was given several examples of the establishment of plants of different sizes for the production of special steels, showing the investment necessary in each case. This document also gives cost calculations for special steel production—a subject of great interest for all countries. Because of the general lack of knowledge of the individual cost items in Latin American countries, and the considerable difficulty of the problem itself, only one cost calculation is given for a plant of pre-determined size, although it includes various qualities within the different groups of special steels. A cost calculation is made for each individual type, according to available figures, which gives an indication of the production costs in a plant of this kind.

175. When establishing a non-current steel plant, consideration must be given to each of the relevant factors, in order to define the economic prospects. It was determined that such factors include: (*a*) limitation of the number of qualities to the minimum possible, and (*b*) distribution of the quality groups between the smallest possible number of plants, with closely co-ordinated production programmes. To achieve this objective the producer and consumer must work closely together, establishing programmes which by their simplicity will allow the greatest possible economy in the plants.

176. To ensure this condition, it was proposed that a Committee should be set up in ECLA to examine both this aspect and the difficult and multiple problems of classification, standardization and simplification of types. To this end, it was thought advisable to take into account the work done by the High Authority of the European Coal and Steel Community. Since this work falls within the scope of the ECLA Iron and Steel Committee, constituted at the fifth session, the meeting appointed a consulting group, to assist the said Committee in this work.[36]

[35] See ST/ECLA/CONF.4/L.A IV-5.

[36] See part I of the present report, paragraph 17.

B. Iron and steel transforming processes

Section B I. Economic and technical aspects of forging

177. One of the main purposes of the meeting was to interchange ideas concerning technical and economic aspects of the application of forging processes in the industrialization of under-developed countries. Since this process of transformation in its present form of development is relatively little known in Latin America, the greater part of the session on this subject had an informatory character, with foreign experts summarizing the present status of forging industries in the United States and Europe. The meeting felt that drop-forging methods using mostly drop-forging hammers were better suited to Latin American conditions owing to a lower capital intensity in comparison with press forging.

178. The final part of the meeting on forging was devoted to economic evaluation of drop-forging processes under Latin American conditions, involving aspects of investment and manufacturing costs as a function of market size. The study presented[37] indicated that the difference between selling prices of drop forgings in an industrialized area and an area representing typical Latin American conditions is approximately 44 per cent. The analysis of this difference showed that 70 per cent was due to financial requirements resulting from high capital intensity and only 30 per cent to higher manufacturing costs.

179. The papers reviewed by the meeting[38] indicated the following characteristics of drop forging methods: in industrialized countries for the sake of speed of output, hammers are used below their maximum forming capacity, since multi-impression dies for continuous forging from bar stock require an additional area of die surface and additional rigidity of the machines for off-centre blows. Secondly the speed of output requirements limit the amount of metal utilization to an average of 73 per cent.[39] Thirdly, multi-impression dies require a large amount of die steel and machining, which result in high cost, and unless it is distributed over a large number of forgings, the die replacement cost per ton of output becomes excessive.

180. Since total useful life of drop forging hammers is usually between 14 and 20 years, the possibility of employing less expensive and slower hammers of obsolete design cannot be entertained, because market conditions are almost certain to change during the life of the machine, requiring faster productive output. At the same time the potential market for drop forgings develops in response to their availability; hence a new plant in an undeveloped area would very probably have to go through a period of very short productive runs. In view of the heavy investment, it was deemed that some adaptation of method would be required for the transitory period of market development, to adjust the manufacturing costs to prevailing conditions.

[37] See ST/ECLA/CONF.4/L.B I-5.

[38] See ST/ECLA/CONF.4/L.B I-1 to 4.

[39] See ST/ECLA/CONF.4/L.B I-1.

181. In order to increase the material utilization, preforging operations must be developed to a stage where the amount of steel during the final impression forging is sufficient only to produce hydraulic pressure to fill exactly the die cavity, and produce the minimum "flash". To achieve this effect and at the same time reduce tooling costs, the preforging operations must be carried out by an auxiliary, less expensive hammer, such as, for instance, a pneumatic type. In this way the principal hammer, working with only one centrally located impression, can be used almost at its maximum forming capacity, and will therefore produce heavier average forgings. The resulting rate of output in forgings per hour is naturally considerably reduced, but output in kg per hour is partly offset by heavier forgings.

182. The single impression dies, especially of insert type, are much less expensive to produce, and, what is important under Latin American conditions, there is a considerable reduction in the amount of die steel required. Stress was laid on the disadvantage of this method of reducing die life in comparison with multi-impression dies where the wear is distributed between several impressions.

183. From the initial investment point of view, the addition of a preforging hammer to each drop hammer productive unit is partly or wholly offset by the reduction of die-shop equipment, since slow-down in output rate proportionally reduces the variety of forgings to be handled, and moreover simpler dies are required in this method.

184. The estimates indicated that within the range of average runs of between 2,000 and 4,000 forgings per order, application of process adaptation should result in over-all savings of approximately 7 per cent of total manufacturing costs.

185. The meeting recommended that the type of study submitted to its consideration should be extended to (*a*) forging for heavy engineering, (*b*) machine and press forging, (*c*) cold forging.

Section B II. Economic and technical aspects of casting

186. Steel foundries are comparatively advanced in Brazil, Mexico, Chile and Argentina, where the level of semi-heavy mechanical industry has been reached, and the foundries supply the material normally corresponding to that level. In the other countries much less progress has been made. Almost the entire industry works with electric furnaces with capacities mostly ranging from half a ton to 6 tons. The use of converters combined with cupolas is not very common. The larger pieces are cast with metal from open-hearth furnaces. In Brazil pieces of up to 35 tons have been cast. At times weldments replace steel castings, and this method is interesting although sometimes, because it is cheaper to do so, the trend is to use castings.

187. The meeting showed great interest in obtaining more information and statistical data relating to the number of electric furnaces in operation, the industry's productive capacity and on working conditions in general. The data relating to productivity are scanty and the figure of 150 man-hours per ton of castings, as deduced from one of the papers presented[40], ought to be subjected to further study.

188. Foundries of some size usually have adequate control laboratories, and produce articles of reasonable quality, mainly in accordance with ASTM specifications.

189. In Brazil there are about 18 electric furnaces, with an approximate monthly output of 2,500 tons. Electric energy costs are rated at 0.5 cruzeiros per kWh in industrial areas. There is also a trend in that country towards the use of basic linings, because of the local manufacture of magnesite bricks. Monolithic roofs are also frequently used in the electric furnaces. Stress was laid on the difference between the Brazilian case and that of most of the other countries where the use of acid linings is common, and where monolithic linings are also quite frequent.

190. In connexion with gray iron foundries, the meeting showed great interest in the following subjects:

(i) The use of steel scrap in cupolas, and recarburization processes using this system, or in electric furnaces;

(ii) The use, and the manufacture of nodular iron, instead of malleable iron, particularly in connexion with the automotive industry;

(iii) The progressive mechanization of foundries;

(iv) Obtaining of greater details on productivity.

191. In relation to point (i), the meeting analysed recarburizing processes, which are interesting from the economic point of view, because steel scrap is cheaper than foundry scrap in most countries except Mexico; it was concluded that recarburization in cupolas, or in electric furnaces, had been used for some years on a commercial scale in various parts of Latin America.

192. Coke consumption is normal. Only 5 per cent more coke is needed for recarburization in excess of normal consumption. The coke should be of selected quality, particularly as regards S content, since there is an evident tendency for the steel charge to absorb sulphur. In the cold air cupola the highest possible temperatures are maintained (of the order of 1350° C), but at the same time the blowing is slow, to prevent rapid combustion of the coke. The coke ought to be relatively large in size, with adequate porosity. The slag retained is relatively basic and fluid.

193. There is a reduction in the hourly output of the cupola, which can be up to 30 per cent. The coke bed is kept relatively higher than in normal operations. Carbon contents of from 2.5 to 3.5 per cent are obtained. Forehearths can be used to obtain greater uniformity in the metal. Although the carbon contents can vary slightly, at levels around 3.5 per cent, it is considered that specifications of the articles usually produced by this process do not require an absolute control of these carbon levels. In any case a uniform and regular operation can be obtained. There was disagreement on coke consumption since during the discussion opinions were put forward relating to consumptions exceeding the normal ones by as much as 30 per cent and more (18 to 20 kg per 100 of charge), whereas other experts maintained the view that there was only 5 per cent excess over that consumption. The experts consulted promised more detailed written communications on the subject.

[40] See ST/ECLA/CONF.4/L.B II-1.

194. The meeting also examined refractories consumption. It was stated that consumption in the fusion area was relatively higher.

195. As to recarburization it was indicated that at times ferro silicon was added in the charge, and at times final adjustments were made in the pouring ladles. It was also maintained that it was difficult to obtain carbon levels exceeding 3.2 per cent, although there were also opposite views on this subject. It was observed that in Germany recarburization in cupolas is normally done in hot air cupolas, while at the same time it was pointed out that two installations were being put up, one in Brazil and the other in Cuba, of the so-called metallurgical blast cupolas, which also recarburize steel scrap. This experience will provide more information on the subject. Nevertheless it was stressed that the recarburization in acid cupolas, with cold air, was advantageous from the economic standpoint, even though it requires greater control and technical care.

196. With respect to point (ii), manufacture of nodular iron[41], the meeting observed that great interest was shown in Latin America in its properties and applications, as well as in the lower investments that might be required for the heat treatment section. In Brazil, a factory will shortly start producing nodular iron, and experiments are being made in other countries.

197. The meeting thought, as a conclusion derived from the discussions, that it was advisable to give further study to the properties of nodular iron with regard to magnetic properties, losses through histeresis and corrosion in comparison with ordinary gray iron. The meeting also deemed it advisable to make a more thorough analysis of the problems that may arise with arsenic additions in the material handling operations and the influence this may have on the refractories, in particular of the ladles, as well as on auxiliary equipment.

198. The use of an alloy of magnesium and ferrosilicon appears to offer cost advantages as compared with ordinary nickel-magnesium alloys, apart from the fact that better mechanical properties are obtained, through the introduction of small percentages of silicon in the material. The use of copper magnesium alloys is restricted by the price and by the amount of residual copper that may remain in the metal.

199. In relation to point (iii), foundry mechanization,[42] it was concluded that due to the relative influence on costs of the value added by labour, and of fixed expenses, the progressive mechanization of foundries is amply justified despite the financing costs, which are usually high in Latin America.

200. The meeting considered that the mechanization of the section for handling sands and moulding was most important, as well as a better knowledge of the properties and applications of sands.

201. There is a tendency to use sand slingers when the weight of the pieces exceeds 200 kilos. Below this size, moulding machines are preferred.

202. Figures were presented to the meeting for foundries which have undertaken extensive mechanization; they revealed a very considerable decline in the number of man-hours, with the consequent reduction in costs.

203. The meeting took into account in relation to point (iv) the inadequacy of data to appreciate the number of man-hours and productivity for the foundries as a whole, so that it recommended that studies on those subjects should continue in order to obtain more data concerning the number, capacity and conditions of foundries in Latin America. Since the development of the industry in recent years has been considerable, it was thought that the subject was very topical and interesting, due precisely to the number of enterprises which are modernizing their methods of production, and the new companies which are being set up in this field.

Section B III. Economic and technical aspects of machining

204. In order to facilitate the analysis and discussion of conclusions, the papers presented to the meeting in this section of the agenda[43] can be divided into two groups—one dealing with the economic aspect of the process, and the other with the development of machine tools and cutting tools.

205. It was stated that the low productivity in machining in Latin America is fundamentally due to deficiencies in work preparation, methods, procedures and utilization of machines, all of which are related to poor management since they are almost exclusively a function of the organization and techniques introduced by managers or directors. Cutting operations are governed by basic laws, so that the relative advantages of each machining process must be about the same in all countries.

206. In the particular case of lathes, the meeting concluded that two-thirds of productivity losses were due to deficiencies in the unit time spent on the job and only one-third was accounted for by the unit time required for preparation. When the meeting examined the causes which affect unit time of execution it was agreed that important deficiencies were not apparent in net time of execution, when the tool is in contact with the metal, but in lost time betwen the end of one cut and the start of another. There was ample possibility of improving productivity in this direction without large additional investment.

207. There are other causes which exert a marked influence on productivity. Amongst these are poor utilization of more automatic or bigger lathes or of the properties of specific raw materials, deficient organization of the whole operation of the factory—particularly in connexion with the supply of materials for the lathe operator—lack of adequate methods for quality control, and lack of uniform quality of raw materials, limiting the utilization of automatic machines and increasing the proportion of rejects. All these factors are further aggravated by the lack of technicians and skilled labour.

208. In comparison with industrialized areas, it was recognized that Latin America is in a favoured position with respect to cost per machine-hour and cost of machining per piece as a result of cheaper labour, not-

[41] See ST/ECLA/CONF.4/L.B II-7.

[42] See ST/ECLA/CONF.4/L.B II-2 and 5.

[43] See ST/ECLA/CONF.4/L.B III-1 to 7.

withstanding the higher capital costs involved in the same operations. In industrialized countries, however, there is a relatively greater cost reduction with increasing mechanization, investments and length of the runs. As regards this latter aspect, it was agreed that the scale of operations is not a limiting factor in the adoption of more mechanized equipment, and it was stressed that increased mechanization in Latin America would only be limited by the lesser availability of capital and the smaller incentive for greater investments.

209. The meeting showed that, although at first sight the adoption of more mechanized equipment in Latin America would appear to be inconsistent, since it would involve substitution of cheap and abundant labour by capital, it appears to be necessary because of the shortage of skilled labour required for the operation of more simple machines. On the basis of this assertion, and those mentioned earlier, it may be stated that the centre lathe, for instance, is an obsolete machine in so far as production operations are concerned not only in more industrialized areas, but also in Latin America and that the transformation of universal machines by the use of hydraulic tracer attachments is a most satisfactory solution. The advantages of the tracer lathe lie in the rapidity of setting up, precision, the use of simple tools of more or less standard design, and its great versatility. These comments are also applicable to other machine tools such as boring lathes, facing lathes, milling machines, special grinders and planers.

210. The meeting decided that the work presented by the secretariat on the method of evaluation of metal working processes should be continued, and should include selection of the most suitable equipment for Latin America, with a view to replacing scarce skilled labour by mechanization.

211. From the analysis of machine-tool and cutting-tool development, the conclusion of the meeting is that the following changes in lathe design may be expected, given the present situation and the evaluation of general costs, which are increasing whilst those of tools are decreasing: (*a*) higher speeds; (*b*) greater power; (*c*) bigger feeds; (*d*) greater rigidity and precision; and (*e*) greater complexity, but demanding less operator skill.

212. The meeting was of the opinion that cutting tools of the most modern type, which require no sharpening, are of special importance to Latin America, where skilled labour is scarce.

Section B IV. Economic evaluation of steel transforming processes in Latin America

213. Rational application of investment capitals is of critical importance in industrialization with limited resources. Inadequate statistical data relating to economic factors and technical coefficients for industries at the development stage do not permit a rational policy to be established within manufacturing enterprises or the carrying out of industrial studies and economic planning.

214. A proposal for a new technique of evaluation was discussed at the meeting.[44] The technique discards concepts of sectors or products and penetrates more deeply into the economic structure by evaluating basic processes. The evaluation of products is in fact reduced to determining their composition in terms of the amount of processing of different types required to manufacture them.

215. The evaluation of a process must be based on data from enterprises engaged in the activities under study. Such enterprises may vary in size, degree of mechanization, degree of integration of activities towards basic materials, diversity of products, proportion of capacity utilization and productive efficiency. Application of the management type of analysis based on a "break-even" concept permits their characteristics to be converted rapidly to a comparable basis. Calculations of practically attainable capacity is achieved by applying the law of diminishing returns in terms of elimination of environmental deficiencies affecting productivity. Establishment of acceptable deficiencies permits the final determination of the optimum efficiency level which would assure minimum manufacturing costs for a size of operations which had been selected in relation to market demand.

216. The technique is sufficiently elastic to allow evaluation to a required degree of accuracy, ranging from approximate general terms at one extreme to another where the exact detailed evaluation coincides with conventional engineering estimates.

217. Since evaluation of processes includes complete requirements for input of resources per unit of weight or time, as well as determination of unit costs and selling prices, rapid predictions could be made for varying degrees of manufacturing integration. Therefore in planning the manufacture of a new product, immediate estimates could be made for an entirely integrated operation from basic materials to final products or, if only certain stages of manufacturing were contemplated, for complementing them by the purchase of semi-products and industrial services from outside suppliers.

218. In all cases a reliable forecast could be made of the total resources required, such as manpower, materials, investment in plant and working capital as well as unit costs, level of selling prices, profitability at various levels of capacity utilization, growth rate requirements, and competitive position towards imported products.

219. During the discussion the economists present expressed the views that the proposed evaluating technique was (*a*) potentially a very useful tool in the group of devices employed by planners and business executives who were attempting to predict the possible successful performance of new or enlarged industries; (*b*) applicable to situations where an economic evaluation might result in implementation or rejection of a proposed development project; (*c*) a substantial implementation of input-output methods and constituted a valuable instrument for linear programming in some economic sectors.

220. The industrialists taking part in the discussion agreed with the advantages of applying this method of evaluation to economic control of enterprises and pointed out its originality in the use of costing as a basis for predicting capital structure.

[44] See ST/ECLA/CONF.4/L.B IV-1.

221. The special committee formed to discuss the matter further examined the necessary studies required to perfect the technique into a complete working form. The following recommendations were made:

(i) Since the potential utility of this evaluation method was of more than regional interest, it would be advisable if ECLA could undertake a study of it in conjunction with the Economic Commission for Europe and the Bureau of Economic Affairs of the United Nations;

(ii) The present committee members would continue to serve as advisers until the evaluating technique acquired its final, usable form;

(iii) A pilot study should be undertaken at once for the practical evaluation of the technique.

222. During the subsequent plenary meeting on the automotive industry,[45] the following recommendation was made:

"It is recommended by the participants in the Latin American meeting of Experts on Steel Making and Transforming Industries, held at São Paulo, October 1956, after considering the discussions on the road vehicle industry and the paper presented by Mr. Podgorski on *Economic evaluation of the iron and steel transforming processes* that a study should be made of the road vehicle industry in Brazil using the evaluation system proposed in that paper, in order to examine and improve upon the techniques therein described."

[45] See section D III, paragraphs 288 *et seq.*

C. Training of personnel for the Latin American steel transforming industries

1. General aspects of the problem

223. The discussion of the problem resolved itself into two main aspects: (*a*) the training of engineers and technicians and (*b*) training of foremen, skilled and semi-skilled workers, and instructors. With regard to the training of executives, and to the problems of scientific management and productivity, it was recommended that ECLA and UNTAA should, in collaboration with other international agencies, make a study of what is being done in the various Latin American countries. It was thought that these problems should be included in the agenda of a future conference.

224. From the studies presented, and the discussions on them, it was clear that there were serious labour training problems at all levels of the mechanical and metallurgical industries. Furthermore, the lack of adequately trained personnel could constitute an obstacle to the normal expansion of these industries, and the economic development of Latin American countries.

225. The various Latin American countries had tried to solve the problem posed by this shortage in widely differing ways, but all their efforts had been insufficient to meet the demands of industrial development. Furthermore, it had been seen that there was no uniform opinion regarding the training of labour. In view of this situation, the meeting decided that there was an obvious need for standardization of the guiding principles of vocational training at the different levels.

226. Experience has shown the usefulness of international technical assistance in this field, but a more intensive and scientific use of this is essential in order to obtain the maximum results from the limited resources available for this purpose. Technical assistance is particularly important in training programmes for foremen, skilled workers and instructors.

227. The problem was thought by the meeting to be sufficiently important to justify a proposal that ECLA and UNTAA should make a wide examination of the situation in Latin America, in order to determine the extent of the labour deficit at various levels, from engineers to skilled and semi-skilled workers. This study should be undertaken in collaboration with other international agencies.

228. In order to obtain the best results in training at all levels, the meeting pointed to the desirability of programmes being implemented in close collaboration with private industry; the latter should combine with educational establishments to publicize the prospects which industry could offer to the rising generation.

229. Finally it was stressed that professional and educational guidance is a basic requirement to widen the knowledge of industrial activities, and to interest youth in the professions offered by industry, either as technicians or as skilled workers.

2. Examination by categories

(a) *Engineers and Technicians*

230. There is a considerable deficiency in the training of specialized engineers, chiefly in the metallurgical and mechanical branches. Even in more industrialized countries, such as the United States, the need for engineers (50,000) is much greater than the number of graduates from the Universities (25,000). In Latin America, the meeting paid particular attention to the case of Brazil, where only 30 per cent of the needs of the mechanical, metallurgical and electrical industries are met by the engineering schools.

231. The quality of the training was also inadequate; one aspect of this was the insufficient specialized training.

232. The lack of medium grade technicians has resulted in misuse of the available engineers, who have been doing technicians' work. It is quite normal to find engineers carrying out projects, preparing standards and specifications, supervising inspection work, making time and method studies, etc.

233. Some of the experts suggested the introduction of industrial engineers below university level, as a means of supplying industry with a greater number of technical specialists. It was stated that this system already existed in some European countries and in Chile and Mexico among the Latin American ones.

234. The exchange of teachers from technical schools was recommended, and also an evaluation of the career of engineer in Latin American countries.

235. It was also considered advisable that teachers in engineering schools should have a solid industrial background.

236. The experts, examining the problem of training technicians, found that it was different in the various countries. In fact, while Brazil had a serious deficit (80 per cent per year) in Chile and Argentina it was much less.

237. Amongst the principal measures recommended by the meeting to alleviate the shortage of engineers were the following:

(i) Formation of a Latin American specialization centre for metallurgical engineers, with financial and technical assistance from ECLA and UNTAA, making use of existing institutions such as the Instituto de Pesquisas Tecnológicas (IPT) of São Paulo;

(ii) Amplification of the scholarship or fellowship systems for the specialization of engineers in more industrialized countries;

(iii) Establishment of post-graduate courses in universities and technological institutes;

(iv) Use of the "three and two" system of the United States for the training of specialized engineers.

238. With regard to the shortage of technicians, the meeting offered the following principal solutions:

(i) Technical schools in areas where metallurgical and electrical industries are established should give preference to training of technicians in metallurgy, construction of machines and motors, and electrotechnology;

(ii) Extensive training of assistant technicians within industry, by means of promotion of competent personnel, and with the co-operation of specialized schools and technological institutes; and

(iii) Selected immigration of technicians.

(b) *Foremen, skilled and semi-skilled workers, and instructors*

239. The need was stressed for action by industry for the systematic improvement of the foremen, in order to raise their technical and supervisory standards.

240. Amongst other methods to achieve this object, the meeting was unanimous on the efficiency of the TWI system (Training Within Industry).

241. The meeting also agreed on the importance of international technical assistance as a means of helping industry to improve the professional level of foremen.

242. As regards skilled and semi-skilled workers, the meeting pointed out that, in spite of all efforts to remedy the shortage, it had not been possible to satisfy the increasing needs arising from the development of the mechanical and metallurgical industries. Brazil's case was taken as an example: although strenuous efforts have been made, regular courses cover only 45 per cent of the needs.

243. In some Latin American countries, apprentice systems have already been instituted. For this scheme to be successful, it was suggested that it should be on a national scale, as in Brazil, where the SENAI is financed and directed by industry itself.

244. The following are some of the measures suggested by the meeting to ease the deficit of skilled workers:

(i) Development of industrial apprenticeship systems under industry, with the co-operation of specialized agencies;

(ii) Intensive training of adult workers by means of special courses;

(iii) Establishment of adequate promotion systems within each enterprise to encourage the training of skilled labour;

(iv) Selected immigration of skilled workers from more industrialized countries.

245. Both in the papers and in debate, the meeting emphasized the imperative need for the training of instructors for skilled worker training at various levels, and it was shown that Latin America does not possess the number required by its industries.

246. To meet this deficit, the meeting proposed the following:

(i) Interchange of directors, teachers and instructors in industrial training among the various countries to improve their knowledge;

(ii) Training of instructors in the great industrial enterprises as well, to take care of the apprenticeship of their own personnel;

(iii) Utilization of the only instructor and teacher training centre for all Latin America, operating within SENAI, in Brazil, with the co-operation of ILO. The work of this centre should be aided by technical and economic assistance from ECLA and UNTAA.

D. Development problems of Latin America's mechanical and metallurgical industries

Section D I. Raw material requirements

247. During the meeting dealing with this subject five papers were presented, in the following order: Mexico, Chile, Venezuela, Argentina and Brazil.[46] Their statistical content, although not homogeneous, and requiring revision and clarification in certain aspects, may be summarized in the following table:

I. Production of steel ingots (*thousands of tons*)

	1955	*Projected for 1960*
Argentina	250	900
Brazil	1,156	1,934
Chile	340	489
Mexico	725	1,141
Venezuela	55	570
	2,526	5,034

[46] See ST/ECLA/CONF./L. D-3, D-2, D-10, D-20 and D-12 respectively.

II. Ingot equivalent of steel consumption[a] (*thousands of tons*)

	1955	Projected for 1960
Argentina	1,700	2,214
Brazil	1,800	2,580
Chile	286	489
Mexico	1,061	1,560
Venezuela	760	1,000
	5,607	7,843

III. Ingot equivalent of *per capita* steel consumption in 1955 (*kgs. per year*)

Argentina	87
Brazil	30.8
Chile	47.5
Mexico	35.8
Venezuela	127[b]

IV. Ingot equivalent of per capita production in 1955 (*kgs. per year*)

Argentina	13
Brazil	20
Chile	56
Mexico	25
Venezuela	9

V. Average annual rates of increase (*percentages*)

	1950-1955		Projected 1955-1960	
	Steel consumption	Production of steel ingots	Steel consumption	Production of steel ingots
Argentina	8.5	5.0	6.7	(52)
Brazil	9.5	9.3	8.7	13.5
Chile	17.6	7.3	14.2	8.8
Mexico	7.8	17.2	9.4	11.5
Venezuela	12.2[c]	—	7.9[d]	(187)

VI. Flat products as a percentage of steel consumption in 1955

Argentina	46.5
Brazil	40
Chile	42
Mexico	34
Venezuela	18
United States	56.5[e]
Western Europe	44[f]

[a] Calculated on the basis of 1 ton of rolled products = 1,330 kgs. of ingot.

[b] Estimate (118 for 1953).

[c] Average for 1949-1953 in relation to the average for 1945-1947.

[d] 1953-1958.

[e] Average 1937-1953.

[f] Estimated.

248. The most important points emerging from an analysis of these figures are given below.

249. It is expected that the production of steel ingots in Latin America will be doubled within five years, but the consumption of the five countries under consideration will increase by 46 per cent during the same period.[47]

250. This rate of increase of production, much greater than that of consumption, is typical of the development of many of the less industrialized countries of the world and is closely linked to difficulties in the balance of payments. Nevertheless, this discrepancy between the rates of development is especially pronounced in Latin America as a result of the excellent development prospects for steel industries in the majority of Latin American countries.

251. It should be noted that if the forecasts for the five countries are fulfilled, import requirements would remain constant in 1955 and 1960, unless development plans were further increased.

252. In order to appreciate the magnitude of the problem of self-sufficiency in steel production in Latin American countries, it is interesting to note that additional investments of approximately 1,100 million dollars will be required if quantitative self-sufficiency is to be achieved, without taking into account qualities and specialities. This figure does not take into account expansion plans which are either well advanced or already in course of execution.

253. The *per capita* consumption remains close to the relative level of national income, while the production does not compare very closely.

254. Apart from Argentina and Venezuela, where an increase of steel production from a very low level is foreseen, the rates of increase of production and consumption expected in the other three countries for the period 1955 to 1960 are somewhat lower than those for 1950-1955, and from this it may be assumed that these rates will actually be greater than those given in the various papers presented to the meeting. Apart from Chile, the expected rates of increase of production are greater than those of the development of consumption.

255. It is interesting to see that the percentages of flat products within the total consumption in Latin American countries in 1955 have almost reached the average European level.[48] This is probably due to the heavy consumption of sheet and tin plates for the manufacture of consumer goods.

256. At the same time, the industrialization of the larger Latin American countries is accompanied by an increasing demand for heavy flats used in the establishment of chemical and oil industries, shipyards, etc.

257. The production of rails does not appear to show any notable development; this is due to irregular demand, and to the fact that rails are a relatively cheap product which is often financed through foreign loans arranged by the overseas seller.

258. It is seen that in certain countries there is a strong tendency to base steel production on imported raw materials; Mexico for instance is a heavy importer of scrap, and Argentina buys particularly large quantities of ingots and semi-products.

[47] This considerable rate of increase is not only due to the demographic growth and the rise of income, but also to the progressive integration into modern economic life of new sections of the population.

[48] Except in the case of Venezuela, due to the heavy consumption of tube and pipe by the oil industry in that country.

259. Special mention must be made of the difficulties which might arise from such a policy due to shortage of scrap, ingots and semi-products, which in turn is due to the extreme rapidity of the growth of world steel production.

260. The development of the mechanical industry, and especially the motor vehicle industry, in Latin America raises the problem of the increase and diversification of non-current steel production in these countries (this problem has already been discussed[49]). Some Latin American countries, however, have a large number of small steel works making common steels in electric furnaces. As production capacity of the large integrated plants increases, with relatively low costs, the smaller plants could probably turn to both special qualities and special shapes; this change in direction would necessitate additional investments, and a considerable technical effort.

261. In the discussions on the papers mentioned above different points of view were put forward. In spite of the generally expressed opinion that the increase of consumption and production of basic industrial products such as steel must reach saturation point after its rapid development, the industrial development during the postwar period shows quite clearly that no country in the world is approaching this saturation so far, and development of the steel industry continues to show a rapid rise.

262. The meeting considered that this fact ought to be taken into account in the planning of iron and steel making industries in Latin America, both as regards investments and the supply of raw materials. Moreover it was not thought impossible that this phenomenon might completely alter the structure of the world steel market, transforming Latin American countries from net importers to net exporters.[50]

263. It was also borne in mind that the possibility of obtaining low cost electricity in the future from atomic reactors might have a great influence on this type of development.

264. Because of the high investment necessary for the development of iron and steel production, the rate of expansion presents price and amortization problems which, in the opinion of the meeting, ought to be considered very carefully.

265. Finally attention was drawn to the need for a special effort in Latin America to increase the amount of detail and the quality of information available on the steel industry, especially with regard to production, consumption, trade and future demand.

266. In order to discuss in more detail the points raised in paragraphs 264 and 265 above, a committee was formed.[51] This committee decided that ECLA, with the assistance of other specialized organizations should be asked to make a study on the following lines:

(i) *Amortizations.* A study of the amortization policy for the iron and steel making and transforming industries, suited to the economic necessities of Latin American countries;

(ii) *Statistics.* A study of the most effective methods of compilation, presentation and publication of statistics of production, consumption and trade in steel products in Latin America, together with other types of information on the steel industry;

(iii) *Market.* A study of the markets for the iron and steel transforming industry with a view to preparing projections of the demand for steel, and making recommendations for the improvement of the most appropriate methods for preparing these projections, taking into consideration, among other points, the following: (*a*) elasticity of demand in relation to income; (*b*) elasticity of demand in relation to industrial production, and (*c*) input-output ratios.

Section D II. Machine-tool manufacture in Latin America

267. The meeting examined two papers presented on machine-tool manufacture in Argentina.[52] From these papers it appeared possible that of the Latin American countries, Argentina and Brazil in particular could produce universal and some semi-automatic machines.

268. Some 250 enterprises in Argentina make machine tools to a value of more than 450 million Argentine pesos. These firms have been developing from small workshops, and are now turning to a certain amount of series production, thus reducing their costs and improving the quality of their products.

269. The greater part of Argentine machine-tool production comes from medium size enterprises (15 to 70 workers), and it is estimated that there are only 15 of greater size—that is, with more than 70 workers. There is thus little concentration, either in enterprises or types of products.

270. The discussion during the meeting on the size of enterprises and of production, showed that in Germany there are various sizes of machine-tool manufacturers, from small specialized factories with 100 workers, to large plants employing 2,000 people. Amongst these, in many cases, there is an interchange of experience and designs, and some of these firms have a joint sales organization for their products.

271. The total capital of the United States machine-tool industry is some 300 million dollars; there are approximately 400 factories, of which 40 make lathes. The average number of workers is 300 per plant.

272. During the last twenty years there has been a tendency in the United States for small firms to merge with the larger ones, although the size of the plant has no effect on quality—the smallest, as well as the largest, produce good machines.

273. The size in Brazil varies between 70 and 900 workers.

274. The meeting also considered what types of machines should be manufactured in Latin America, examining first the present production situation of the two countries under consideration.

275. At present, Argentina produces some 2,400 centre lathes per year, 900 turret lathes, 5,300 drills, 100 universal grinders, 830 shapers and planers, 300

[49] See Section A IV, paragraph 162 *et seq.*

[50] This might also happen in other countries such as India, for example, which have a good supply of raw materials.

[51] See part I of this report, paragraph 16.

[52] See ST/ECLA/CONF.4/L. D-8 and 9.

milling machines, and 1,000 units per year of saws and abrasive cutters, apart from others such as sharpeners, shears, roll-formers, guillotines, forging hammers, hydraulic presses, etc., totalling more than 9,000 units per year.

276. The machine-tool factories in Brazil together produce between 3,600 and 3,800 lathes per year, of between 1 and 5 metres between centres. There is also a large production of drills and shapers, which, together with centre lathes, are the machines most used in Brazil.

277. Amongst the types which the meeting considered should be made, both in Argentina and Brazil, were broaching machines, planers with electro-magnetic clutch, hydraulic presses, and articulated drills. The production of heavy special products, highly automatic machines, those with delicate operating mechanism, and very large, heavy or complex machines, only manufactured in highly developed countries, was not considered advisable.

278. In general, the types made should correspond to the size of the market, and although both common and simple machines, and larger and more complicated types will eventually be made, it is difficult to establish a correct division. In this respect the meeting considered that economic integration of Latin American countries could be advantageous for increasing the size of the market.

279. To facilitate the manufacture of more modern and powerful machines in Latin America, the meeting considered that the countries manufacturing machine-tools should conclude agreements with foreign manufacturers, in order to obtain not only designs of modern machines, but also adequate technical assistance. This system of manufacturing under licence, with technical assistance, could be complemented by a policy of interchange of technicians, in order that the Latin American personnel could gain experience; this system could also be extended to the sales organizations of the various firms.

280. The discussion on raw materials had stressed the need for the establishment of standards within the countries for uses and qualities of materials. In the case of steel, for instance, it must be decided which types are suitable for the manufacture of gears, spindles, collets, etc., for machine-tools.

281. Another item meriting the attention of the meeting was the possibility that machine-tool manufacturers could complement their own production by using components made more economically by other domestic or foreign manufacturers.

282. The ownership of patents and trade marks was also discussed, and it was agreed that it was difficult to apply in practice, regardless of the means adopted to safeguard a copyright, not only in Latin America, but in the world in general. It was agreed, however, that these problems could be solved by the intervention of the local machine-tool manufacturers' associations, which should not encourage the introduction of prototypes of machines without a prior manufacturing agreement with the foreign firm concerned.

283. Finally, technical improvements in machine-tools were considered, together with their incidence on depreciation and taxes. The discussion showed that this progress made machines obsolete in a much shorter period than had previously been considered normal.

284. A depreciation or amortization policy more adapted to reality was required on a basis of rates which would adequately cover the replacement of these assets within the appropriate period. If this was not done, enterprises would not be in a position to maintain their standards of equipment in line with the advancing techniques.

285. The discussion showed the existence, in many Latin American countries, of taxation systems which set rates not in accordance with reality. It was considered that the retention of such systems might lead to a limitation of technical progress in those countries which are in process of development.

286. It was suggested that the competent international organization should undertake a study of this problem and should suggest a suitable taxation policy with respect to depreciation rates. The meeting made a recommendation to this effect.

287. Recommendations were made on aspects of national and international integration, and on the desirability of employing foreign techniques in Latin American countries.

Section D III. Motor vehicle manufacture[53]

288. In principle, the discussion centred around the general problems relating to motor vehicle manufacture in under-developed economies. Nevertheless, since most of the background data referred to Brazil and most of the experts present had gained their experience in that country, it was inevitable that much of the discussion should relate to specific conditions in Brazil, with little possibility of reaching more general conclusions.

289. The problems discussed by the meeting referred both to questions of industrial policy in the automotive sector and to certain more specific aspects of the problem of motor vehicle manufacture in Latin America. The need to discuss industrial policy arose out of the recognition that the installation of such a new, complex and large-scale industry so closely connected to the other important sectors of the economy could only take place in accordance with an integral system of measures tending to foster such development. This aggregate of measures can be conceived in different ways and in fact, the solutions put forward for the different Latin American countries vary. There is no doubt that, to a large extent, the incentive systems in the automotive industry differ because they are adapted to specific conditions in each country. Even so, there is still a broad margin of choice of method, for each of which there is a different balance of advantages and disadvantages. Hence there is justification for comparing experiences in some Latin American countries, mainly Brazil, Argentina, Mexico and Colombia.

[53] Annex IV contains a brief study on this subject, prepared by the secretariat with the collaboration of some experts nominated for that purpose by the meeting. Some data has been brought up to date and a much more complete picture is given of the problem of motor vehicle manufacture in Latin America than was possible when drafting the text above.

290. In Brazil, a definite policy was established in relation to road vehicle manufacture. A government agency was set up in June 1956 (GEIA) as a dependency of the Development Council. This Council embodies all the executive power relating to regulation, guidance and fiscalization of activities relating to road vehicle manufacture. Briefly, Brazil's official policy concerning the installation of the automotive industry includes the main features discussed below.

291. The industry is reserved entirely for private enterprise, the government undertaking only such action as the guidance and co-ordination of private initiative, designed to encourage different mutually comparable enterprises, to ensure a sound technical and economic basis and to reconcile the exchange requirements of the different undertakings with the country's possibilities.

292. Government action is indirect, through preferential exchange treatment for the imports of equipment and component parts. Moreover, this action is taken flexibly, leaving the enterprises free to carry out their programmes on their own initiative, the only conditions being that they shall not profit from the preferential exchange concessions.

293. The granting of preferential exchange is conditioned to the prior approval of the individual technical and economic projects of the enterprises and to the subordination of these projects to a government programme for progressive substitution (which is quite rapid) of the imported parts and pieces by components of domestic manufacture, the aim being to produce in the country, within a five-year period, over 90 per cent of the vehicle.

294. Intensive sub-contracting practices were adopted, which implies a horizontal structure of the industry.

295. In relation to the participation of foreign and Brazilian enterprises, the orientation adopted is to encourage foreign companies to set up assembly activities and for the Brazilian firms to concentrate on making parts and pieces. The underlying reason for this is that the foreign firms appear to have more experience in mass production assembly lines; moreover, there is greater capital intensity of these activities (and the greater import capacity of equipment) on the one hand, while on the other there is already a domestic industry producing parts, which offers a good starting point for the new initiatives needed in this sector, whilst requiring relatively less capital.

296. There is no over-all policy in Argentina for building up the automotive industry, the prevailing practice being to consider each project separately on its own merits. Other aspects in which the Argentine system differs from the Brazilian one is the absence of any government executive entity, the practice of less intensive contracting and the dependence of the subcontractors in relation to the assembly enterprises (that is, the manufacturers) for purposes of equipment supplies, etc.

297. Mexico appears to prefer direct methods, such as, for example, import restrictions for parts made in the country, so that the country's assembly plants are obliged to use the domestic component.

298. In Colombia tax exemption and exchange facilities are granted for imports of equipment; in this way it is hoped that the assembly enterprises will gradually change over to manufacturing motor vehicles. Nevertheless, it has been observed that Brazil's experience reveals a tendency for simple assembly lines within the country to constitute an obstacle to the implementation of plans for domestic manufacture.

299. As to limitations imposed by the size of the market on the suitability of domestic manufacture of vehicles, the problem appears in different form for the various types of vehicle. In the case of light and heavy lorries, the size of the market in Argentina and Brazil seems to be already sufficient for all of them to be made, under cost conditions which will, in the not too distant future, be able to compete with the international market.

300. In the case of Brazil, it is observed that for lorries with a capacity exceeding 5 tons, the potential market compares favourably with the markets available for the output of some other countries outside Latin America with higher degrees of industrialization. No accurate assessments can be made on the basis of information available for Mexico and Colombia.

301. For tractors also, the Brazilian and Argentine markets are sufficiently broad to warrant manufacture at relatively low cost. Moreover there are certain technical reasons favouring the manufacture of these vehicles in Latin America, since they are less complex to make than other kinds of vehicle, and do not make such heavy demands on auxiliary industry.

302. The manufacture of jeeps in Brazil and Argentina is also favoured by the size of the market, but this does not hold true—except with various reservations—in the case of passenger cars. The production programmes for these vehicles in the two countries would seem to merit special caution, since this branch of the automotive industry requires considerably broader markets and much greater facilities in the way of auxiliary mechanical industry.

303. The capacity of the Brazilian and Argentine markets for different types of vehicles is the object of estimates which seem difficult to reconcile. This discrepancy calls attention to the need for a joint handling of this problem, such as the adoption of a uniform criterion of evaluation for the two countries. This evaluation ought to take into account, as far as possible, the elasticity-price of purchasing the different kinds of vehicles. Since the various factors influencing this elasticity vary, it is difficult to know with reasonable accuracy the degree of market sensitivity to variations in the prices of vehicles. In view of the instability of bases for exchange conversion in the Latin American countries, this problem is a really serious one for assessing the real prospects for domestic manufacture.

304. Cost comparisons (or better, manufacturers' prices) between the different items making up automotive production, up to complete vehicles, can only be made for the present in a relatively complete form for Brazil, and that only in the case of medium-sized lorries. A comparison of c.i.f. prices for similar imported vehicles shows that certain domestic products enjoy a dollar comparative value below the free market

rate (and below the exchange rate for exporting manufactured products); these products are steel sheet, pig iron, semi-finished castings and forgings and pieces and components already manufactured in large series. On the other hand domestic prices for parts manufactured in small series and for special steels would correspond to much higher conversion rates.

305. The cost of a medium sized lorry ought, as a result, to be quite reasonable, and in fact, slightly above the international price converted into cruzeiros at the free rate. This, naturally, is after an initial adaptation period of four or five years has elapsed.

306. An important problem is that relating to the difficulties of reconciling the steadiness of vehicle design over long periods of manufacture in Latin America, with the annual change in the same designs in the foreign parent companies, because of the dependence on imported components. These difficulties originate in four main points:

(*a*) the foreign product may suffer fundamental changes during the nationalization period—calculated at four or five years in the case of Brazil—so that completely new models result, whereas the design for the Brazilian vehicle ought to be "frozen";

(*b*) less important but nevertheless almost continuous modifications in components;

(*c*) the need to import elements which form part of the sub-assemblies;

(*d*) the need to modify foreign specifications, tolerances, standards, etc.

307. Unless these difficulties are solved it was thought that it may become impossible to assemble the vehicles, or may lead to component inventories which are obsolete and have to be scrapped. Another serious consequence could be the reduction of capital "turnover" and resultant enhancement of price.

308. Finally, there were problems relating to raw material supplies. The automotive industry, by its very nature, can only be launched as a joint effort. But this implies the sudden creation of an enormous additional supply of raw materials and finished products, mainly made of steel. The steel industry and the manufacturers of parts and pieces probably will not create production facilities (which imply very high investments) before large-scale automotive manufacture has begun.

309. The meeting therefore thought there was a clear need for a mechanism of programming to face up to this lag in raw materials supply.

310. The meeting suggested that ECLA should undertake a study of the market for motor vehicles in Latin America, with special reference to the price-elasticity of demand. It also recommended the expansion of the ideas expressed at the plenary meeting concerning motor vehicle manufacture in Latin America.[54]

Section D IV. Integration of industrial resources

311. The meeting considered that capacity relating to mechanical industry in some Latin American countries would make it possible to group several industries for the production of important machinery and equipment so that domestic production could replace imports from industrialized areas. For the efficient achievement of this goal, the formation of these groups should be sponsored by Latin American development banks and institutions and should receive the required technical assistance from the United Nations. The meeting also examined the possibilities of medium and long term financing on the basis of credit obtainable from the corresponding institutions, since such credit is already available for imports from highly industrialized countries.

312. It was observed that in order to obtain this financial aid, it would be necessary to ensure the good quality of locally-produced goods. The solution might be that technical assistance should include efficient control of equipment production and entry into operation.

313. The secretariat suggested that development banks and institutions should promote the establishment of industrial groups for the manufacture of such equipment as is required for the development of the region and that the institutions in question should request, through their respective governments, United Nations technical assistance for the successful implementation of such a programme. Moreover, industrialists from Brazil and other countries would be requested to provide illustrative data on domestic integration possibilities.

314. The meeting also took note of the development of Japan's metallurgical industries in recent years and expressed the view that it provided a very interesting experience for the study of integration among Latin American countries. A suggestion was put forward to hold a round table meeting in order to obtain more information on the integration of industrial groups in Japan.[55]

315. Mexico is also considering integration possibilities, and the Bank of Mexico's Department of Economic Research (*Departamento de Investigaciones Económicas*) is at present surveying industrial and raw material possibilities. In discussing Mexico, the meeting was of the opinion that integration should also be extended to other sectors of the economy and that the organic nature of the industrial structure should be taken into consideration; in others words, it was necessary to effect an integration between industry and necessary production factors in a rational relationship between domestic raw materials and finished products.

316. The meeting analysed Latin American integration possibilities at a regional level on the basis of a survey prepared by ECLA. ECLA's working group, appointed some months ago to make preparations for the Trade Committee which will meet in November in Santiago, came to the conclusion that the problem of South American industry should be tackled on the basis of supra-national or multi-national markets, at least for those products which cannot be manufactured economically on the basis of the domestic demand of a single nation. Specialization would be of benefit to industrialists and to the region in general since costs would decline and better utilization would be made of equipment capacity.

317. The meeting recommended that ECLA should undertake a study of industrial integration possibilities

[54] See annex IV, in which the secretariat, with the collaboration of experts nominated by the meeting, has made a first attempt to implement this recommendation.

[55] An unofficial round table meeting to discuss the subject was held on 26 October 1956.

in Latin America as a first step towards the preparation of specific projects. In the course of the discussion it was concluded that such a development would not affect Latin American trade with other regions.

318. On the basis of the information provided by the High Authority of the European Coal and Steel Community,[56] the meeting was able to appraise what had been done in this connexion in Europe and considered that the experience might be of value for Latin America.

319. The meeting was particularly interested in this point because in some countries, such as Chile, excess production capacity already existed. Such capacity could not be fully utilized on account of the small size of the domestic market and the impossibility of exporting a sizeable volume of industrial products mainly because of exchange difficulties.

320. The meeting showed its interest in regional integration when it analysed specific cases such as the possibility of trade between Brazil and Argentina for the manufacture of tractors. Another example was mentioned in which the raw material was sent from one country to another, processed in the latter and then re-exported to the supplier of raw materials.

321. The meeting considered that to achieve inter-Latin-American integration it was first necessary to standardize specifications for products and to establish a system of common margins of tolerance and fits. It recommended that ECLA should study the subject, including, at least for tariff purposes, the standardization of nomenclature.

322. A paper prepared in India was also presented at the meeting; it dealt with the possibility of economizing steel through the establishment of new shapes and the adoption of criteria more in line with modern techniques. Steel savings were estimated at 15 to 20 per cent of the weight, which is particularly significant for the Latin American countries in relation to the development of their steel making industries.

323. In this connexion the meeting thought it advisable that ECLA should carry out a study, and recommended that when new steel works were established in Latin America consideration should be given to the possibility of rationalizing and standardizing shapes according to India's experience.

[56] See ST/ECLA/CONF.4/L D-1.

PART IV

SUMMARY OF RECOMMENDATIONS REQUIRING ACTION BY THE UNITED NATIONS

324. In this part of the report the secretariat has abridged, standardized and rearranged the texts of the recommendations, although where included in the sectional reports in part III, they have been left in their original form.

325. The meeting, in the course of its work and discussions, made the following recommendations:

I

That, on the basis of data contained in several of the papers presented at the meeting, together with any new information concerning the possible cost of producing oxygen in several Latin American countries, the Economic Commission for Latin America should prepare a complete study on the economic aspects of the use of oxygen in steel making in Latin America.

II

That the Economic Commission for Latin America should, in collaboration with the Technical Assistance Administration, examine the the difficult and multiple problem of classification, standardization and simplification of the different types of non-current steels. It was further suggested that the special consulting group appointed by the meeting should co-operate in the work, taking into account the results of the work already done by the High Authority of the European Coal and Steel Community for statistical purposes, as well as that of other institutions.

III

That the Economic Commission for Latin America should undertake a study on productivity in Latin American iron and steel foundries, and at the same time compile data on existing productive capacity, degrees of mechanization and the general working conditions prevailing in these foundries.

IV

That the secretariat should continue its work on the economic evaluation of metal-working processes, including the selection of the suitable equipment for Latin America, bearing in mind that mechanization reduces the requirements for skilled labour, which is scarce in the region.

V

That the secretariat, in collaboration with certain Brazilian institutions, should undertake a study of the motor vehicle industry in Brazil, using the evaluation system proposed in the paper entitled "Economic evaluation of the iron and steel transforming processes in Latin America" (ST/ECLA/CONF.4/L.B. IV-1). This study should not only aim at determining the impact of the programme for the development of the motor vehicle industry on that country's economy, but also at examining and improving upon the techniques of analysis proposed in that paper.

VI

That the Economic Commission for Latin America should continue the work on economic evaluation of processes, in conjunction with the Economic Commission for Europe and the Bureau of Economic Affairs of the United Nations.

VII

That the Economic Commission for Latin America and the Technical Assistance Administration, in collaboration with other international agencies, should make a study of what has been done in the various Latin American countries with regard both to the training of engineers and technicians for industry and to scientific management and the raising of productivity. It was further recommended that these problems should be included in the agenda of a further meeting.

VIII

That the Economic Commission for Latin America and the Technical Assistance Administration should, in collaboration with other international agencies, determine the extent of the labour deficit in Latin America at various levels from engineers to skilled and semi-skilled workers.

IX

That a Latin American specialization centre for metallurgical engineers should be formed with financial and technical assistance from the Economic Commission for Latin America and the Technical Assistance Administration, making use of existing installations and equipment such as those of the Instituto de Pesquisas Tecnológicas (IPT) of São Paulo.

X

That the training of instructors for skilled labour for Latin America should be intensified, with the collaboration of the International Labour Organisation and with technical and economic assistance from the Economic Commission for Latin America and Technical Assistance Administration. This could be done by expanding the only existing training centre in the region, run by the Serviço Nacional de Aprendizagem Industrial (SENAI) in Brazil.

XI

That the Economic Commission for Latin America should study the bases for an amortization policy for the iron and steel making and tranforming industries, suited to the economic necessities of Latin American countries.

XII

That the Economic Commission for Latin America should, with the help of other specialized agencies, study the most effective methods of compilation, presentation and publication of statistics of production, consumption and trade in steel products in Latin America, together with other types of information relating to conditions in the steel industry.

XIII

That the Economic Commission for Latin America should, with the help of other international agencies, undertake studies of markets for the iron and steel making and transforming industries with a view to preparing projections of the demand for steel. It was further suggested that research should be undertaken in conjunction with this work concerning the most appropriate methods for preparing these projections, taking into consideration, among other points, the following: (*a*) elasticity of demand in relation to income; (*b*) elasticity of demand in relation to industrial production, and (*c*) input-output ratios.

XIV

That the Economic Commission for Latin America should undertake a market study for motor vehicles in Latin America, with special reference to the price elasticity of demand.

XV

That existing development banks and institutions should sponsor the formation of industry groupings for the manufacture of the heavy equipment needed for the development of the Latin American countries, and that the institutions in question should request, through their respective governments, United Nations technical assistance for the successful implementation of such a programme.

XVI

That the Economic Commission for Latin America should undertake a study of industrial integration possibilities in Latin America as a first step towards the preparation of specific projects for common supra-national or multi-national markets, at least for those products which cannot be manufactured economically on the basis of the domestic demand of a single nation.

XVII

That the Economic Commission for Latin America should prepare a project for rationalizing and standardizing rolled steel shapes, with a view to its official adoption by all Latin American countries. It was proposed that this should be done along the lines of the work carried out by the Indian Standards Institution, and possibly with the assistance of that Institution, as well as with the co-operation of the specialized agencies.

XVIII

That the Economic Commission for Latin America should, in conjunction with other international agencies, undertake studies relating to the standardization and specifications for products of the iron and steel transforming industries, with special reference to tolerances and fits. It was further suggested that such a study might commence with the standardization of nomenclature for such products, at least for tariff purposes.

XIX

That the Economic Commission for Latin America should, in collaboration with the Associação Brasileira de Metais and other interested institutions, continue, expand, perfect and complete the Glossary of technical terms in English, Spanish and Portuguese submitted by the secretariat to the meeting, so that a standard terminology might be available to Latin American industrialists. It was further suggested that the Glossary be expanded to include German and French.

ANNEX I

Addresses delivered at the inaugural session of the Latin American Meeting of Experts on Steel Making and Transforming Industries on 15 October, 1956

1. Address by Mr. Luiz Dumont Villares, President of the Associação Brasileira de Metais

As Chairman of the Associação Brasileira de Metais, I have the honour to preside over this inaugural session of the Latin American Meeting of Experts on Steel Making and Transforming Industries. Sponsored by the Government of Brazil and the United Nations Organization, this meeting was organized jointly by the Economic Commission for Latin America and the Associação Brasileira de Metais. From the very beginning of the preparations and the first contacts with the United Nations agencies, the Association considered itself honoured by the request that it should collaborate in the project. We appreciate, too, the selection of the city of São Paulo as the seat of the meeting; this surely constitutes an acknowledgment of the industrial development taking place here, for the greater welfare and progress of Brazil.

I should therefore like first to express my gratitude to the United Nations Organization and its technical agencies for this honour, and I am very glad to welcome here today Mr. Raúl Prebisch, Mr. Henri Laurentie and Mr. Carlos Quintana. When we undertook this task, we fully understood the responsibilities we were accepting. However, from the start we have worked in a most favourable atmosphere: dozens of large iron, steel and metallurgical industries have come to our aid, both morally and financially, and I am indeed pleased to be able to thank them on behalf of the Association. I also have the pleasure of making a special reference to the generosity of the Instituto de Engenharia and the Federação das Indústrias do Estado de São Paulo in making this magnificent building available to us for our meeting, and of bearing witness to the unlimited goodwill with which they have met all our requests.

I am happy to welcome also the representatives of the Governor of the State of São Paulo, Dr. Janio Quadros. When His Excellency received the Executive Committee he expressed great enthusiasm for the meeting, which he regards as a further guarantee of the future progress of the Latin American countries.

To the visiting experts, I would say this: Many of you have come a long way to collaborate here with colleagues from the four corners of the earth. Together with our Brazilian engineers, united by the same ideals of welfare and progress, we are all of us here to examine the basic problems of our countries. I believe that it is perhaps the first time in industrial history that so many well-known experts have been gathered together in the same hall, united in a common effort, and representing the industrial power of so many nations of the old and new worlds. I welcome you in the name of the Association and the Brazilian people, and I sincerely hope that you will enjoy your stay in this country.

Your presence here, and the importance of the papers you have contributed, is evidence of your desire to cooperate not only in ensuring the success of this meeting, but also in promoting the basic development of the Latin American countries. Your presence, and that of the representatives of so many Governments, constitutes the best possible guarantee of the successful outcome of the meeting.

In greeting our lady guests, I wish to add the good wishes of the Association to those which have already been expressed to you by the Ladies' Reception Committee. We are very happy to see you here, making the desert of our technical discussions blossom as the rose, and reminding us that material progress, even when expressed in millions of tons of steel, counts but little if love and beauty are denied the homage that is their due. Please accept, then, from the Brazilian engineers, our gratitude for your presence.

Gentlemen: I have the honour to declare open this Latin American Meeting of Experts on Steel Making and Transforming Industries, and in doing so, to express the faith of the United Nations and the Association that its outcome will be the continued progress, peace and brotherhood that are so dear to our hearts.

2. Address by Mr. Carlos Prieto, President of the Compañía Fundidora de Fierro y Acero de Monterrey, S.A. (México)

The kind invitation extended to me, shortly before I left Mexico, by the Economic Commission for Latin America and the co-sponsors of this Meeting of Experts on Steel Making and Transforming Industries, gives me an opportunity of speaking a few words at the present inaugural session on behalf of the Latin American countries herein represented.

I believe that the honour was conferred on me so that I could represent both my own country, Mexico, and a Mexican firm which has pioneered in the iron and steel industry of Latin America. In fact, the first blast furnace for a totally integrated industry was built by my company around 1900 in the town of Monterrey, and for more than 40 years there was no other blast furnace south of the Rio Bravo, while the name of Monterrey was known throughout this hemisphere for its steel industry.

Since 1940, the iron and steel industry has developed in many other Latin American countries; first in Brazil—this great country which now gives us generous hospitality—with the ambitious installations at Volta Redonda; Brazil was followed by Chile, Colombia and Argentina, to be joined shortly by Venezuela, which at present is making preparations for processing in the country the rich iron ores of the Orinoco.

But may I remind you that during this period, that is, since 1940, Mexico has not been content to rest on its laurels. On the contrary, as its entire economy—including national income, investment, production and consumption—has expanded at an accelerated rate, its production of steel has increased by 560 per cent, that is, from 130,000 tons to 720,000 in 1955; and in the next two years, it should rise to 1 million tons. This has been possible for two reasons. The first was the demand arising from the Second World War, which enabled the fullest use to be made of installed capacity while stimulating new and heavy investment. The second has been a government policy unwaveringly based on the respect and encouragement of private enterprise and the resolute implementation of a free exchange system.

Perhaps I may also be forgiven for mentioning that our company has continued to play a very important role in the expansion of Mexico's iron and steel industry; but, because our long years of work have furnished us with invaluable experience acquired in weathering many social and economic crises, our enterprise has developed slowly but steadily, with decision but prudence, and invariably guided by the three following rules: prevention of over-accumulation of capital; avoidance of excessive credit commitments; and maximum reinvestment of profits. What has been achieved on the basis of these criteria and what we aim at doing in order to modernize and expand facilities will be dealt with in a paper submitted to this meeting by our company and which will be discussed by the Director of our Monterrey plant.

It is therefore undoubtedly for reasons of age and the privileges attaching to tradition, that Mexico and the Fundidora de Fierro y Acero de Monterrey (which I represent) have been honoured by my being entrusted with these inaugural words of greeting and thanks in the name of the Latin American participants attending this meeting, in which we have placed so many legitimate hopes.

In fact, this happy initiative taken by the United Nations with the efficient and generous sponsorship of the Brazilian Government and the Associação Brasileira de Metais, will give us an opportunity to discuss the problems we have in common, to exchange experiences and solutions and to compare our knowledge with that of the foreign experts and observers who are attending the meeting and are thus making it extraordinarily valuable for us. Problems connected with raw materials: with quality, treatment, systems and equipments; with non-current steels, to achieve specializations which have barely begun; with personnel training, of capital importance among us, all constitute, together with the economic and technical aspects of the same problems, an agenda of great interest to all of us. Our first words of thanks and congratulation are therefore addressed to the Economic Commission for Latin America—so ably led by our old and admired friend, Dr. Raúl Prebisch, who is efficiently seconded by high officials of that Commission—for all the work of preparation and organization entailed in this meeting which we solemnly inaugurate today.

We then have to thank ECLA and the United Nations Technical Assistance Administration for having invited such distinguished foreign experts on the steel making industry and for having persuaded so large a number of them to attend. The presence of these engineers and the valuable papers they have presented and which we shall examine, as well as of representatives of important research and co-operative institutions of world renown, will enable us to profit from their wisdom and experience; while they in turn will acquire a better understanding of the efforts we are making to transform our economies through the arduous process of industrialization, in order to make the best possible use of our resources and to raise our standards of living. Several of the foreign organizations herein represented have given many of our countries a positive assurance of their understanding and sympathy in relation to such important endeavours and in some cases indispensable economic and technical assistance has also been rendered.

To them—individuals and institutions—we also offer our gratitude. We are convinced that the industrial and financial powers have reached the conclusion that the industrialization of under-developed countries in no way involves a danger for their economies, but, on the contrary, creates new, stronger and more stable markets not only for their manufactured products but also for their machinery and their technical and organizational services.

Last, but by no means least, I wish to express the most cordial and sincere thanks to the Government of Brazil and the São Paulo authorities for having sponsored the present meeting in this beautiful city, whose remarkable urban and industrial development is so justly admired.

This enables us to acquire a first-hand impression of the world-famous natural beauty and resources of this country, to note how much the effort and intelligence of its inhabitants has achieved and to predict the wonderful future which awaits Brazil.

Under such happy auspices, therefore, let us start our activities with cheerful anticipation and reassert our hope that the iron and steel industry of these young and promising Latin American countries will develop strongly and intensively in the near future.

3. Address by Mr. Enzo Giacchero, member of the High Authority of the European Coal and Steel Community

This is the first time that a member of the High Authority of the European Coal and Steel Community comes to South America; this is also the first time that we have the opportunity of speaking before a Latin American meeting. There is no need to stress how honoured and pleased we feel at having been so kindly invited.

On behalf of the coal and steel industries of the six countries which integrate our Community—Germany, Belgium, France, Holland, Italy and Luxembourg—whose welfare is the High Authority's responsibility—and in the name of my colleagues of the High Authority, I wish to thank all those who have contributed to the organization of this meeting.

I know from experience what it is to organize an international conference—the heavy workload implied and the goodwill required. This is why I think I speak in the name of all European participants when I express my most sincere gratitude to the Associação Brasileira de Metais, the Executive Committee of the meeting and

all the United Nations representatives who have participated in its organization, for the opportunity they have given us to attend.

Likewise I take pleasure in expressing the cordial greetings of the High Authority and its gratitude to the Government of Brazil which has contributed to and sponsored the meeting, for having given us an occasion to visit this pleasant and charming country.

Finally, I wish to give particular thanks to the Associação Brasileira de Metais for the kind invitation they have extended to me.

This invitation is not only a great personal honour, but it also constitutes an indication of the great importance you attach to matters of international co-operation, as was made clear in the letter of invitation. It shows the interest with which the organizers of the meeting view our European experience in the field of economic integration. I shall now take up some of your time for a brief review of our activities in recent years in Europe.

In the 50 years preceding the creation of the Community, the world had been witnessing disintegration movements, which were frequently unpremeditated and on occasion those responsible for such movements were not fully aware of the disintegration they originated.

Before the First World War the world was politically divided but there was a high degree of economic integration. Men, all kinds of products and capital could circulate freely. There was an automatic mechanism for adjustment called "the gold standard". This might be considered as the age of automatic or unconscious integration.

But, after the First World War, there came a time, lasting a decade or so, in which it seemed as though the automatic mechanism might again be restored. The countries of Western Europe made great efforts to maintain the value of their currencies with respect to the dollar without realizing what fundamental changes the war had wrought on their economic vigour.

The economic catastrophe of 1929–31 revealed this fundamental disequilibrium. The governments tried to improve the situation of their respective countries by means of several import restrictions—both quantitively and through exchange controls—and the limitation of the freedom of capital movements, as well as by raising the tariff barrier.

This was the easiest way out; but the countries which thus sought to ensure the recovery of their own economies and industries were not clearly aware of two facts.

First, that the imports of one country are the exports of another; if all countries sharply curtail their imports, the exports of all will be equally restricted and in the end all will lose much more than they gained temporarily.

Secondly, that restrictions imposed on foreign competition in relatively small countries, by allowing for the utilization of obsolete equipment during a prolonged period and the existence of inefficient enterprises, bring with them the seed of economic atrophy and destroy the urge towards expansion.

After the Second World War it was very apparent that Europe would never recover her former economic position if the division of its economy into small and almost self-sufficient national markets were not eliminated. Then came attempts to promote trade by means of co-operative measures among the countries of free Europe. You all know how the Organization for European Economic Co-operation was established to reduce quantitative controls, as well as the European Payments Union aimed at mitigating the effect of exchange restrictions and turning trade once again into multilateral channels while, on a world level, the GATT was created to lower customs duties.

The work of the first two organizations has undoubtedly been very useful. Without them, Europe would never have reached its present state of prosperity. In addition, the GATT has been successful in effecting a considerable reduction in the raising of customs tariffs and has obtained appreciable reductions in other sectors.

All this resulted in some recovery in Europe. But it did not provide the necessary impetus so that the old continent could keep pace with the expansion of the new economic colossi: the United States and Russia. We were steadily losing ground in comparison with these countries.

Although the reduction of quantitive controls had brought about an increase in trade, individual countries still had the right to reintroduce such restrictions under certain circumstances, and they did. Moreover, some countries reduced quantitative controls but at the same time kept their right to raise customs duties, and so they did. In many economic sectors the small national markets remained as before, almost completely sealed off. Co-operation was not sufficient.

For this reason, Jean Monnet, who was afterwards elected as first chairman of the High Authority, thought not of simple co-operation, but of European integration, which would create a large market of 160 million people in the countries of Western Europe.

The materialization of this idea, sponsored by the French Chancellor, Mr. Robert Schuman, began by the ratification on the part of the six countries of the Schuman Treaty in April 1951. The market is already a reality in relation to coal, steel, iron ore and scrap. There are no longer any frontiers between the six countries for these products. A single executive organization, the High Authority, is responsible for this fundamental sector in the economy of six countries. A single market of 160 million Europeans already exists; the seeds of a federal structure have already been sown.

I do not wish to go into details about the Community's achievements. Later on, when I shall deal with the operation of the common market, I shall provide the information which enables me to speak with such confidence and assurance.

We are convinced that so much could not have been achieved on the basis of co-operation alone, or without an executive organ wielding effective power. Unfortunately, without such an organ, co-operation is usually an ephemeral thing, for reasons called "national interests". In Europe, in our Community, there is already a general interest—that of the Community as a whole—and all concerned—consumers, industrialists and trade unions—begin to realize that this interest, comprising the need for technical progress, economic expansion and improvement of the standard of living, is proving to be more beneficial than what had been done before

by the frequently conflicting interests of the various national groups.

I believe that today it would be difficult to find an industrialist of the Community ready to do away with the Schuman Treaty, although at the beginning it would perhaps have been difficult to find one in favour of it. As to the trade unions, they are our staunchest supporters and in Luxembourg, seat of the High Authority, there is a united federation which represents all six countries.

We have thus chosen the path of economic integration. In the coming months experts from the six countries will meet in Brussels to draft two new treaties—the first for the gradual establishment over a period of twelve to fifteen years of a common market for all products—a market without frontiers or internal restrictions and with a common tariff for imports from non-member countries; a market which will give our economy an enormous impulse and which, with its investment fund, will enable the achievement of an expansion rate similar to that of the United States and Russia.

The second treaty provides for the creation of a Common Authority for atomic energy and for the establishment of large common atomic installations.

Great Britain, aware of the significance of being excluded from such a common market, is seeking ways and means of being associated with it through the establishment of a free trade area without disturbing the imperial preferences which are one of the most important bonds in the Commonwealth.

There is no doubt that Europe is on the go. The Community, which in 1954 produced 44 million metric tons of steel, will this year produce 57 million and the target for 1965 has been set at about 80 million tons. The six countries constitute the most rapidly expanding market in the world; no less than 60 per cent of all world trade expansion between 1950 and 1955 took place in the countries of Western Europe, excluding Great Britain.

Of course, your problems differ from ours. These young countries, with vast natural resources on hand, develop at an almost miraculous rate. But we do have certain problems in common, particularly the shortage of investment funds, the threat of inflation and the problems involved in the distribution of national income between consumption and investment.

Naturally we have not come to provide solutions for the problems of your countries. We know that you have the required vigour and imagination to tackle them yourselves on the basis of your own needs and experience.

But if our experience can be of any use, if by showing you the errors we have committed and paid for we can prevent their being repeated here, we shall be well pleased.

4. Address by the Executive Secretary of the Economic Commission for Latin America, Mr. Raúl Prebisch

I

No city in Latin America could claim a better right than São Paulo's to act the host to such a Meeting of Experts as we are inaugurating today. In the course of barely three decades, an area whose economy was of a primary character, and subject to all the complications and vicissitudes involved in dependence on a single line of exports, has turned into this impressive centre of industrial activity, whose entrepreneurs are constantly and unhesitatingly venturing along fresh avenues of expansion. Such a metamorphosis bears witness to the dynamic efficacy of the driving force that spurs on private enterprise, also animated in this instance by a strong consciousness of an example to be set and a mission to be fulfilled—a mission in the economic development of Brazil, and an example within the broad territories of Latin America.

It is my privilege to address you today on behalf of the Secretary-General of the United Nations, Mr. Dag Hammarskjold, and of Dr. Hugh Keenleyside, Director-General of the Technical Assistance Administration, as well as in my own capacity as Executive Secretary of the Economic Commission for Latin America. As the representative of ECLA, I have great pleasure in expressing our gratitude to the Government of Brazil, which, in sponsoring the present meeting, has given yet another demonstration of its unfailing support of the United Nations Organization, and, in particular, of the latter's regional agency in Latin America. I must add that this meeting would never have materialized if we had not enjoyed, from the very outset, the whole-hearted co-operation of the Associação Brasileira de Metais, with whom we have had the pleasure of sharing the responsibility for its preparation, and whose directors have spared no effort to ensure its success. For this, and for all their personal kindness to the United Nations staff, we owe them a debt of gratitude which I am especially happy to have this opportunity of acknowledging to their distinguished representative, Dr. Luiz Dumont Villares.

The idea of this Meeting of Experts dates from some time back, and was originally broached in this very country, at the memorable ECLA session held at Quitandinha in 1953. Our analyses of the real situation in Latin America had been revealing that the countries which had advanced farthest along the road towards full industrialization had already passed the first milestone—the straightforward replacement of imports of staple consumer goods by domestic production—and were entering upon a stage of greater technical complexity, calling for more intensive investment. It was the concern of the Governments members of the Economic Commission for Latin America for the technical and economic problems inherent in this new phase of industrial development, together with the inducement afforded by the success of the earlier meeting on steel making which the United Nations had organized at Bogotá in 1952, that led them to decide upon convening the present meeting on iron and steel making and transforming industries.

But what is the *raison d'etre* of this industrial evolution? Why should effort be expended on the creation of these more complicated industries, when manufactured products from abroad so frequently combine lower costs with better quality? Is autarky becoming the ruling principle in the economic policy of our countries?

Anyone who is acquainted with the current situation in Latin America and with the forces behind it is well

aware that the ideal of autarky has been definitely discarded. Undoubtedly, in earlier times it did represent the primitive impulse towards economic nationalism which was the typical reaction to foreign trade setbacks in countries on the periphery of the world's economy, when it did not derive from a purely reflex response to the spectacle of thriving industries elsewhere. But we—the Latin American countries—are not alone in displaying such economic nationalism. It should not be forgotten that for a long time there were some in the great industrial centres who based their negative attitude towards their countries' incipient industrialization on a concept of international division of labour, which, apart from its serious theoretical shortcomings, was in essence a patent expression of nationalistic exclusiveness. How could it be anything else, when, on these allegedly scientific grounds, it divided the countries of the world into two vast categories, according to their supposed aptitudes? Was it not economic exclusiveness to attribute to some countries the intention of continuing to produce primary goods, while in others the expansion of manufacturing activities was to be perpetuated in the shape of constant advances in productive technique?

United Nations studies, and discussions during its meetings and conferences on these subjects, have done much to supersede these obsolete ideologies, and to clarify the dynamic significance of industrialization for countries in process of development, revealing industrialization as an indispensable concomitant of technical progress itself with respect to primary activities—especially agriculture—in the countries in question.

It is not that industrialization is necessary because agriculture brings poverty in its train. Industrialization is necessary just when agriculture is seeking to emerge from its poverty by adopting more advanced techniques. The process has been repeatedly explained. Improved techniques in primary production mean that fewer workers are required per unit of product, and the development of industry and other activities is absolutely essential for the absorption of manpower that would otherwise become superfluous or redundant. This is necessary so that wages may rise with the increase in productivity resulting from technical progress, and the trend towards the deterioration of price relationships between primary products and industrial goods in the world market may thus be offset.

It may be asked, however, whether this labour could not be reabsorbed by the expansion of primary production itself. This is not what usually happens since employment naturally follows the lead given by demand, and it is well known that the demand for primary products is apt to increase much less rapidly than demand for manufactured goods. There are a number of reasons for this. To begin with, demand for foodstuffs rises relatively slowly, in line with the growth of *per capita* income; and further, demand for natural raw materials is affected by competition from synthetic substitutes apart from other unfavourable effects of modern productive techniques as regards primary products. This explains why, in the peripheral countries, demand for industrial imports tends as a rule to increase much more than exports and home consumption of primary products, although it must be recognized that in some instances a mistaken policy has prevented the export trade from expanding to the extent that might have been possible.

Clearly, therefore, in such countries the dynamic function of industry is twofold. On the one hand, it must absorb the manpower no longer required for primary production, and on the other, it must supply all those industrial products which cannot be imported in view of the relatively slow growth of exports.

The problem facing these countries therefore consists in keeping their imports within the bounds set by their capacity for foreign payments, and meeting the remainder of their increasing industrial requirements with domestic production. The first question which must be answered is: how are these industrial requirements to be broken down into those which must still be satisfied with imports and those which domestic production will cover? Such a decision could not be based on any but strictly economic considerations. Among the immense quantity and variety of articles needed there is a whole range of cost differentials in relation to imports. Clearly, those goods whose cost differs as little as possible from that of the corresponding imports must be produced domestically; or, to be more exact, in view of Latin American experience, domestic industries must undertake those lines of manufacture in which the disparity betwen their costs and those of the imported item is less than in others. It is obvious that everything possible must be done to reduce this disparity, but the fact that it exists does not necessarily mean an economically unsatisfactory solution, since if the capacity to import is insufficient, it is better to have these articles at a cost reasonably higher than that of their imported counterparts than not to have them at all, and at the same time throw away an opportunity of employing labour with greater productivity than in technically inferior sectors of the economy.

This is definitely the problem which the most highly-industrialized countries of Latin America must now solve. As I have pointed out, the countries concerned have already emerged to a large extent from the simple phase of substituting domestic production for imports of staple consumer goods, and, given the tendency to disparity in the rates of increase of exports and imports, more complex substitutions must now be undertaken, among which great importance attaches to some intermediate products, capital goods and certain durable consumer goods.

II

The agenda for this meeting is based upon this real necessity imposed by the growth of Latin American countries. If steps must inevitably be taken towards these new forms of production, how are the selective economic criteria of which I spoke a moment ago to be applied in practice? What indications can be gathered from experience in the world centres of industry of the solutions best adapted to the needs of the Latin American countries? The field covered by these questions is of course enormous, and must be gradually and methodically explored. At the present meeting we shall be discussing a sector of industry which is arousing evident interest in most of the Latin American countries. Indeed, the initial stages of development of the iron and steel transforming industries are already giving rise

to a series of problems which it would seem desirable for this meeting to examine. The scope of these problems ranges from certain aspects of raw material production to the mechanical and motor vehicle industries, and embraces topics relating to rolling and forging. As economists, we ECLA officials shall confine ourselves to explaining and presenting to the technical experts the difficulties we have encountered in the more advanced countries of Latin America, and we would now urge them to discuss possible solutions. Some background documents—although not as many as we could have wished—have been presented with this end in view. I propose to mention here some of these problems as we have interpreted them, and I hope that the experts who are with us today will look with a tolerant eye upon this brief exploratory intrusion into their territory.

The problems of raw material for the steel transforming industries had already been discussed at the Bogotá Meeting of Experts. But recent technological developments suggest that two points in particular should be examined on the present occasion. One of these is the question of procedures for the desulphurization of pig iron, and the other is the use of oxygen. The papers on desulphurization offered highly interesting evidence of consequences whose economic importance is unquestionable. The capacity of the blast furnaces, and therefore the capital invested in these, can be more intensively utilized; and the possibility of using high-sulphur coal means that fuller advantage can be taken of Latin America's coal deposits. Which are the desulphurization procedures most suitable for adoption in Latin America?

As regards the use of oxygen in steel making in our region, where capital is scarce, the possibility of making open-hearth-type steels in converters which hitherto have been used only for lower-quality steels, and which represent considerably less investment, would be a great advantage. Which methods of using oxygen could best be adapted to Latin America's requirements, and in what specific cases would such procedures prove more satisfactory than those traditionally followed?

It is not only in the primary phases of production that investment per units of product can be reduced; the same is true of subsequent processes for the obtaining of rolled products. One of the greatest obstacles to progress at this secondary stage in Latin American countries has been the heavy investment requirements of blooming mills. The relevant documents presented here show that in relatively small plants the use of blooming mills can be replaced by continuous casting, or by forging processes involving much less capital outlay. Apart from this saving on investment, continuous casting would allow the gradual increase of rolling capacity by the successive addition of similar units, instead of an initial heavy investment of which the full benefit cannot usually be reaped to begin with because of the inadequate size of the market.

I am sure that this subject will be of very considerable interest to the Latin American countries, and I hope that in the course of our discussions the virtues and drawbacks of this procedure will be compared with those of the methods hitherto adopted, and ideas will be exchanged as to whether a judicious selection of these latter might not in the long run offer greater economic advantages for countries whose market though small at present, shows promise of rapid development.

I said earlier that the new and more complex phase upon which the Latin American countries are entering must include expansion of the capital goods industries. It is clear that the existence of the iron and steel industry—apart from satisfying the increasing consumer demand for current steels in industrial construction building, transport, etc., also constitutes the basis for the manufacture of machinery. But if this industry is to attain its proper dimensions, certain special steels, particularly for the mechanical industries, will have to be domestically produced. Among other obstacles to the making of these steels is the size of the market, which does not permit the economically satisfactory manufacture of the wide range of products needed today by the mechanical industries. As a first step, an attempt would have to be made to reduce the number of types used, and also to seek some form of country-by-country specialization in their production.

This applies not only to special steels, but also to the common rolled steels mentioned earlier. In these, too, the excessive variety of shapes and sizes must be reduced by standardization, which immediately enlarges the market for the smaller number of types established especially in the case of this class of products. However, not only standardization, but also rationalization is required. Much can be learned from India's experience, described in another of the reports to be presented at this meeting. In the process of standardization, many old designs of rolled products have been superseded, and the resultant economy in raw material, combined with the advantages of standardization, has led to a saving of 20 to 25 per cent on the raw material consumed by the structural steel industry in India, which should represent an annual figure of 20 million dollars when current development projects are fully implemented.

Inherent in standardization, of course, is the establishment of specifications and standards of quality to ensure the uniformity of each type of product, and in Latin America several institutions have successfully engaged in this work. But it would seem advisable to go somewhat farther in two directions. On the one hand, more widespread knowledge and acceptance of these standards among industrialists and consumers should be ensured, and, on the other, an attempt should be made to see that medium- and small-scale industries, which are debarred from access to modern techniques by the limited nature of their operations, use the materials most suitable for the manufacture of their products.

In including this item on the agenda for the present meeting, ECLA has pleasure in bringing forward a proposal made some time ago by General Macedo Soares, to whose distinguished services industrialization in Brazil is so deeply indebted. Perhaps a special committee might be set up to prepare the bases for standardization, in consultation with industrialists and consumers in the countries concerned, and with the collaboration of universities and technological centres. The task is one of international scope which could not be undertaken by any single country, and I can give

you an assurance that the Economic Commission for Latin America would be very pleased to co-operate in putting it into effect.

I should now like to allude to two basic aspects of the transforming industries which must be given careful consideration if these industries are to gain momentum in Latin America. I refer to casting and forging. In point of fact, casting is still in its initial stages. There are innumerable small foundries whose techniques are as a rule far behind the times; mechanization is inadequate, and control of sands and of the quality of the products is very unreliable. Apart from these independent establishments, metallurgical and mechanical enterprises usually have their own foundry, the small size of which results in higher costs. This is a serious defect, which is also to be found in other auxiliary services of such enterprises. Can certain forms of specialization be worked out which would mean lower costs? And, if so, what would be the size best calculated to ensure efficient mechanization?

If the weaknesses just mentioned are to be detected in casting, the problem is even more complicated in the case of heavy forging, since it is no exaggeration to say that this constitutes a missing link in the iron and steel transforming process. It is true that the investment required is so substantial as to be justifiable only if a large market is available, but it would in any case be well to discuss the most suitable procedures and the various scales on which they could be applied, without forgetting that a combination of the individual country markets might enable economic dimensions to be attained quite easily in the case of certain products such as railway axles and crank-shafts.

Despite all these obstacles, the development of the mechanical industries has been following a course which, although still in its early stages, has already provided some degree of technical experience which will allow the progressive establishment of new manufacturing lines. These industries began by processing simple mechanical elements and durable consumer goods, and later undertook the manufacture of machinery for which there is a wide market, such as certain machine tools and motors. They have also given proof of their ability to manufacture some kinds of machines which, as they are not mass-produced even in the industrialized countries themselves, can be economically made for a small market. Lastly, it should be noted that an interesting development is taking place today—the manufacture of plant, structures and heavy equipment, especially for the steel making, pulp and paper and petroleum industries, mining and hydroelectric works. In some Latin American countries the mechanical industry is already in a position to embark upon this branch of production, especially if various enterprises co-ordinate their efforts, as was recently done in this country. The experiment is undoubtedly one to be watched with the closest attention. Needless to say, in this field the technique of the large industrial centres is essential, and in many cases the preparation of projects abroad could be combined with their execution by local enterprises.

Despite the great interest attaching to the machine industry, the ECLA secretariat was unable to make as much progress in this connexion as it would have wished when preparing for this meeting. However, the presence of specialized experts leaves room to hope that special group meetings can be organized with a view to the discussion of this problem in terms consistent with the real situation of Latin America, and to the clear and specific definition of content and method for the research in this field which could be carried out after the meeting.

The above remarks also apply to the motor vehicle industry. Some countries have already begun to manufacture lorries, jeeps and tractors, and there is much interest in the possibility of also producing automobiles. A series of aspects requiring elucidation present themselves here. The first, so repeatedly stressed in previous connexions, is the size of the market.

It seems that in countries like Argentina, Brazil, and Mexico the market for lorries might attain satisfactory dimensions. As regards automobiles, the problem appears to be somewhat more difficult, since the optimum size of the market is greater and demand is much lower than in the more developed countries, because *per capita* income is less. A relatively limited market might result in excessively high costs. Admittedly, this would depend upon the proportion of the value which it was considered desirable and feasible for the local industry to produce. The domestic manufacture of almost 100 per cent might mean that costs were very heavy, at least at the outset. But this is not the only reason for anxiety, as the greater the variety of models produced, the more serious are the difficulties attendant upon a limited market. Would it be possible, in this field as well, to reach a reasonable degree of standardization whereby the number of models might be reduced? And, to advance a step farther, is it conceivable that parts and spare parts might be so far standardized as to ensure their interchangeability? A precedent is supplied by the radio industry in the United States, which developed after the automobile industry, and was therefore able to profit by the latter's experience and avoid dispersion by means of its characteristic standardization. Lastly, would it be practicable to consider the possibility of types of vehicles whose construction was sufficiently simple and more economical than that of existing models for costs to be substantially lowered? A reminder may not be out of place that, broadly speaking, motorization in the Latin American countries is in its initial stages, and that consequently there may be a vast potential demand over the next few decades, as *per capita* income rises. It may be worth while to consider whether the vehicles at present in use constitute the most economically sound solution of this problem, and whether road communications are likely to improve so rapidly that there is no point in envisaging vehicles better adapted to roads of the type at present prevailing.

The use of the diesel engine is, up to a point, a concession to the fuel situation, which is not the same as in the United States, and the results achieved should also be examined from the standpoint of a given country's over-all economy, the greater cost of the engines being set against the saving in fuel. From another angle, the further possibility can be glimpsed that multiple utilization of the diesel engine might be developed in such a way that slight modifications would enable the

same type to be used for lorries, tractors and power generators.

Another aspect of the manufacture of motor vehicles should be studied in the light of the experience—preliminary though it is—acquired in the three countries mentioned earlier. Existing plants might conceivably be utilized for the manufacture of parts, the appropriate technical assistance being provided, and attention being simultaneously devoted to the problem of special steels, of which I have already spoken, and which is undoubtedly one of the key factors in a rational solution.

As in the case of the manufacture of machinery, it would be of great value to us to secure the collaboration of the experts in this field who are attending the present meeting, so that the study of this question could be approached from the point of view of the Latin American countries, and the possibilities of assisting the motor vehicle industry in its early stages could be discussed with careful consideration of the advantages and disadvantages of alternative solutions.

III

The topic of economic dimensions for industrial enterprises has been implicit in the whole of this address. There are some cases in which the domestic market of certain countries will suffice, and others—a great many others—in which production costs will prove excessively high. This might very seriously limit the expansion of industry on economically sound bases, and I greatly fear that unfavourable balance-of-payments situations or weighty considerations of another kind may prevent the bounds thus imposed from being transcended. If circumstances demand the restriction of imports from the more highly-developed countries, it would be extremely regrettable to set out upon this path without having first explored the possibility of establishing a regional market, in which several countries might participate, for certain new or incipient products of the transforming industries. Of course, it is only the nature of the present occasion that leads me to confine my remarks to these industries despite the fact that such a policy will undoubtedly have to embrace other economic sectors, in due co-ordination with traditional trade patterns. Perhaps it might be feasible to consider specific forms of country-by-country specialization, as, for instance, in certain raw materials or intermediate products, special steels, rolled products, machinery, forging, motor vehicles or their parts. Would it, for example, be advisable for each country to attempt the domestic production of large, medium-sized and small tractors, when several countries might each specialize in one type, with a common market and a considerable saving in costs?

I feel we are very fortunate in that three distinguished representatives of the European Coal and Steel Community are present at this meeting. I have no doubt that they will tell us of their experiences, and will perhaps encourage us to follow a course that some years ago would have been thought utopian for Europe, as in the opinion of many it probably seems today for Latin America, which has not hitherto succeeded in making any decisive progress towards the rational integration of its more highly-industrialized countries.

The problem is much more difficult in Latin America than it has been in Europe, since—as we have just been told by no less an authority than Mr. Enzo Giacchero—in their case it was an attempt to reconstruct and restore former patterns of integration which had been broken up by the vicissitudes of the Second World War, and by economic crises. In Latin America on the other hand, there has been no previous economic co-ordination between our countries, except in very few instances, and on relatively narrow bases, precisely because—in view of the old theory of international division of labour—we have traded almost exclusively with the great industrial centres. Consequently, the necessity for the encouragement of inter-Latin-American trade did not arise before or even during the initial stage of industrialization since in this early phase more satisfactory dimensions can more readily be attained in the consumer industries within the bounds of the domestic market. But, now that we are entering upon more complex industries, which require more substantial investment, and for which the small market is often a serious limiting factor, an analysis of the possibilities of a common market appears an immediate necessity.

Happily, a clear conception of the vital importance of this question has gradually been taking shape, especially with the opening of the present new phase of development, characterized as it is by industries for which investment and the size of the market are much more important than is usually the case with the industries manufacturing staple consumer goods, established during the phase now almost over. It is precisely this recognition of the existence of the problem that recently induced the Governments members of ECLA to decide upon the creation of a Trade Committee. On the agenda for the meeting of this Committee in Santiago, at the end of November, investigation of the prospects for a common regional market holds a prominent place. I feel sure that the technical information emerging from this São Paulo meeting will provide valuable background data for the meeting in Santiago.

I should like to make it clear to the non-Latin American experts who are present that an intensification of trade among the countries of this region would on no account imply a contraction of their imports from the great industrial centres. Their imports depend upon those countries' purchases from Latin America and on the amount of their investment. The region's purchases abroad will not decrease because of industrialization and increased inter-regional trade, but their composition will be changed, without detriment to their expansion in proportion to the accompanying growth of Latin American exports and foreign investments. Moreover, the development of industries integrated in this way and able to rely upon a sizeable market will open up a wider range of possibilities for the efficient investment of foreign capital and for reciprocally beneficial technical collaboration.

Before bringing these remarks to a close, I should like to refer to another of the points that seem to me most significant on our agenda; that is, technical training. There is no need for me to stress its importance for productivity. This is a problem which must be tackled without delay, since otherwise the expansion programmes of the industries we are discussing might be seriously handicapped. Two fundamental defects exist. Technical training is not always consistent with

present requirements, and much less with those likely to arise in the future. Furthermore, the number of technicians and skilled workmen trained every year is inadequate from every point of view. I was impressed by the conclusions reached in this connexion, according to one of the reports presented to the meeting, in the case of a Latin American country which is among those which have displayed the greatest concern for this problem.

IV

In the foregoing observations it has been my aim to give a clear idea of the problems that seem to us most vital for Latin America's industrial development, and of the reasons why we feel them to be so important. As economists we cannot venture upon technical ground. To repeat what I have already said, we must confine ourselves to describing certain difficulties and asking the technical experts to help us to define others; and we invite discussion and the frank and friendly exchange of knowledge and experience. Such is the object of the present meeting. We deeply appreciate the presence of industrialists and experts of the calibre and qualifications of those who are here today, and we offer them our thanks in advance for all that their co-operation will mean to us. We also wish to thank the authors of the papers which are presented for the consideration of the meeting, and which, in my opinion, are admirably designed to serve the purposes for which they were requested. There is every reason to hope that the ends pursued by the United Nations in preparing this meeting, and by the Government of Brazil in honouring us with an invitation to hold it in São Paulo, will be fully attained.

I am convinced that this meeting will help to strengthen the form of international collaboration of which it is representative, and that the United Nations, through UNTAA and ECLA, who organized the meeting with such public-spirited and indispensable assistance from Brazil, will be able in the future to tackle with ever-increasing efficiency the problems of Latin America's current situation.

ANNEX II

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ANNEX III

List of working papers presented at the meeting

PART A. IRON AND STEEL MAKING

Document symbol
ST/ECLA/CONF.4/L.

A I. Reduction Furnaces

A I-1 *Soda-ash desulphurization of pig iron*
by Pierre Coheur, Professor, University of Liège and Director, Centre National de Recherches Métallurgiques, Liège (Belgium)

A I-2 *Desulphurization of pig iron with solid lime*
by Bo Kalling, Director, and Sven Eketorp, Assistant to Director, Research Department, Stora Kopparbergs, Bergslags Aktiebolag, Domnarvet (Sweden)

A I-3 *Dephosphorization and desulphurization of pig iron and steel by treatment with molten slag*
by René Perrin, Vice-Pesident and Director General, Société d'Electro-Chimie, d'Electro-Métallurgie et des Aciéries Electriques d'Ugine, Paris (France)

A I-4 *Influence of manganese on the desulphurization of pig iron*
by R. A. Hacking, Director of Research, and C. E. A. Shanahan, Chief Chemist, R.T.S.C. Laboratories, Whitchurch, Bucks (United Kingdom)

A I-5 *Assessment of practical desulphurization limits in the blast furnace*
by Héctor Canguilhem, Chief Metallurgist, and Valerio Rioseco, Engineer, Metallurgical Department, Compañía de Acero del Pacífico, S.A., Huachipato (Chile)

A I-6 *Recent developments in lime desulphurization of pig iron*
by B. Trentini, Research Engineer, Steelmaking Department, L. Wahl, Assistant to General Manager, and Marc Allard, General Manager, Institut de Recherches de la Sidérurgie, Saint-Germain-en Laye (S & O) (France)

Document symbol
ST/ECLA/CONF.4/L.

A I-7 *Latest developments in electric pig iron smelting*
by K. Sandvold, Manager, Metallurgical Department, Engineering Division, Elektrokermisk A/S, Oslo (Norway)

A I-8 *Latest results of the International Low-Shaft Blast Furnace at Liège*
by the International Steering Committee

A I-9 *Electric pig iron and steel production*
by Herman Walde, Director, DEMAG (Federal Republic of Germany) and Borut Marincek, Eidgenössische Technische Hochschule (Switzerland)

A I-10 *Electric arc furnaces for steel foundries and bulk steel production**
by F. S. Leigh, Manager, Melting Furnace Division, Birlec Ltd. (United Kingdom)

A II. Use of oxygen in steel making

A II-1 *Scientific and technical aspects of the use of oxygen in steel making*
by Robert Durrer, Managing Director, Louis de Roll Iron Works Ltd., Gerlafingen (Switzerland)

A II-2 *Technico-economic review of the use of oxygen in steel making, especially in the case of the ordinary Bessemer converter*
by A. M. Clark and J. L. Harrison, The British Oxygen Company Ltd., London (United Kingdom)

A II-3 *Top blowing with oxygen in the manufacture of Bessemer steel*
by Herbert Trenkler, Hüttendirektor, Vereinigte Oesterreichische Eisen- und-Stahlwerke A.G., Linz (Austria)

* This paper was discussed by the meeting under Section A II.

Document symbol
ST/ECLA/CONF.4/L.

A II-4 Not received*

A II-5 *Quality of oxygen-blown converter steels*
by Karl G. Speith, Betriebsdirektor, Mannesmann-Hüttenwerke, A.G., Duisburg (Federal Republic of Germany)

A II-6 *Stora's Kal-Do rotary oxygen steelmaking process*
by Bo Kalling, Director of Research, and Folke Johannson, Stora Kopparbergs Bergslags Aktiebolag, Domnarvet (Sweden)

A II-7 *New control instruments for Bessemer steels in small steel plants*
by P. Leroy, Institut de Recherches de la Sidérurgie, Saint-Germain-en-Laye (S & O) (France)

A II-8 Not received**

A II-9 *Oxygen-blown converter steel in Latin America*
by Georg Bulle, Director, Gutehoffnungshütte, Mühlheim-Ruhr-Broich (Federal Republic of Germany)

A II-10 *The use of oxygen in making electric steels in small steel plants*
by W. E. Lewis, Pittsburgh Lectromelt Furnace Corporation, Pittsburgh, Pennsylvania (United States of America)

A III. Rolling mills and finishing

A III-1 *The problem of steel rolling in Latin America*
by General Edmundo de Macedo Soares e Silva, President, Companhia Siderúrgica Nacional, Volta Redonda (Brazil)

A III-2 *Selection and economy of equipment for blooming mills in view of the growth of the Latin American steel market*
by Kurt Schlesinger, Sales Engineer, United Engineering & Foundry Co., Pittsburgh, Pa. (United States of America)

A III-3 *The development of flat rolling in a growing economy*
by W. F. Cartwright, Assistant Managing Director and General Manager, The Steel Company of Wales, Ltd., Port Talbot, and M. F. Dowding, Engineering Sales Manager, Davy and United Engineering Company Ltd., Sheffield (United Kingdom)

A III-4 *Selection of equipment for bar and shape mills in view of the growth of the Latin American steel market*
by Ernst Wilms, Chief Engineer, Dortmund - Hoerder - Hüttenunion A.G., Dortmund, and Ernst Krebs, Director, Hüttenwerk Rheinhausen (Federal Republic of Germany)

A III-5 *The replacement of blooming mills by forges and presses in tonnage steel works*
by E. de Seze, General Manager, Société des Aciers Fins de l'Est, Boulogne-Billancourt, and Julien Courthéoux, Consulting Engineer, U.C.P.-M.I., Hagondange (France)

A III-6 *The replacement of conventional casting bays, soaking pits and blooming mills by continuous casting*
by J. Savage, Head, Physics Department, British Iron and Steel Research Association, London, and J. S. Morton, Director, Campbell, Gifford and Morton, Ltd., Weybridge, Surrey (United Kingdom)

A III-7 *Description and versatility of Sendzimir rolling mills*
by Michael T. Sendzimir, Vice-President in Charge of Sales, The Sendzimir Company, Middletown, Ohio (United States of America)

A III-8 Not received*

A III-9 *Expansion and modernization of the rolling mills of the Compañía Fundidora de Fierro y Acero de Monterrey*
by Rodolfo Barragán, Sub-Director, Compañía Fundidora de Fierro y Acero de Monterrey (México)

A III-10 *Rolling problems of a semi-integrated Latin American steel mill*
by Miles M. Sherover, General Manager, and W. P. Lewicky, Production Manager, Siderúrgica Venezolana Sivensa S.A., Caracas (Venezuela)

A III-11 *Contribution and improvements to modern seamless tubes manufacturing processes*
by Alberto Calmes and T. Passoni, Innocenti Societá Generale per l'In-

* *Use of oxygen in steel making: summary and conclusions of an open session of the Associação Brasileira de Metais.*

** *Description of a steel furnace using fuel oil and pure oxygen,* by Georg Bulle, Director, Gutehoffnungshütte, Mühlheim-Ruhr-Broich (Federal Republic of Germany).

* *Adaptation of rolling mills to the growing capacity of the Volta Redonda steel works,* by the Companhia Siderúrgica Nacional, Volta Redonda (Brazil).

Document symbol ST/ECLA/CONF.4/L.	
	dustria Metallurgica y Meccanica (Italy)
A III-12	*Standardization in the production and use of rolled steel sections in India*** by the Indian Standards Institution, Delhi (India)

A IV. NON-CURRENT STEELS

A IV-1	*The problem of non-current steels in Latin America* by Theodoro Niemeyer, Technical Director, Aços Villares S.A., São Paulo (Brazil)
A IV-2 & 3	*Non-current steels in Brazil and Chile* study presented by Fritz Riekeberg, Consulting Engineer (Federal Republic of Germany), to the secretariat of the Economic Commission for Latin America

** This paper was discussed by the meeting under Section D IV.

Document symbol ST/ECLA/CONF.4/L.	
A IV-4	*Description of a non-current steel plant in Brazil* by Luiz Dumont Villares, Director President, Aços Villares, S.A., São Paulo (Brazil)
A IV-5	*Investment and production costs in non-current steel plants of various sizes suitable for Latin America* study presented by Fritz Riekeberg, Consulting Engineer, (Federal Republic of Germany) to the secretariat of the Economic Commission for Latin America
A IV-6	*Classification and standardization of steels* by the High Authority of the European Coal and Steel Community
A IV-7	*Production of non-current steels in Mexico* by Fernando González Vargas, Banco de México, México D.F.

PART B. IRON AND STEEL TRANSFORMING PROCESSES

B I. ECONOMIC AND TECHNICAL ASPECTS OF FORGING

Document symbol ST/ECLA/CONF.4/L.	
B I-1	*Drop forging in the United States: equipment and methods* by Eugene C. Clarke, President, Chambersburg Engineering Company, Chambersburg, Pa. (United States of America)
B I-2	*Press and machine forging in the United States: equipment and methods* by Robert G. Friedman, President and General Manager, The National Machinery Co., Tiffin, Ohio (United States of America)
B I-3	*Hammer press and machine forging in Europe: equipment and methods* by Günter Peddinghaus, Technical Vice President, Carl Dan. Peddinghaus A.G., Ennepetal-Altenvoerde, Westf. (Federal Republic of Germany)
B I-4	*Main processes and equipment for heavy engineering forging* by André Mercier, Director, Société d'Etudes et d'Entreprises Sidérurgiques, and Professor of Metallurgy, Ecole Centrale des Arts et Manufactures de Paris, Paris (France)
B I-5	*Adaptation of forging processes to Latin American conditions* study presented by Stefan Podgorski, Consulting Engineer (Brazil), to the secretariat of the Economic Commission for Latin America

B II. ECONOMIC AND TECHNICAL ASPECTS OF CASTING

Document symbol ST/ECLA/CONF.4/L.	
B II-1	*Economic problems of steel casting in Brazil* by M. Novinsky, Chief Engineer, Steel Foundry, Companhia Brasileira de Material Ferroviario COBRASMA, São Paulo (Brazil)
B II-2	*Methods and equipment for foundry mechanization: summary and conclusions of an open session of the Associaçao Brasileira de Metais*
B II-3	*Adaptation of gray-iron foundry technique to Latin American conditions* by Joaquín Prieto Isaza and Jaime Rudas Gómez, Consulting Engineers, Bogotá (Colombia)
B II-4	Not presented*

* *Influence of mechanization and scale of operations on foundry costs* by Ulrich von Hummel, Consulting Engineer, Santiago (Chile).

Document symbol ST/ECLA/CONF.4/L.	
B II-5	*Economic aspects of foundry mechanization* by Beardsley and Piper, Chicago, Illinois (United States of America)
B II-6	*Productivity in iron foundries* by Manoel A. de Moraes, Consulting Engineer, and F. Homem de Melo, Technical Director, Usina de Fundição da Industria Filizola S.A., São Paulo (Brazil)
B II-7	*Nodular cast irons* by H. Morrogh, Research Manager, The British Cast Iron Research Association, Birmingham (United Kingdom)

B III. ECONOMIC AND TECHNICAL ASPECTS OF MACHINING

B III-1	*Some aspects of productivity in lathe operations in selected Latin American countries* by the secretariat.
B III-2	*Influence of the choice of equipment and length of runs on cost and investment for selected metal-cutting processes* by the secretariat
B III-3	*Development of the lathe in the United States* by Milton C. Shaw, Professor in Charge, Metals Processing Division, Massachusetts Institute of Technology, Cambridge, Mass. (United States of America)
B III-4	*Some engineering aspects of productivity of metal cutting* by J. Koloc, Research Institute for Machine Tools and Metal Cutting, Prague (Czechoslovakia)
B III-5	*Machining research and its impact on speeding production* by P. A. Oliver, T. S. Lister, M. D. Kinman and D. Fitzgeorge, The Machine Tool Trades Association, London (United Kingdom)
B III-6	*The machining of selected automotive elements* by H. Optiz, Technische Hochschule, Aachen (Federal Republic of Germany)
B III-7	*Trends in lathe design* by B. C. Harrison, Coventry (United Kingdom)

B IV. ECONOMIC EVALUATION OF STEEL TRANSFORMING PROCESSES

B IV-1	*Economic evaluation of steel transforming processes in Latin America* study presented by Stefan Podgorski, Consulting Engineer (Brazil), to the secretariat of the Economic Commission for Latin America

PART C. TRAINING OF PERSONNEL FOR THE LATIN AMERICAN STEEL TRANSFORMING INDUSTRIES

Document symbol ST/ECLA/CONF.4/L.	
C-1	*Evaluation of management efficiency* by S. Podgorski, Consulting Engineer, São Paulo (Brazil)
C-2	*Case histories in the management of selected Chilean industries* by the Servicio de Cooperación Técnica Industrial (Chile)
C-3	*Engineers and technicians required by Argentina for the mechanical and metallurgical industries* by Augusto Legrand, Manager, Sociedad Mixta Siderúrgica Argentina, Buenos Aires (Argentina)
C-4	*Training of technicians and skilled workers in Brazil* by Italo Bologna, Regional Director, Serviço Nacional de Aprendizagem Industrial (SENAI), São Paulo (Brazil)
C-5	*Role of the Instituto de Pesquisas Tecnológicas, São Paulo, Brazil, in the training of engineers and technicians for Brazilian metallurgical industry* by Tharcisio D. de Souza Santos, Chief, Secção de Metalurgia Extrativa, Instituto de Pesquisas Tecnológicas, São Paulo (Brazil)
C-6	*The problem of labour training at the Companhia Siderúrgica Nacional (Brazilian national steel mill)* by José Furtado de Araujo, Director, Escola Tecnica Pandía Calógeras, and Benedito Martins de Andrade Companhia Siderúrgica Nacional, Volta Redonda (Brazil)

Document symbol ST/ECLA/CONF.4/L.	
C-7	*Training of technicians and skilled workers in Colombia* by Italo Bologna, Regional Director, Serviço Nacional de Aprendizagem Industrial (SENAI), São Paulo (Brazil)
C-8	*Training of engineers for the metallurgical industries of Latin America* by G. R. Fitterer, Dean, Schools of Engineering and of Mines, University of Pittsburgh, and Director of Research, Acid Open Hearth Research Association, Inc., Pittsburgh, Pa. (United States of America)
C-9	*Promotion, recruitment and training of personnel at the Huachipato plant, Chile* by Alejandro Hartwig, Acting Chief, Department of Industrial Relations, Compañía de Acero del Pacífico, S.A. Huachipato (Chile)
C-10	*Technical assistance given by the Servicio de Cooperación Técnica Industrial for the training of skilled workers in Chile* by the Servicio de Cooperación Técnica Industrial, Santiago (Chile)
C-11	*French experience in the training of engineers and technicians in the metallurgical industry* by Jean Papier, Professor, Ecole Supérieur des Mines de Saint-Etienne, Creuzot (France)
C-12	*The co-operation of the International Labour Office in the training of technicians and skilled workers for the metal industries* by The International Labour Office
C-13	*Training of teachers and instructors for vocational education* by the United Nations Educational, Scientific and Cultural Organization
C-14	*Some aspects of the rationalization process in the Chilean metallurgical industry* by Vicente L. Sota Barros, Consulting Engineer, Santiago (Chile)
C-15	*The Faculty of Industrial Engineering at the Catholic University of São Paulo* by José Gomez Bueno, S.J., President of Ação Social, Fundação de Ciencias Aplicadas, Facultade de Engenharia Industrial, Universidade Católica, São Paulo
C-16	*Technical training in Chile* extracts from a study by Norberto Toledo and Sergio Santander

PART D. DEVELOPMENT PROBLEMS OF LATIN AMERICA'S MECHANICAL AND METALLURGICAL INDUSTRIES

Unlike the other subjects dealt with at the meeting, this item on the development problems of Latin America's mechanical and metallurgical industries is still at the stage of posing problems rather than providing suggestions for solving them. Industrialists themselves and those who are in a position to plan economic development will be invited to put forward their ideas concerning those problems which retard the development of industry. It is confidently anticipated that the discussion will throw some light on the objective pursued and the paths to be followed in the study and solution of those problems. The international organizations participating in the meeting expect to obtain from the discussions under this item some directives or guides for their future work, in regard to both technical assistance and research in specific branches of the mechanical and metallurgical industries.

Document symbol ST/ECLA/CONF.4/L.	
	D I. RAW MATERIAL REQUIREMENTS
D-20	*Some aspects of iron and steel production in Argentina* data obtained by the secretariat from a group of Argentine industrialists
D-12	*Data concerning the market for steel products in Brazil* by the Centro Moraes Rego, São Paulo (Brazil)
D-2	*Raw material requirements for the transforming industries of Chile* by the Compañía de Acero del Pacífico S.A. (Chile)
D-3	*Raw material requirements for the transforming industries of Mexico* by Marcelo Arámburu, Altos Hornos de México, S.A., Monclova (México)

Document symbol
ST/ECLA/CONF.4/L.

D-10 *Study of the iron and steel making plan in Venezuela*
by the Oficina de Estudios Especiales de la Presidencia de la República (Venezuela)

D II. MACHINE TOOL MANUFACTURE IN LATIN AMERICA

D-8 *Machine tool manufacture in Argentina*
by Heinz Kiekebusch, Consulting Engineer Asociación de Industriales Metalúrgicos, Buenos Aires (Argentina)

D-9 *Economic and technical aspects of machine tool manufacture in Argentina*
by Osvaldo Casati and Mario Mendivil, Consultants (Argentina)

D III. MOTOR VEHICLE MANUFACTURE

D-4 *Economic aspects of road vehicle manufacture in Brazil*
by Eros Orosco, member of the Grupo Executivo da Industria Automobilística, Rio de Janeiro (Brazil)

D-5 *Argentine experience in the manufacture of road vehicles*
by Higinio Monserrat, Consultant, Buenos Aires (Argentina)

D-6 *Economic and technical aspects of the manufacture of tractors in Latin America*
by Fiat Someca Construcciones Córdoba Concord S.A.I.C., Córdoba, (Argentina)

D-11 *Report on Industrias Kaiser Argentina, S.A.C.I.F.*
by Industrias Kaiser, S.A.C.I.F., Buenos Aires (Argentina)

D-17 *The Argentine experience in the manufacture of tractors*
by Mario Mendivil and Osvaldo Casati, Consultants (Argentina)

D-23 *A short note on General Motors do Brasil*
by General Motors do Brasil

D-24 *Successful industrialization and big markets*
by A. Grey, Foreign Development Consultant, São Paulo (Brazil)

D-25 *Description of a Brazilian factory making automobile parts*
by the Companhia Fabricadora de Peças, São Paulo (Brazil)

Document symbol
ST/ECLA/CONF.4/L.

D-26 *Participation by Willys Overland do Brasil in the Plano Nacional Automobilístico*
by Willys do Brasil, São Paulo (Brazil)

D-27 *Report on the D.K.W. station-wagon factory*
by VEMAG S.A., São Paulo (Brazil)

D-28 *A study of the Brazilian market for tractors*
by Nelson Nobrega, Consultant (Brazil)

D-29 *Problems relating to the gradual substitution of domestic for imported parts*
by Paulo Ivanyi, VEMAG S.A., São Paulo (Brazil)

D IV. INTEGRATION OF INDUSTRIAL RESOURCES AND DEVELOPMENT PROBLEMS OF OTHER MECHANICAL INDUSTRIES

D-1 *Notes on the establishment, operation and results of a common market*
by the High Authority of the European Coal and Steel Community (Luxembourg)

D-14 *Some features of the steel transforming industries of certain countries of Asia and the Far East*
by the Economic Commission for Asia and the Far East

D-15 *Decentralization of some Japanese steel transforming industries*
by the Japan Iron and Steel Federation and the Japan Machinery Federation, Tokio (Japan)

D-16 *The mechanical and metallurgical industries in Uruguay*
by the Asociación de Industriales Metalúrgicos del Uruguay

D-18 *Possibilities for Mexico's industrial development based on*
verbal statement by Gonzalo Robles, Banco de México (México)

D-19 *Integration of Brazilian resources for the manufacture of heavy industrial equipment*
by the Associação Brasileira para o Desenvolvimento das Industrias de Base (Brazil)

D-21 *Development prospects of the metallurgical industry in Chile*
study presented by Max Nolff, Consultant (Chile) to the secretariat of

Document symbol ST/ECLA/CONF.4/L.	
	the Economic Commission for Latin America
D-30	*The application of steel economy concepts to Latin America* by Jack Robert Miller, Executive Vice-President, Ramseyer & Miller Inc., New York (United States of America)

Document symbol ST/ECLA/CONF.4/L.	
D-7	*Economic and technical aspects of the manufacture of textile machinery in Argentina* by Talleres Coghlan, S.A., Munro (Argentina)
D-13	*Some growth problems of an Argentine electro-mechanical industry* by Siam di Tella, S.A., Buenos Aires (Argentina)

ANNEX IV

The development of motor vehicle manufacture in Latin America

Recent years have seen the commencement of a road vehicle industry in several Latin American countries.[1] In Argentina, Brazil, Chile, Colombia and Mexico, the first steps took the form of manufacture of the more rapidly-wearing spares for road vehicles. This spares industry, which is well developed, and which has accumulated a considerable amount of technical experience, especially in Argentina, Brazil and Mexico, constitutes an excellent starting point for further road vehicle manufacturing activities, such as the making of more technically complicated parts for supply to assembly lines.

The meeting considered that in the Latin American countries, vehicle assembly, with the gradual inclusion of a growing percentage of domestically manufactured components, was a logical sequence to the growth and consolidation of the spares industries, and of the pressure of difficulties for importing complete vehicles, due to foreign exchange regulations. By this process, regular imports of unassembled vehicles (CKD packs) are now made in the countries mentioned, especially of lorries, jeeps and other utility vehicles, but without the import of such parts as could be supplied by the domestic industry, such as tyres, sheet metal work, accumulators, springs, bumpers and other iron and steel items.

Because of the constant foreign exchange difficulties restricting imports, this process could lead gradually to complete domestic manufacture, by systematic elimination of imported components. The duration of the process would depend on the size of the market, and also on the pressure exerted by the foreign exchange problem. The experience of some Latin American countries is showing meanwhile that a strong trend may emerge either to retard unduly the process of domestic manufacture or to consolidate and perpetuate intermediate stages with a high percentage of imported components, taking advantage of the favourable exchange rates which have been granted to encourage the establishment of assembly plants.

In the light of these observations placed before the meeting, the experience of both Argentina[2] and Brazil, and their attempts to establish a road vehicle industry with almost complete domestic manufacture in an extremely short period, acquires considerable interest.

The amount of foreign exchange expended in road vehicles and equipment provided the first indication that this was a sector in which manufacturing activities would be well justified. Naturally, a more definite conclusion of this type can only follow an analysis of the size of the market and of probable costs, as well as of certain other conditions; in the meantime, the various motor vehicle manufacturing initiatives in Latin America developed as a result of the foreign exchange policy.

Brazil is an outstanding example.[3] The principal imports into this country during two recent periods expressed in thousands of dollars, were as follows:

	Annual average value	
Product group	*1945-1952*	*1954-1955*
Wheat and wheat flour.....	106,775	122,312
Petroleum products	114,606	153,370
Road vehicle products[a].....	142,388	126,601
Total imports	1,130,552	1,209,405

[a] Excluding tractors and road building machinery.

Imports of road vehicle products were greater than those of either wheat or petroleum products, and in the period 1945/52 the annual average was nearly 13 per cent of total imports. Whilst it is true that up to 1952 the exchange rate was over-valued, this fact does not inflate the imports of road vehicle products, since the rate was the same for all the items, and since in any case the higher rate was offset to some extent by the quantitative restrictions.

As from 1952, there was an enormous increase in road vehicle prices as a result of the introduction of an exchange differential, with a consequent reduction in imports.[4] In the period 1954/1955, the road vehicle figure is still higher than that for wheat,[5] and still represents more than 10 per cent of total imports.

These figures made clear to the meeting the very great economic interest which the large-scale development of this industry would have for Brazil, from the point of view of foreign exchange savings. This reason alone, however, is not sufficient, either in the quoted case of Brazil, or in those of other Latin American countries, to justify the creation of a vehicle industry; the size of the market is another basic factor which the meeting took into consideration.

The pressure arising from the foreign exchange problem is corroborated by the size of today's market in many Latin American countries. The limitations imposed by the size of the market reflect in different ways for different types of vehicles. In the case of jeeps,

[1] The discussion in the plenary session of the meeting was, in principle, focused on general problems of road vehicle manufacture in countries with under-developed economies. However, since the greater part of the available data referred to Brazil (and to a lesser degree to Argentina), and since the majority of the experts present had experience of the problems as applicable to Brazil, it was inevitable that many points were discussed with specific reference to that country, without any possibility of arriving at any general conclusions.

[2] See ST/ECLA/CONF.4/L. D-4 and D-17.

[3] See ST/ECLA/CONF.4/L. D-4.

[4] Until 1952, imports were made at a standard rate of slightly less than 20 cruzeiros per dollar. The new rate then introduced rose to 200 for trucks, jeeps and parts not made in the country, and 350 for passenger cars.

[5] Both wheat and petroleum products continued to be imported at a much lower rate than that applied to road vehicle products.

tractors and lorries in Brazil, and of jeeps, tractors and light pick-ups in Argentina, the size of the market already seems sufficient to warrant manufacture of almost the complete vehicle under cost conditions which would permit internationally competitive prices within a fairly short period.

The meeting reached the conclusion that a market survey must take into account, in its widest application, the price-elasticity of demand for the various types of vehicles. Since the different factors affecting this elasticity are juxtaposed it is difficult to arrive at even an approximate idea of the degree of sensitivity of Latin American markets to vehicle price variations. The frequent modifications of the exchange rates in Latin American countries make this a critical problem in the examination of the possibilities of domestic manufacture.[6] For these reasons, the estimates presented to the meeting, as given below,[7] must be considered merely as simple indications of a probable market size.

The number of vehicles in service in the four countries where manufacturing activities are being attempted is as follows:

Type of vehicle	*Argentina 1955*	*Brazil 1954-55*	*Colombia 1954*	*Mexico 1955*
Lorries[a]	163,408	352,217	60,000	213,584
Passenger cars[b]....	314,185	350,000	68,000	273,697
TOTAL	477,593	702,217	128,000	487,281

[a] Including buses.
[b] Including jeeps.

Accepting ten years as a first approximation of the useful life of a vehicle, the annual requirements for replacement only for the different countries is seen to be between 47,000 and 70,000 units; this does not allow for an annual increase of the number in service arising from population increases or the normal development of the economy.

[6] The difficulties are increased by the lack of a uniform evaluation criterion in the estimates presented to the meeting, which relate mainly to Argentina and Brazil. The estimates of the market capacities in Argentina and Brazil for the different types of vehicle are difficult to reconcile. This discrepancy drew the attention of the meeting to the necessity for uniform evaluation criteria in the elaboration of the market problem.

[7] See ST/ECLA/CONF.4/L. D-4, D-5, D-17 and D-28.

The estimates presented to the meeting, and other evidence brought out by the discussion during the session on motor vehicle manufacture are given below and indicate present and immediate future annual requirements:

Type of vehicle	*Argentina 1956*	*Brazil 1962*	*Colombia 1956*	*Mexico 1960*
Lorries and pick-ups	50,000	113,000	21,000	27,000
Jeeps	12,000	15,000	—	—
Tractors	17,000	20,000	—	7,000
Passenger cars	20,000	20,000	23,000	28,000
TOTAL	99,00	168,000	44,000	62,000

The Brazilian estimates presented to the meeting, especially for lorries, are prepared in great detail, and therefore merit a more lengthy discussion.[8]

It has been observed in Brazil that the age-composition of vehicles in service cushions the impact of variable import prices on the number in service. When the exchange rate causes import prices to rise, or when strict quantitative restrictions on imports are enforced, the replacement period is lengthened, the time in service becomes greater, and the average age of vehicles in service rises, without any change in rate of development of the quantum of the lorries total in service. On the other hand, when import conditions are favourable, there is an increase of imports and the age-composition returns to normal. This without doubt is a stabilizing factor in the Brazilian lorry market which could favourably influence the development of manufacturing activities. It is also an argument in favour of adopting an average rate of increase for the number in service, to calculate possible future increases, without too much independence on price levels (either for imports or domestic production) at which lorries may be offered in Brazil.

The development of the Brazilian lorry market according to different hypotheses of growth of the number in service is as follows:

[8] The estimates of the Brazilian lorry market are based on a careful analysis of the age-composition of the vehicle in service, and replacement habits. Those of the annual increase are based on previous increases of the number in service over a relatively long period. See ST/ECLA/CONF.4/L. D-4, especially the Annex.

	Number in service			*Potential market requirements for*			
					Replacement and increase		
Years	*6.2%*	*10.0%*	*14.5%*	*Replacement 6.2%*	*6.2%*	*10.0%*	*14.5%*
1956	397,000	425,000	454,000	24,000	47,000	50,000	71,000
1958	448,000	515,000	591,000	35,000	61,000	72,000	89,000
1960	505,000	625,000	591,000	11,000	40,000	66,000	98,000
1962	570,000	757,000	1,020,000	35,000	68,000	94,000	157,000
1964	643,000	920,000	1,337,000	35,000	73,000	110,000	196,000
Total (9 years).....				140,000	535,000	702,000	1,144,000
Annual average				15,000	59,000	78,000	127,000

The most conservative estimate was calculated on the basis of a cumulative annual increase of 6.2 per cent observed during the period 1930-38. The post-war rate (1945-54) was 14.5 per cent, but this may have been inflated by the very favourable exchange rate in force at that time.[9] An intermediate hypothesis offers an annual rate of 10 per cent.

[9] This increase in the number of new vehicles has a greater effect on the average age of the lorries than on the total number in service.

Based on an annual increase of 6.2 per cent, the Brazilian lorry market could absorb 395 thousand new units during the next nine years—or an annual average of 44 thousand units—to increase the number in service, quite apart from those required for the replacement of old vehicles. Assuming a somewhat slower replacement rate for Brazil than the one in the United States, some 140 thousand units would be needed during the same period, or 15 thousand per year. Thus the totals for 1956-64, according to the most modest estimate of the rate of increase, would be 535 thousand vehicles at an annual average of 59 thousand units. In 1962 the market would absorb 68 thousand units, a figure which would increase in subsequent years.

The remaining market estimates are based on less conservative hypotheses, but it is possible that they may not be exaggerated. If an estimate is made on the basis of the post-war figure of 14.5 per cent annual increase (and this rate is being maintained with only slight variations) the maximum annual average becomes 127,000 units, with a market for 196,000 lorries in 1964. The intermediate hypothesis gives an average of 78,000 vehicles per year, with 110,000 for 1964.

It therefore appears certain that the Brazilian lorry market will lie between these two extremes, that is, between 59,000 and 127,000 units, for the next nine years, reaching an even higher level at the end of the period.

The high Brazilian vehicle market figures given above result from a sharp expansion during the post-war period, determined not only by permanent factors of the natural economy, but also by any transitory circumstances, which nevertheless have a marked influence. Amongst the permanent factors the more important are (*a*) the uneven rates of expansion of domestic production and traditional communications by rail and sea; (*b*) the extension of the road network and of paving and (*c*) the reversal of the direction of goods traffic resulting from the development of the internal market and the linking together of the consumer areas. Other factors, such as the preferential exchange rate for the import of liquid fuels, although only temporary, have effects which are difficult to erase, and also lead to the intensification of road transport.

These are probably the causes which lead the Brazilian market to be stronger for commercial vehicles than for passenger cars. The comparison below between the vehicle market of the four Latin American countries and that of some European countries and Australia shows that in the first named there is already a considerable market for commercial vehicles, but that the demand for passenger cars is less; the figures in the table are for production or potential market.

Type of vehicle	*Argentina Brazil Colombia Mexico*	*Brazil 1962*	*France 1952*	*Federal Republic of Germany 1952*	*United Kingdom 1952*	*Italy 1952*	*Australia 1952*
Passenger[a]	118,000	35,000	361,000	295,000	432,000	111,000	23,000
Commercial	211,000	113,000	132,000	125,000	237,000	24,000	8,000
TOTAL	329,000	148,000	493,000	420,000	669,000	135,000	31,000

[a] Including jeeps.

The potential Brazilian market not only compares favourably with Australia, where there has been a vehicle industry for some years, but also comes quite close to the Italian market. This picture becomes more favourable when it is remembered that the Brazilian market for commercial vehicles, as from 1962, will probably not be greatly inferior to the 1952 markets in France and the Federal Republic of Germany.

The meeting later considered the composition of commercial vehicle requirements by sizes, and the figures below show that in Brazil and Mexico medium and heavy lorries predominate, whilst the reverse is true in Argentina. British and French production show a similar preponderance of light vehicles.

Vehicle classification	*Argentina*		*Brazil*		*Mexico*[a]		*United Kingdom*		*France*	
	Capacity (kg)	*No. of vehicles*	*Capacity (kg)*	*No. of vehicles*	*Capacity (kg)*	*No. of vehicles*	*Capacity (kg)*	*No. of vehicles*	*Capacity (kg)*	*No. of vehicles*
Light	-2,500	45,000	-2,000	22,600	-2,268	5,865	-750	119,836	200-2,000	83,496
Medium	2,500-4,500	5,000	2,000-6,000	67,000	2,266-6,330	5,370	750-6,100	115,143	2,000-5,000	28,336
Heavy	—	—	6,000	22,600	6,350	8,408	6,100	11,948	5,000	9,735
TOTAL		50,000		113,000		19,643		246,927		121,567

[a] Includes only vehicles imported from the United States (nearly 95 per cent of the total).

Potential Brazilian demand for medium and heavy lorries is about 76 per cent of the equivalent British production, and more than double that of France.

These figures would appear to justify the Brazilian policy of concentrating first efforts in the vehicle industry on commercial types, and in particular, medium and heavy lorries. The meeting also noted the complementary nature of the Brazilian and Argentine markets.

In the case of tractors, both Brazilian and Argentine markets are sufficient to permit domestic manufacture at relatively low costs.[10] Given an adequate market,

[10] See ST/ECLA/CONF.4/L. D-6, D-17 and D-28.

there is even some technical justification for the manufacture of these vehicles in Latin America, since it is less complex than other types, and does not make such a heavy demand on the auxiliary industry.

The size of the market also favours the manufacture of jeeps in Argentina and Brazil, but the same cannot be said in the case of these two countries for passenger cars. Special caution is required in the evaluation of manufacturing programmes for this latter type in the two countries—and more particularly in Colombia and Mexico—since this branch of the industry requires a much larger market and a better-equipped auxiliary industry if economic production is to be achieved. This would possibly be a field for combined action on the part of various Latin American countries, whereby an integrated market might produce more advantageous results.[11]

The meeting noted that the size of the market was not the only determining factor with regard to economic production volume; the number of competing manufacturers also affected the level of costs in any given market.

The horizontal structure of the vehicle manufacturing industry is more notable in those countries, such as Brazil, where there is an inclination towards United States practice. The manufacturers are assemblers, obtaining many components from sub-contractors, and confining their activities to assembly and to the manufacture of certain elements such as steel sheet work, machining of the motor, etc.

Manufacturers at present commencing their activities in Brazil estimate that, when their programmes are fully operative, they will receive 55 per cent of the weight and 45 per cent of the value per vehicle from sub-contractors.

A large number of these parts will therefore be made by sub-contractors who are supplying several assembly plants, and by use of common designs mass production will be possible, covering almost the whole of the potential market. The size of the production series of those parts made by the assemblers, a little more than half the weight of the vehicle, will depend upon the number of active assembly plants; hence the importance of the discussion as to whether to follow a restrictive or a liberal policy concerning the number of assembly plants to be authorized in the country. The restrictive solution would result in greater production runs for parts made by the assemblers, and to a certain extent by the sub-contractors also, although this latter depends upon the diversity of designs. It would, however, restrict competition almost to the state of monopoly within each type of vehicle, with the consequent disadvantages in the market structure. If the liberal solution were adopted, it would ensure competitive manufacture, but would also inevitably reduce production runs of the individual manufacturers, with a resulting increase in costs.

This is a very difficult problem, and the discussions of the meeting seem to indicate that it would have to be solved individually, in accordance with prevailing conditions in each country.

The possibilities of reconciling the two solutions has aroused the interest of potential Latin American vehicle manufacturers in the possibility of increasing the degree of component inter-changeability in the different designs. Two examples of this were mentioned to the meeting; the manufacture in Brazil of a DKW station wagon and a DKW jeep with the same motor and various other common components, and of four different types of Kaiser vehicles in Argentina with a large number of common parts, including the motor.[12]

Production runs could also be increased by standardizing the components supplied by sub-contractors for different manufacturers; this would be facilitated by the adoption of certain well-known standards (for instance SAE). In Brazil, makers of pistons and piston rings adopted these standards and achieved a considerable reduction in the number of types. The meeting also considered the advantages of foreign firms allowing their associates in Latin America greater liberty in local standardization, thus giving their engineers greater choice in the use of sub-contractors' parts.

A further problem which occupied the attention of the meeting was the difficulty of maintaining a standard model in Latin America because of dependence upon the import of certain components[13] when the foreign associates had an annual model change. This problem has four different aspects; (*a*) the foreign model may be modified substantially during the period of changeover to domestic manufacture—estimated at 4 to 5 years in the case of Brazil—resulting in completely new models, whilst the Brazilian design must remain frozen; (*b*) the fact that components are subject to inevitable, and almost continuous minor modifications; (*c*) it is often necessary to import parts belonging to sub-assemblies, which makes continuity of design essential; (*d*) local manufacture often necessitates minor alterations to foreign specifications, standards, tolerances and so forth. If difficulties of this type are not solved in advance it may prove impossible to assemble the components, or excessive stocks may have to be carried, this latter with the possibility that subsequent design changes may render them obsolete.

The meeting noted that production costs in Brazil gave no cause for concern; this was not the case in some other Latin American countries which are equally interested in developing the automotive industry, notably Argentina. The Brazilian point of view seems to be that since production conditions are technically satisfactory, because the size of the market will assure lengthy production runs, costs ought to be more or less in line with international prices.

During the meeting, it was only possible to examine thoroughly one vehicle from the cost viewpoint, this being a petrol-engined medium lorry made in Brazil. The results are given below. The comparison with c.i.f. import prices for similar items shows that domestic production is at a dollar-equivalent price equal to or lower than the free market dollar exchange rate (and also lower than the export rate for manufactured goods) in the cases of steel sheet (35 to 40 per cent of the vehicle) pig iron, semi-finished casings and forgings, as well as for such parts and components as are already made in large series. The parts made in short runs, and non-current steel items, are more expensive than the imported equivalent.

[11] See ST/ECLA/CONF.4/L. D-24 and D-26.

[12] See ST/ECLA/CONF.4/L. D-11 and D-27.

[13] See ST/ECLA/CONF.4/L. D-29.

Product	Domestic manufacture cruzeiros per dollar
Raw materials	
Hot and cold rolled sheet	74.00
Plate	63.00
Current steel bars, 2" to 4"	73.00
Non-current steel rolled bars	120.00-180.00
Pig iron	57.50-62.50
Semi-finished products	
Grey iron castings (medium size pieces)	55.00
Malleable iron castings	75.00
Cast steel	54.50
Drop-forgings[a]	
Non-current steels	1/2
Current steels	1/2.5
Current or non-current steels, small pieces	1/5
Components	
Long runs (domestic raw material)	48.00- 50.00
Long runs (material imported at 120 cruzeiros/dollar)[b]	50.00- 70.00
Short runs	70.00-100.00

[a] This is the rate of material cost to finished part. Comparative ratios: Germany, 1/2.5; Britain, 1/3.

[b] Example: pistons for four types of vehicle, 51.00; 56.00; 66.00; 67.00.

It therefore appears that the cost of a petrol-engined, domestic medium lorry, should be at a reasonable level, only slightly above the c.i.f. price of the imported equivalent, converting the cruzeiros at the free rate of exchange (at present 70.00 cruzeiros per dollar). These figures, of course, are applicable after an initial settling-down period of 4 to 5 years.

The figures below show that cost estimates for other types of vehicles being made, or to be made in Brazil, are not so favourable as those for the petrol-engined lorry which will be produced in larger quantities. The figures refer to the period when the greater part of the vehicles will be manufactured in the country; comparing them with the previous table of costs of raw materials and domestic components, it is seen that the high costs are more probably due to technical manufacturing factors and to shorter production runs than to the costs of domestic sub-contracted parts or domestic raw materials.

Vehicle category	Domestic production cruzeiros/dollar	Imported cruzeiros/dollar
Diesel lorry, 100 H.P.	105.00	165.00
Petrol-engined lorry H.P.	80.00 to 100.00	165.00
Jeep, 42 H.P.	133.00	165.00
Panel-body pick-up lorry, 42 H.P.	150.00	211.00

The considerable difference apparent when comparing domestic costs and import prices of the lorry and those of the panel-body vehicle (van)—which is already approximately more to the passenger car—serves to emphasize the fears regarding the level of economy which could be achieved under present Latin American conditions, in the production of passenger cars.

The relative satisfaction with regard to costs seems to be based on the high import prices, also shown above. Comparison of the corresponding dollar exchange rate for each type of vehicle manufactured in the country, or imported complete, shows that domestic manufacture will bring about a reduction in prices to the user in all types. A comparison of this kind is dangerous, however, since import prices are increased by the exchange rates which were introduced in lieu of quantitative import restrictions. A better and more important comparison would be between the domestic production price and that of imports converted at a rate which represents approximate parity with price levels in the country and abroad. The comparison otherwise tends to underestimate heavily the true amount of the resources which must be diverted from other applications in order to instal the vehicle industry in the country, thereby involving a risk of inefficient distribution of possible productive resources.

The meeting thought it necessary to discuss the policy of conversion to domestic manufacture, and it appears that the installation of such a new, large and complex industry, so closely bound up with other sectors of the economy, could not prosper unless carefully considered measures were taken to assist in its creation. The measures could take several forms, and in fact, the various Latin American countries where the industry was in process of installation, had attempted different solutions. For this reason, the meeting thought that a brief comparison should be made of the experiences of these countries, chiefly Argentina, Brazil, Colombia and Mexico.[14]

The Brazilian industrial policy regarding the manufacture of vehicles, in certain of its aspects, is somewhat advanced for Latin America, and indeed for any of the under-developed countries, and for this reason the meeting examined it at some length. In June 1956, Brazil created a government body—*Grupo Executivo da Industria Automobilistica* (GEIA) (Executive Group of the Road Vehicle Industry)—under the *Conselho do Desenvolvimento* (Development Council), which has full executive authority in the regulation, guidance, financial and legal supervision of all road vehicle manufacturing activities in the country.

The complete sector is reserved for private enterprise, the government taking part only through GEIA in guidance and co-ordination, in order to make the several initiatives compatible one with the other, to ensure sound technical and economic foundations and to reconcile the foreign exchange requirements of the various enterprises, within the country's possibilities. The only government action is the granting of preferential exchange rates for the import of equipment and components. The table below shows the exchange incentives offered by GEIA for the manufacture of different types of vehicles.

[14] See ST/ECLA/CONF.4/L. D-4, D-5, D-17, D-26.

Application of the exchange rate	*Lorries and Jeeps*	*Pick-ups and station wagons*
Imports of equipment for manufacturers and sub-contractors	(i) Preferably as a foreign investment (import without foreign exchange coverage) (ii) As an import with coverage at the rate of the cost of the exchange, when it is financed for a period of at least five years, and in proportion to the Brazilian capital invested in the company	Same as for lorries and jeeps
Imports of parts and complementary components	(i) Exchange rate with the average overprice of the last three quotations of the second category, if the motor is not manufactured (ii) Exchange rate with the average overprice of the last three quotations of the first category, once the motor is made	Exchange rate with average overprice of the last three quotations of the third category

NOTE: The corresponding regulations for the manufacture of passenger cars and tractors had not been fixed at the time of the meeting. The term "motor" in the above table includes the block (complete with all internal components), from the fan to the flywheel, including supports and the following accessories: carburettor, petrol pump (or injection pump with injectors), water pump, normal motor electrics (less battery), air and oil filters. It is considered to be of domestic manufacture if a minimum of 60 per cent of the weight is made in the country.

The preferential exchange rates are subject to the prior approval of the technical and economic projects of each individual enterprise, and to compliance of these projects with the government's progressive substitution plan for the replacement (at a very rapid rate) of imported components by domestic ones, designed to achieve 90 per cent domestic manufacture within five years. The obligatory proportion of domestic components (percentage of weight) varies between vehicles, as shown below.

	Obligatory goals for		
Date	*Lorries*	*Jeeps*	*Pick-ups and station wagons*
31.12.56.....	35	50	40
1. 7.57.....	40	60	50
1. 7.58.....	60	75	65
1. 7.59.....	75	85	75
1. 7.60.....	90	95	95

The domestic content may comprise any parts of the vehicle, to suit the manufacturers' convenience. Variations from the fixed percentages, up to a total of 3 per cent of the total weight of the vehicle, and for a period of 90 days, will be permitted. All projects must include domestic manufacture of the motor, either directly by the manufacturer or by sub-contractors, within a maximum of two and a half years as from 1 July 1959, in accordance with the same 60 per cent limit fixed for the exchange rates.

Sub-contracting, or a horizontal structure, is widely adopted. The general division between foreign and Brazilian enterprises is that the former specialize in assembly, and the latter in parts-manufacture. This division seems to be based on two factors, the first of which is the greater experience of the big foreign concerns in mass production assembly, and the greater capital intensity (and greater capacity for imports of equipment without foreign exchange coverage) required in these activities; the second factor is that a domestic parts industry already exists, which provides a satisfactory starting point for this sector, and at the same time requires relatively less capital.

The fundamental aspect of the Brazilian policy is the establishment of a definite number of stages for the progressive increase of domestic content of the vehicles. This seems to be determined by the desire to induce the assembly industries to include domestic components at a rate sufficiently rapid to allow a low coefficient of dependence on foreign exchange within the short period of five years, and at the same time to provide a basis for annual calculations of foreign exchange requirements for the manufacturing programme.

Since the Brazilian market is limited when compared to those of the larger European producers—not to mention the United States—and since the manufacture of many of the parts will call for new metallurgical and mechanical processes, it may be accepted as a very general rule that for several years at least, domestic manufacturing costs will be higher that those of the imported article, at an exchange rate close to true parity. This disproportion of domestic costs will certainly be greater in the case of the more complicated parts, where the length of the production run has the greatest effect on costs. For this reason, the meeting was of the opinion that one question of great interest is that of the relative advantages of the different solutions regarding the quantity of domestic content from the viewpoint of foreign exchange savings. The greater the extent of substitution, the greater the economy in foreign exchange, but at the same time, the higher will be the domestic costs, in national currency. For these reasons, the haste to achieve a high proportion of domestic content in a very short time must be accepted with some reserve. It is true of course, that these high costs will be reduced as the market grows, and production runs are longer. It is also true that the limitations of foreign exchange may become such as to constitute almost a determining factor. If foreign exchange availability, according to forecasts for the next five years,

is extremely limited, and if, therefore, when applied to a vehicle manufacturing programme with a high percentage of imported components would cover only a small part of the commercial vehicle market, the argument based on high initial costs in national currency (that is, national resources applied per vehicle) loses much of its force. The exchange savings factor in this case is decisive, and this seems to be the conclusion reached by the Brazilian authorities when defining their vehicle manufacturing policy. In any case, thorough analysis of this problem is probably justified in other Latin American countries, showing specifically the percentage rise in final costs of the vehicle resulting from each of the alternative solutions, with an increasing domestic content. This analysis will at least allow the government policy more flexibility in its application to vehicles with differing manufacturing characteristics.

The government programme at present in process in Brazil is expected to achieve an annual production of 130,000 vehicles within five years, importing only 5 to 10 per cent of the weight, together with replacement spares for 1,100,000 vehicles. The road vehicle industry will by then be billing some 400 million dollars annually, with a capital investment of approximately 200 million dollars, of which 25 per cent is already invested in the existing parts industry in the country.

The new Brazilian policy does not contain any restrictive measures regarding the number of enterprises which may operate in the industry. The only limiting factor is the availability of foreign exchange, which will definitely moderate the number and extent of approved projects, and prevent an excessive number of participants. A further factor will be the degree to which preferential exchange rates are granted, varying with the essentiality of the type of vehicle.

The situation in Brazil in December 1956, with regard to projects already in progress is as follows:

Type of vehicle and manufacturer	*Project approved; volume of 1960 production*		*Project not yet approved, or to be presented shortly*	*Other possible projects*
Lorries				
1. Mercedes-Benz (Diesel) ..	x	8,500		
2. FNM-Alfa Romeo	x	6,000		
3. General Motors	x	50,000		
4. International			x	
5. Ford				x
6. Krupp (Diesel)			x	
7. Chrysler			x	
8. Magyrus			x	
Jeeps				
9. Willys	x	15,000		
10. Vemag-D.K.W.	x	5,000		
11. Toyota				x
12. Land-Rover (M.B. Amaral)				x
Pickups—Station wagons				
13. Vemag-D.K.W.	x	5,000		
14. Volkswagen	x	16,000		
15. Austin (B.M.C.)			x	
Passenger cars				
16. Hudson (Am. Motors)....			x	
17. Alfa Romeo			x	
18. Mercedes Benz				x
19. Volkswagen				x
20. Simca				x
21. Vemag D.K.W.				
Tractors				
22. FNM-FIAT			x	
23. International			x	
24. Hanomag				x
25. Fordson				x
26. Ferguson (Vemag)				x
Production volume of approved projects		105,500		

If this programme is to be met, there are grave raw material supply problems, which were duly considered by the meeting. The motor vehicle industry is compelled by its very nature to work in a common effort, following the Brazilian example. This procedure will create a sudden heavy demand for raw materials and finished products, especially iron and steel. It is doubtful if the steel industry and the parts manufacturers will instal additional production equipment (which requires considerable capital investments) without an assured market, which means not until motor vehicle manufacture has reached an appreciable scale. Some mechanism or system of programming is necessary to solve the question of this supply lag.

Argentina has as yet no defined policy for the structure of the vehicle industry; each project presented is considered on its own merits. Other differences from the Brazilian system are the absence of unified government action, a less intensive sub-contracting system, and the dependence of the sub-contractors on the assembly plants to obtain foreign exchange permits for imports of equipment or raw materials.

The present position in Argentina is shown below:

Manufacturers	*Type of vehicle*	*Annual production when programme complete*
Manufacture in process		
1. Fiat-Someco-Concord	Diesel tractors, 25, 40 and 55 HP	5,100
2. Kaiser Argentina	Jeep	20,000
3. IAME (Rastrojero)	Small pick-up with Borgward diesel motor	3,000
4. IAME (Institec)	Small DKW station wagon	250
Programmes in process or projected		
5. Fiat-Someco-Concord	Diesel lorry, 2.5 tons	2,500
6. Kaiser Argentina	Pick-up, ¾ tons	5,000
7. Kaiser Argentina	Lorry, 2 tons	5,000
8. Kaiser Argentina	Passenger car	10,000
9. Mercedes Benz	Diesel lorry, 4.5 tons	7,200
10. Siam di Tella.....	Volkswagen type passenger car	20,000

In Mexico there is no completely defined policy; it appears that the government prefers direct methods (prohibition of imports of parts made in the country) to compel their inclusion in assembly lines.

In Colombia the system of tax exemption is used, and also preferential exchange rates for equipment, by which means it is hoped that the assemblers will gradually be transformed into manufacturers. Nevertheless, it is seen from Brazilian experience that simple assembly plants in a country are always an obstacle in the path of true domestic manufacture.

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[58E1]

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