OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

05967

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Distr.
RESTRICTED

UNIDO/IPPD.158
4 September 1974

ENGLISH

PROGRAMMING THE DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY IN MEXICO 1/

REPORT OF PHASE IB OF
THE UNDP/UNIDO ASSISTANCE TO
NACIONAL FINANCIERA S.A.

by

a team of UNIDO Experts

1/ The views and opinions expressed in this paper are those of the authors and do not necessarily reflect the views of the secretariat of UNIDO.

id.74-6055

TABLE OF CONTENTS

SCHEDULES

LIST OF TABLES

INTRODUCTION

Background

1. Following the report of an exploratory mission from UNIDO to Mexico in September 1970, it was decided on the request of the Government of Mexico that the UNDP/UNIDO should assist Nacional Financiera, S.A., Mexico's Industrial Development Bank, in programming the development of capital goods manufacture in Mexico. The objectives of the project were to undertake a systematic analysis of the domestic requirements of capital goods, export possibilities and existing domestic manufacturing capacity in this sector, and in the light of such analysis, to identify capital goods which would have adequate manufacturing potential in Mexico. Thereafter, a co-ordinated programme and strategy would be evolved for the development of the capital goods industry in Mexico, and specific industrial investment projects would be formulated and evaluated.

2. The capital goods study was initially conceived in three principal stages. During Phase I, it was intended that a team of UNIDO experts would carry out projections of domestic demand for various capital goods items, excluding the transport sector, analyse and forecast domestic manufacturing capacity for such projects and based on these studies, to identify principal production gaps and formulate appropriate policy measures which would foster the development of this sector. In Phase II, specific industrial projects were to be formulated and feasibility studies undertaken in the identified capital goods branches. The preparation of the specific projects would include an evaluation of the projects and of the appropriate technology and terms and an examination of the financing arrangements. Emphasis would be placed on the promotion of investments and the formulation of specific policy measures and implications that such a capital goods development programme would entail. Phase II would also cover various aspects of assistance during the implementation stage of the selected capital goods manufacturing projects.

3. The first phase of the project (Phase IA) commenced in November 1971 and was completed in August 1972. Technical assistance from the UNIDO was provided in the form of five international experts in the fields of (i) industrial programming, (ii) economic and industrial policies, (iii) domestic market analysis, (iv) engineering and technical aspects of domestic manufacture and (v) export market analysis. This expert group, working with counterpart personnel of Nacional Financiera (NAFINSA), conducted the basic techno-economic investigations, particularly in respect of growth trends in various industrial sectors, projections of demand for capital goods items, and investigated existing capital goods manufacture and the general possibilities of setting up primarily export-oriented industries in this field. The final report for Phase IA covered: (a) trends and features of Mexican industrial growth, (b) objectives and instruments of industrial policy in Mexico, (c) overall projections of capital goods demand for the period 1976 - 1980, and (d) general aspects of capital goods production and export.

4. In May 1972, progress on the project was reviewed and it was considered essential to conduct more detailed investigations, particularly in respect of the domestic capital goods manufacturing sector, including plans for new investments and expansions. Consequently, an additional phase (PhaseIB) of the UNDP/UNIDO assistance was introduced.

5. The UNIDO expert group for this phase of the capital goods study project consisted of the following:

(a) R. K. D. N. Singh - Team leader and Industrial Policies Adviser

(b) Jaroslav Zdenek - Domestic Market Analyst (up to 7.12.1972)

(c) Gunnar Ymse - Industrial Engineer (Processing Equipment)

(d) Ernst Meiner - Industrial Engineer (Machine Tools)

(e) Subramania Swayambu - Electrical Engineer (Electrical Equipment)

Structure of the Report

6. The present report, while it constitutes the final report for Phase IB, has also sought to incorporate the more significant findings and conclusions of Phase IA. From this viewpoint, therefore, this report may be treated as broadly covering the entire first phase of the capital goods study.

7. The report is meant to present in a co-ordinated way the various findings and recommendations of the team members as well as most of the data and information on which the findings are based. As a result, the report became rather voluminous, and in order to ensure that it is surveyable, clear and handy, it was decided to break it down into the following volumes:

Volume I - Objectives, Methodology and Summarised Conclusions

Volume II - Features of Mexican Industrial Development

Volume III - Identification of Capital Goods Sector Growth Potentials

Volume IV - Policy Considerations

Volume I constitutes a summary of the other three volumes and can thus be considered as a self-contained document. On the other hand, this volume is rather condensed and in order to facilitate the reference to the complete version in the other volumes, the respective paragraphs are specifically mentioned in each case.

Acknowledgement

8. Counterpart assistance by way of local professional staff was provided by the Gerencia de Proyectos y Programación of Nacional Financiera. The UNIDO team group is grateful for the interest and support of Mr. Guillermo Martínez Domínguez, Director General of NAFINSA, and Mr. Agustín Foucue Díaz, Director, under whose able guidance the present phase was completed. The project received invaluable assistance and participation from Mr. Gerardo Bueno, Gerente of the Department until January 1973, who was very closely associated with the study from the beginning. Considerable assistance was also received from Mr. Eduardo Colín, present Gerente of the Department. Fullest assistance, co-operation and participation was received from the counterpart staff provided by Nacional Financiera, under the able guidance of Mr. Héctor Castro Ulloa, who was associated with the project from the start and who provided invaluable assistance and participation in all the techno-economic studies, besides various administrative matters. The counterpart team included Messrs. Filipe Tobín and López Arce and a number of other experts who worked in close collaboration with the team of experts.

VOLUME I

Objectives, Methodology and Summarised Conclusions

A. Objectives of Phase IB

9. Apart from supplementing the data and information compiled in Phase IA of the study, the principal objectives to be achieved in Phase IB were: (i) formulation of detailed projections of domestic demand and anticipated imports of principal capital goods groups and products, constituting a break-up of the macro figures of demand and imports prepared during Phase IA, (ii) further techno-economic studies, particularly in respect of certain capital goods sub-sectors, such as electrical equipment manufacture, which were not covered in the previous phase, (iii) detailed assessment of domestic manufacturing capacity in Mexico for various capital goods items and groups, including expansion proposals under implementation or consideration, (iv) identification of major production and technological gaps in respect of capital goods items in the light of (i) to (iii), and grouping of such products, wherever necessary, into possible industrial projects, and (v) formulation of specific policy and other measures for promoting capital goods development and domestic manufacture of the identified capital goods groups and items. In addition, it was also considered necessary for investment promotion purposes to prepare brief investment profile sheets for each of the principal groups or items identified as having adequate manufacturing potential in Mexico.

B. Methodology

10. Since the present phase of the study was essentially a continuation of the earlier phase, the methodology adopted followed a similar basic pattern, though more detailed techno-economic investigations were undertaken. The same definition of capital goods was adopted as in Phase IA, i.e., comprising mechanical (non-electrical) and electrical equipment and major parts and components thereof, utilised as machinery and production equipment in the principal production branches. Capital goods used in the transport sector and machinery and equipment not directly

used in industrial production (e.g., business machines, etc.) and auxiliary equipment (such as tubing, wiring, fittings, etc.) have not been covered. It was considered that the above definition would be quite adequate for identifying the principal capital goods items which needed to be taken up for domestic manufacture.

The projections of demand and imports were made for the period 1976 - 1980. The start in 1976 was chosen since a period of at least two to three years would in any case be required for any new production in this sector to become effective. Specific demand and import projections beyond 1980 would on the other hand not be realistic.

In projecting capital goods demand and imports as also anticipated domestic production values have been expressed in terms of fixed prices based on 1968 prices for purposes of more effective comparison. If values at current prices are required, an approximate figure of 9.9 per cent increase in the annual price index for machinery and equipment may be assumed, which would necessitate multiplication of the projected figures by a co-efficient of 1.3 to obtain values at current prices in 1978. This value in 1978 is estimated to present the average price level for the period 1976 - 1980. A minimum GDP growth rate of 6.5 per cent has also been assumed for the period 1978 - 1980 on the basis of the high rate of internal savings of over 17 per cent during 1967 - 1970 and an even higher investment rate during this period.

11. The development of a matrix covering the capital goods requirements of the economy and breaking down these projections in terms of specific capital goods items proved an extremely complex task. General theoretical models relating to growth of demand and import projections had only limited application as the aim of the study was to identify specific capital goods products which would have adequate potential for manufacture in Mexico. Much greater emphasis was therefore given to factual yield studies and investigations while general growth co-efficients were used only to a limited extent.

In Phase II, an assessment had been made of the requirements of capital goods for the domestic economy for the period 1976 - 1980, based on the capital goods requirements of 6 principal production sectors in the light of projected growth trends in each sector and in the economy as a whole. At the same time, the capital goods requirements were also assessed on the basis of import statistics for the period 1965 - 1969*, which were available in detail and which were projected in total for the period 1976 - 1980. The break-up of the total import figures in terms of projected demand for specific capital goods items and groups was undertaken during the present phase, largely by way of projecting import requirements for these items during 1976 - 1980. Specific growth co-efficients were applied in each case, taking into account likely growth trends in the principal production sector or sectors using such capital goods products. However, a basic assumption has been that the growth of domestic capital goods production would, by and large, follow present trends and that import substitution would proceed on a similar pattern as at present. This assumption has, by and large, been borne out in the course of field investigations and visits undertaken to various capital goods enterprises in the country during the present phase. While various proposals for expansion and for setting up of new capital goods enterprises are under consideration, these do not appear to reflect any substantially different trend from the past decade, though some modifications in the import estimates for specific capital goods items had to be made as a result of the field studies. The import projections which have been made for 26 groups of capital goods (classified as 1 to 7 categories in Schedule I at the end of this chapter), on the basis of growth co-efficients specifically assessed for each item, enables a reasonably adequate identification of the capital goods branches where substantial imports are likely to take place during 1976 - 1980.

---

* SITC classification up to four digits, and in some cases up to five digits were used in respect of 47 capital goods items.

12. For the assessment of domestic manufacturing capacity, including proposed and possible expansion programmes of capital goods enterprises in the country, field investigations and plant visits were made to various domestic enterprises manufacturing capital goods items by the team, accompanied by counterpart personnel. Meetings were also held with representatives of the Secretaría de Industria y Comercio (SIC) and representatives of various governmental agencies and bodies, besides cámaras and commercial associations and groups to obtain necessary data and information regarding proposed new projects. In the light of these discussions the team made an assessment of growth and expansion prospects under consideration in the various capital goods groups categorised in Schedule I. This, in turn, enabled the identification of the principal production and technological gaps which were likely to emerge in the Mexican capital goods sector during the period up to 1990.

13. It needs to be emphasised that despite the extensive field studies and investigations made during this phase, the degree of detailed information and data that could be obtained varied considerably for the capital goods branches. While fairly adequate material regarding demand projections for equipment and of existing and proposed manufacturing capacity could be obtained for certain branches such as electrical equipment and machine tools, such data was not available for certain other sub-sectors. Still, the team obviously had to base its conclusions on such material and data that was possible to be obtained. Despite these undertakings, it is however considered that the projections serve to pinpoint the likely gaps in domestic production and that it is possible to assess the likely scope of manufacture of various machinery products.

14. An attempt was also made to group the identified gaps in capital goods production into possible investment projects in the form either of new enterprises or expansion programmes of existing plants in Mexico. Such grouping must however be considered as being of a preliminary nature and will need to be cross-checked through detailed

pre-investment studies during Phase II of this project before investment decisions can be taken. Such pre-investment studies could be undertaken directly by prospective entrepreneurial groups, both domestic and foreign, but in at least some of the instances, it would be necessary to have such studies independently prepared through the agency of the UNIDO and of National Financiers before adequate investment interest may be able to be generated. The specific fields in which such feasibility studies are likely to be required have also been indicated in the analysis of the various sub-sectors in Volume III, Chapter B.

15. It is necessary to stress that the identification of production and technological gaps has been largely based on internal market projections during this stage of the study, to arrive at projections of likely exports of specific machinery items. The team is of the view that, while considerable export possibilities undoubtedly exist for capital goods to be manufactured in Mexico, the essential base of domestic capital goods production must be the rapid increase of domestic demand. The identification of growth potentials in the machine building industry has, therefore, initially been based on domestic demand projections. Export possibilities have been dealt with only in general terms, though this aspect is considered vital for achieving scale economies in production of specific machinery products. To the extent that particular manufacturing programmes are able to acquire suitable technology and ensure efficient production at adequate scales for purposes of international competition, it would certainly be appropriate and necessary to project specific export co-efficients for each scheme. This can, however, only be done in the course of the preparation of pre-investment studies, where full account would be taken of the essential features and aspects of each manufacturing proposition including possibilities of export.

16. An important feature of the report is the set of recommendations regarding policy and other measures which would need to be undertaken for the effective growth of the Mexican capital goods sector. The manufacture of sophisticated machinery and equipment poses certain special problems of its own which need to be taken into account. Though the precise nature of the problems may vary from project to project, certain broad policy issues and aspects need to be considered for the effective growth of this sector within the overall framework of the country's economic policies.

Summary of Conclusions and Recommendations

(1) Industrial Growth Pattern and Policy Background

17. Rapid industrial growth has taken place in Mexico during the three decades 1940 - 1970, with an annual growth rate of over 6.5 per cent and a per capita growth of over 3.5 per cent. Increase in GDP (at constant prices) averaged 6.4 per cent during 1940 - 1970, while the industrial growth rate during the 1960's rose to 8 per cent. Employment in industry rose to three million by 1970, constituting 21.5 per cent of the total labour force. The GDP (at 1960 prices) rose from 47,000 million pesos in 1950 to 150,000 million pesos in 1960 and over 305,000 million pesos in 1970. Industrial growth has been accompanied by relative price stability (an annual increase of about 3 per cent), except in 1970, though trends during the present year will also need to be carefully watched. The satisfactory industrial growth rate has, however, been accompanied by a continuing deficit in the current account of the balance of payments, the deficit amount to US$ 714 million in 1971 and US$ 891 million in 1972. This has largely been due to greatly increased imports of capital goods equipment, components and intermediate products (ref. para. 27).

17.1 Industrial development has received great emphasis from the Mexican authorities during this period. There has been substantial domestic investment in industry, largely in the private sector. Public

investments in electricity generation and distribution and in industry rose to 30,000 million pesos out of the total public sector investment of 87,000 million pesos in 1971. There has also been considerable inflow of direct foreign investment (over 2,000 million pesos annually during 1966 - 1971) and foreign technology in the last decade. Foreign remittances on account of dividends rose to [illegible] million by 1969, while payments for royalties and technical services rose to about the same figure by 1969. The overall share of industrial production in GDP rose to over 23 per cent by 1970 with metal fabrication production alone rising to 14,900 million pesos in value in that year out of total GDP of 305,900 million pesos. Domestic manufacture largely concentrated on consumer durables during the 1950's, which increased production of intermediate products and less sophisticated capital goods items during the 1960's.

17.2 The capital goods sector, however, continued to remain comparatively small, constituting only 1.7 per cent of GDP in 1967 (cf. paras. 29-31).

17.3 The pattern of trade has gradually shifted due to reduced imports of consumer goods, a gradual reduction in overall imports of intermediate products and substantially increased imports of capital goods items, including components. On the export side there has been a gradual increase of exports of manufactured and semi-manufactured products (cf. paras. 34-36).

17.4 A special programme of border industries initially mainly along the US border and extended to the whole country since last year, which allows duty-free imports of inputs for exporting industries has resulted in the establishment of 310 such export-oriented enterprises by February 1973, with exports in terms of added-value rising to 1,740 million pesos during the last year (cf. para. 37).

17.5 Fiscal and industrial policies during 1940 - 1970 concentrated on maintaining a favourable climate for private industrial investments. Public sector investments in industry have also increased considerably

mainly in certain basic sectors such as steel, mining and petroleum and petrochemicals. Industrial policy has been oriented towards import substitution, and a highly protected market, largely through the application of import controls, has developed for domestically produced items. A more comprehensive tool of commercial economic and apart from simplification of import classification and import duties as also export assistance and incentives, important institutional agencies such as the Mexican Institute for Foreign Trade (IMCE) have been set up, together with a number of special funds (banks) for institutional financial assistance. An important decree was issued on 6 July 1972 which was designed to bring about greater industrial decentralisation through a new pattern of tax and other incentives for industries in less developed regions of the country. Important legislative measures have recently been passed for the regulation of foreign capital investment and regulation of foreign technology patents and trade marks (cf. paras. 38-41).

17.6 The foreign investment law prescribes the fields in which foreign investments would be permitted, the normal limit to such equity investments being 49 per cent. A National Committee for Foreign Investments is to be set up, which would take decisions on the extent of foreign equity to be allowed in particular cases (cf. para. 42-43). The law on foreign technology prescribes for the registration of all agreements in respect of foreign technology, patents and trade marks, such registration to be denied if an agreement violates certain principles and criteria defined in the law (cf. para. 44).

17.7 Existing policy instruments also enable a considerable degree of regulatory control through (i) issue of invitations by the Ministry of Industry and Commerce (SIC) for setting up enterprises in particular sectors, (ii) approval of the programme of domestic integrations, and (iii) issue of import licences. The grant of incentives and other facilities are conditional to securing approval to (ii) above (cf. paras. 48-49)

17.8 A strong protectionist policy has developed, largely taking the form of import controls, which cover the majority of imported items, and local manufacturers can move to have the "border closed" for their production items. This is usually agreed to, provided certain conditions are met. The tariff pattern accords relatively low protection for machinery items, while the impact of duties on capital-goods imports is further reduced by a special provision (Regulation 11), which reduces such duties by 75 per cent. (cf. paras. 52 - 53). Domestic industrial finance has been available to an increasing extent, though interest rates are high. Facilities for institutional financial assistance have increased considerably in recent years and apart from Nacional Financiera S.A., the official Industrial Development Bank, special funds have been set up to meet requirements in different sectors. Apart from industrial finance, considerable tax concessions and incentives are available. The principles guiding such incentives were prescribed by the Law for Development of New and Necessary Industries, while the detailed pattern of tax incentives for different regions of the country has been defined in the Decree of 20 July 1972. Enterprises qualifying for such incentives are required to have domestic integration of 60 per cent and a minimum added-value of 10 per cent or an approved integration programme.

17.9 The pattern of incentives, now defined in the Decree gives a clear picture of the nature and extent of tax incentives in different regions. (cf. paras. 54 - 57)

Apart from general tax incentives, special facilities and incentives are given for exports. This includes institutional export credits, including pre-shipment credit, guarantees against export risks, tax incentives (provided domestic integration is at least 50 per cent), concessional rail-freight and various other facilities. (cf. paras. 58 - 59) The specific implications of various policy measures and procedures are dealt with in a later chapter. (cf. para. 61)

(2) Trends and features of capital-goods production in Mexico

18. The growth of the capital goods sector is of great importance for Mexico, not only because the sector would be able to better meet the increasing domestic demand for machinery and heavy equipment but also because it would contribute to the development of indigenous skills and technology. The capital goods sector also acts as a strong catalytic agent for growth of production and employment in the metal-transportation sector as a whole (cf. paras. 62 - 64).

18.1 The programming of capital goods manufacture requires a selective and co-ordinated approach. The identification of capital-goods having adequate potential for domestic manufacture must follow a detailed analysis of future domestic demand and export projects. Thereafter, the techno-economic feasibility of specific manufacturing proposals would have to be worked out and an evaluation both from the commercial and social profitability point of view. Various aspects of governmental policy also have to be taken into consideration. (cf. para. 65).

18.2 The main reason for slow growth of the Mexican capital-goods sector in the past has been the channeling of investible resources into consumer goods production and the lack of incentives for investments in the capital goods sector. Limited internal demand and the complex nature of heavy machinery and precision equipment also deterred large-scale investments in the capital goods sector. Apart from general encouragement for import substitution, there was relative limited policy support specifically for this sector. Import substitution in Mexico has consequently followed traditional lines for a protected domestic market, concentrating largely on consumer-goods items with an assured domestic demand. On the other hand, producer-goods manufacturers have had to face strong foreign competition because of facilities for machinery imports and low tariffs on such imports. (cf. para. 66).

18.3 In terms of value total production of capital goods is estimated to be about 4, 5[illegible] million pesos in 197[illegible]. Growth trends for this sector for 1976-1980 are difficult to project because of a large number of variable factors. However, it is considered that sectoral growth during the period 1976-1980 should be about 14.5 per cent. On this projection, gross domestic production of capital goods would increase to 1[illegible],392 million pesos by 19[illegible] and would be of the order of 71,[illegible]76 million pesos for the period 1976-19[illegible]. (cf. paras. 69 - 70)

18.4 Machinery exports from Mexico, including consumer durables and electrical materials have been relatively low, amounting to 2,041 million pesos and constituting only 9 per cent of total exports during 1972 and largely comprising of parts, components and spares due to particular Government inducement. Exports of heavy machinery and equipment have been relatively insignificant. Exports of components and parts are likely to increase fairly rapidly. Total machinery and component exports are projected to increase to 6,275 million pesos by 1980. (cf. para. 70).

18.5 About 90 enterprises are principally engaged in the manufacture of capital goods items in Mexico. These are largely concentrated in the Federal District and the State of Mexico together with Monterrey and Guadalajara, besides some major fabrication units in Querétaro, Veracruz and Puebla. These enterprises cover a fairly wide field of machinery production but the level and range of sophistication is relatively low and the proportion of imported components is often very high. Production has been primarily geared to the domestic market. Production equipment has to a large extent been transferred as used equipment, mostly from the U.S.A. (cf. paras. 71 - 73)

18.6 Production costs and domestic prices tend to be considerably higher than international prices for a large number of machinery products, despite much lower labour costs as compared to the U.S.A. The main reasons quoted by manufacturers for higher domestic prices

are (i) higher costs of raw materials and inputs and (ii) low volume of production. These two facts are obviously interrelated. Prices of basic materials, particularly steel, are indeed higher in many cases. There is a cost differential of 10 - 30 per cent for certain steel items while the differential is 40 - 50 per cent on many auxiliary items. There is considerable under-utilization of capacity and most of the capital-goods manufacturing plants operate at between 40 - 60 per cent of capacity.

18.7 A solution to the low utilization of capacity undoubtedly lies in development of exports, but there have been relatively limited efforts to boost exports, especially in the case of many enterprises which are foreign subsidiaries and affiliates. In the case of Mexican companies operating with foreign technology on licensing arrangements, restrictive provisions have often been included regarding exports in licensing agreements. (cf. paras. 74 - 76) In order to foster exports, policy measures will have to be formulated to increase the competitiveness of the capital goods industries and to alleviate as far as possible export restrictions.

18.8 There has also been inadequate development of facilities for designing and detailed engineering and technical services in Mexico. A major problem in this regard has been the multiplicity of equipment imports for various sectors. Planning of domestic manufacture would necessitate considerable variety reduction in the types of industrial equipment used in the country. It would also be desirable to standardise machinery imports on the metric system and in accordance with ISO standards. (cf. paras. 78 - 79)

18.9 The growth of the capital goods sector in Mexico has not followed any co-ordinated pattern and has largely been the result of pressures for limited import substitution, combined with coverage of a protected domestic market. The major problem faced by existing enterprises is in respect of high production costs and these must necessarily be

reduced if international competitiveness is to be achieved. It is also necessary to evolve a scheme of priorities to cover major production gaps to the extent that this is economically and technologically feasible. The growing internal demand can serve as a strong foundation for the growth of the capital goods industry in Mexico on a primarily export-oriented basis, as the country's factor-endowments in terms of geographical location, infra-structure development and other resource advantages, together with general economic conditions and the investment climate are extremely well-suited for this purpose. (cf. paras. 80 - 82).

(3) Projections of demand and imports of capital goods

19. In order to identify the principal gaps in capital goods manufacture, machinery requirements have been projected for the period 1976 - 1980 in terms of macro-projections of demand and of imports. In addition detailed projections of demand and imports have been made for specific capital goods items. (cf. para. 83)

19.1 The macro-projections have been based primarily on the projected likely investments up to 1980 in 14 major production sectors and the anticipated capital goods requirements against such investments. Total capital goods requirements have been projected to be of the order of 102.76 thousand million pesos for the period 1976 - 1980, while projected imports for these sectors are assessed at 52.7 thousand million pesos in the same period. Projected for the economy as a whole, total capital goods requirements during 1976 - 1980 would be of the magnitude of 174 thousand million pesos, while likely imports would be about 83.6 thousand million pesos. (The above values are assessed in terms of 1968 prices. (cf. paras. 93 - 97)

19.2 In the present phase of the study, projections of demand and imports were made for specific capital goods groups and items. Such items have been classified into 26 groups under 3 major heads viz.

(i) non-electrical equipment in common use for various industries, (ii) non-electrical equipment used in specific production sectors and (iii) electrical equipment. The classification of capital goods products and items is given at Schedule I at the end of Chapter I. (cf. paras. 88 - 94)

19.3 Import projections for 1976 - 1980 have been made for each of the 26 grounds and categories. Import figures during the 1965 - 1969 period have been adopted as the base for these projections and individual growth co-efficients were thereafter applied to project the likely imports for the 1976 - 1980 period. These projections are based on the existing pattern and growth trends in the capital goods manufacturing sector and do not take into account the additional impact of a major development programme for the capital goods sector as may emerge on the basis of the study. In sub-paragraphs A to Z of paragraphs 79 to 94, a brief description has been given of the nature and extent of imports during 1976 - 1980 for each of these categories. A more detailed break-up of the projected import figures for this period in terms of major items and sub-items is furnished in Schedule II (Volume III, Chapter A). Projected imports during 1976 - 1980 of various capital goods categories have been further sub-divided for each of the 14 production branches which are major consumers of capital goods items and detailed projections in this regard are given in Schedule III, (Volume III, Chapter A). (cf. paras. 89 - 98)

(4) Production gaps and manufacturing possibilities

20. In order to identify new investment opportunities or "production gaps", the data on projected domestic demand for specific capital goods was reviewed against such investment projects and expansion programmes which were already under consideration or implementation by existing industries. To get a first-hand idea of the status of

industry, extensive feasibility studies undertaken. Except for the transport sector which has not been included in the scope of this study, a fairly comprehensive picture of domestic capital goods manufacture has emerged for identifying major gaps and indicating further manufacturing possibilities. (Cf. paras. [illegible])

20.1 Only particularly significant items have been identified in terms of broad economic viability and technical production capability in Mexico. While import substitution constitutes a starting point for the analysis, the scope for exports will have to be duly taken into account in subsequent investigations. A careful selection of the initial product mix is suggested for each item. The production programme is phased out in two stages. The manufacture of identified products could be undertaken in new plants or through expansion of existing units depending on investment response and economic feasibility.

20.2 A short analysis of existing capacity, demand projections, range of products, new production capacity to be set up and very approximate investment estimates have been furnished in respect of each identified group or item. This information has been separately collated in brief "investment profiles and information sheets" which is being forwarded to prospective investors, both domestic and foreign, together with a brief description of the existing situation regarding capital goods development in Mexico, present policies, procedures, incentives and facilities, etc. The "investment profile sheets" are thus primarily intended for initial investment promotion. Detailed pre-investment studies will be carried out subsequently. (cf. paras. 103 - 107)

20.3 In the following paragraphs the same classification of capital goods items is used as in Schedule I. All money values are given in Mexican Pesos and in terms of 1960 prices. It is important to note that the capital investment figures include only the cost of machinery, equipment and factory services while the cost of land, buildings, etc. is excluded.

(i) Non-Electrical Equipment (Common Use)

(a) Power Generation Machinery (Other than Electrical Equipment)

21. The high pressure boilers, turbines, etc. used for power generation are dealt with later under Section (r) along with electrical generators, etc. The other items, namely boilers and turbines for industrial purposes and internal combustion engines are considered here. Three companies are producing process boilers based on know-how from leading foreign firms and they are in a position to meet the present and future needs of Mexico. The industrial type turbine is not being made in Mexico and the setting-up of new facilities will be justified for an annual production of 30 million pesos, involving a capital investment of about 30 million pesos. A major production gap in heavy diesel engines (1,000 to ,000 hp) for power generation, pumping, marine use, etc. has been identified and it is considered that new facilities will have to be created for an initial annual production value of about 200 million pesos, followed by a stage II programme after 1980 to meet the growth in demand as well as export of 10 - 15 per cent of production capacity. The approximate investment on stage I would amount to 250 million pesos. (cf. paras. 109 - 111)

(b) Machine tools and (c) Other metal working machinery

21.1 The machine tool industry is in an early stage and large imports are taking place. There is need to cover this gap and, at the same time, provide extra capacity for exports for which there appears to be more scope. This group has been analysed under two sections (i) chip-removing machine tools and (ii) chipless forming equipment. The first group includes a number of items for metal cutting, milling, etc. A large production gap of about 688 million pesos per year would exist during the period 1976 - 1980. Even if only 50 per cent of this is covered for a production value of 344 million pesos per year, an investment of about 413 million pesos per year will be required for

machinery equipment in ... stage ... programme will also be justified to meet the growth in internal demand after 19.. and for exports. For the second ... forming equipment, such as hydraulic presses, ... tines, benders, etc there would be a gap of about ... million pesos per year during 19.. - 19... As nearly .5 per cent of the machinery are large, sophisticated and special type machines, it ... not ... economically feasible to produce them in Mexico for some time. For the balance 15 per cent or 30 million pesos in value, ... could be provided and this would require an investment of about ... million pesos

(d) Packaging, spraying and weighing equipment

21.2 Simpler types of spraying equipment are being produced in Mexico and existing companies should be able to cover most of the range of products by expansions. There is thus considerable scope for expansion of three medium-sized companies to cover the internal demand except for sophisticated and complex equipment and also to undertake some exports. In regard to weighing equipment there are two important manufacturers covering most of the items except for a few sophisticated types with automatic indicator and printing mechanism for weights of 1,000 kgs. or more. To cover this gap, the two manufacturers could expand their facilities with provision to cover export possibilities to the LAFTA region. (cf. paras. 117 - 119)

(e) Heating and cooling equipment

21.3 Except for certain large and sophisticated items such as industrial ovens and large heat exchangers, all other items are being fabricated in Mexico. Through their planned expansions these companies should be able to meet the entire demand. They will, however, have to improve their quality and technology in respect of special equipment and to arrange for ASME certification. (cf. para. 120)

(f) Pumps, centrifuges and compressors

21.4 Taking pumps and centrifuges together (as they are allied products with common manufacturing facilities) it is found that while a large portion of small and medium pumps are being made by a number of local firms, no industrial centrifuges of any kind are being produced in Mexico. Allowing for expansion of existing capacities and excluding certain sophisticated types, which may need importing anyhow, the gap during 1976 - 1980 has been assessed at 60 million pesos per annum for pumps and centrifuges. For these items new facilities will have to be created involving an investment of about 72 million pesos with scope being provided for further expansion after 1980. The gap in respect of compressors (the simpler types of which are also being made locally) by a similar manner of assessment as the other two items, amounts to 120 million pesos during 1976 - 1980 and the setting up to new production facilities will be justified which will require an approximate capital investment of 145 million pesos. (cf. para. 121)

(g) Lifting, loading and conveying equipment

21.5 A good volume of production exists locally with a fairly high degree of integration on items such as fork-lifters, conveying equipment, hydraulic jacks etc. However, a large gap is anticipated in (a) key parts and components for bridge cranes, (b) port handling equipment and (c) tower cranes, amounting to a value of around 200 million pesos annually during 1976 - 1980. This production would require an investment of about 200 million pesos. (cf. para. 122)

(h) Other machinery

21.6 A large number of machinery items of a miscellaneous nature for processing various products such as rubber, plastic, ropes, cables, tobacco etc. are included under this group and each industry has specialised needs. Most of the machinery and equipment are sophisticated and widely varying but a small percentage would be of a type which is required for similar applications in several industries and in such cases, fabricators who are making similar equipment will

find it worthwhile to take up manufacture with suitable foreign technology. This approach will require special surveys and the members of the concerned industries should undertake this study. (cf. para. 4)

(i) Machinery parts and components

21.7 The development of capital goods industry would very much depend upon the ready availability of components and processed materials such as (a) Grey-iron castings of medium and heavy weights, (b) gears including reducers, multipliers, etc. (c) precision forgings, (d) standard parts and (e) measuring tools. All these items are in acute shortage at present time and it is considered most essential that the gaps in this key area should be filled as early as possible by the creation of new manufacturing facilities. The extent of projected annual output value and corresponding investment figures are as follows.

	Annual production value million pesos	Capital investment million pesos
a. Grey-iron foundry for castings up to 15 tons single weight	595	655
b. and c. Gears, speed reducers and precision forgings	275	295
d. Standard parts, such as tools, dies, jigs, fixtures, gauges etc.	90	65
e. Measuring tools, such as squares, rulers, vernier calipers, marking plates, gauges of all types, etc.	30	42
	990	1,147

21.8 In arriving at the annual production values for which creation of new capacities would be required, due allowance has been made for the output from existing firms who are mostly producing these components in the smaller ranges and also for very large and sophisticated items which may not be economically justified for production and could preferably be imported. It is also felt that, by and large, none of the existing companies in these lines would be in a position to take up these lines as expansions, as needed facilities will be far too large in magnitude. Foreign technology will be required for all the items. (cf. paras. [illegible])

(ii) Non-electrical equipment (for specific industries)

(a) Equipment for steel and non-ferrous industries

22. Heavy equipment required for 1976 - 1980 for the iron and steel industry (for sponge-iron, pig-iron, ingot-steel and rolled products) is estimated at about 1,123 million pesos. Besides, equipment for aluminium and copper industries would be about 319 million pesos and 242 million pesos respectively for the same period. As the equipment are highly sophisticated, it will not be practicable to build up domestic production capacity to meet these requirements to any substantial extent for 1976 - 1980, but it should be possible to some extent for subsequent years. Detailed studies are being undertaken by a new company sponsored by one of the major domestic steel plants in collaboration with a leading foreign manufacturer of steel plant machinery and equipment. In view of this, this sector has not been analysed in detail in this study. (cf. para. 129)

(k) [illegible]

[illegible] equipment

22.1 A number of companies are producing mining equipment of the simpler types. Heavy imports are taking place in respect of mobile drilling equipment. As a matter of fact, more are likely to be built locally in the near future, it is expected that this gap will gradually be filled by existing companies. (cf. para. 7.0)

Construction equipment

22.2 Construction machinery of all types are being produced in Mexico by a number of companies supported by foreign technology. Total production during 1975 is expected to reach around 400 million pesos and is expected to rise to about [illegible] million pesos in 1980. Some new proposals from certain reputed foreign companies are under consideration for the production of new types of equipment. The existing and new entrepreneurs should be encouraged to set up facilities to increase production to meet the rapidly growing internal market and also to develop exports for which there are good possibilities. Standardisation of types and sizes will contribute to greater and more efficient production. (cf. para. [illegible])

Cement equipment

22.3 While certain simpler components for cement plants are being fabricated locally, major items such as feeders, primary crushers, ball mills, rotary kilns (except for small and medium plants), filters, clinker coolers, etc. are not being made. During 1976 - 1980, an average of 2 to 4 mills each of a capacity of 1,500 to 2,250 tons per day will be required. In order to meet the corresponding machinery requirements which is estimated at 150 million pesos per year, establishment of new fabricating capacity will be justified and the capital investment on this account would be around 150 million pesos for stage I with prospects for expansion after 1980, to meet a 7 per cent growth in cement production. (cf. para. [illegible])

(l) Pulp and paper machinery

22.4 The demand for paper (more particularly newsprint) is expected to grow rapidly and unless new plants are installed on a planned programme, the import (which at present is per cent of consumption), will increase substantially. It is estimated that in order to meet fully Mexico's requirements during 1976 - 1980, three plants of 300 tons per day (or 100,000 tons per year) each will be required to be set up of which one should be for newsprint and the other two for industrial, writing and special papers. For fabricating the machinery for a programme of this magnitude, which is valued at 250 million pesos per year, new facilities will have to be established and the capital investment would amount to approximately 200 million pesos. Foreign technology and know-how from a reputed manufacturer will be necessary particularly for the paper making equipment. There is sufficient indigenous capacity for pulp production equipment. (cf. para. 131)

(m) Sugar and food processing equipment

22.5 At present 60 per cent of the equipment needed for sugar mills are being produced locally and the important items which are being imported are centrifuges, turbines and large size extractors and gears. These items are suggested for production under other sectors of this capital goods programme. When these are established, complete equipment for the sugar industry will be available locally.

22.6 The food processing industry occupies a very important place in the economy. Machinery requirements for 1976 - 1980 have been estimated at about 5,575 million pesos or an average of 1,115 million pesos annually. It is expected that a substantial portion possibly 70 to 80 per cent will be produced by existing fabricators, but the balance will represent certain specialised equipment such as mixers, paste extruders, dryers, pasteurisers, etc. As these items are semi-

what sophisticated, establishment of new facilities will be justified with suitable foreign collaboration. These facilities should provide for an annual production value of about 150 million pesos of food processing equipment and the capital investment on fabricating facilities would amount to 100 million pesos. (cf. paras. 134 - 135)

(n) Equipment for chemical and petro-chemical industry

22.7 The chemical industry is at present growing at a rapid rate and the machinery requirement over the years would be very large. During 1976 - 1980 the average annual demand would be about 1,600 million pesos. There are a dozen companies which are fabricating various equipment items, but this is being done as jobbing work conforming to drawings provided by the customer or main contractors. The Mexican firms are not equipped with design and equipment technology for complete plants and to give process guarantee and hence good portions of equipment are being imported. It therefore appears necessary to establish design and engineering capacities in Mexico in association with one or more foreign consulting engineering firms to deal with complete projects and maximize local fabrication. During 1972, indigeneous production was valued at 350 million pesos and with selective expansion of existing companies to improve their facilities to produce sophisticated equipment, it can be hopefully expected that the future needs could, by and large, be produced locally. (cf. paras. 136 - 139)

(o) Textile machinery and equipment

22.8 There are at present no manufacturing facilities for textile equipment, except for some minor items and spare parts. The demand projection for 1976 - 1980 works out to an annual average value of about 1,600 million pesos, followed by a growth rate of 8 to 10 per cent after 1980. In order to close the gap even partially, it is suggested that under Stage I programme, 50 per cent of the demand

(comprising the simpler items) could be undertaken amounting to an annual production value of 685 million pesos. It is estimated that the manufacturing facilities would cost approximately 750 million pesos. As these machines are highly sophisticated, suitable foreign collaboration will be required. The second stage of the project will provide for more complex machines and also for exports for which there is considerable scope. (cf. para. 140)

(p) Agricultural machinery

22.9 There are eight companies, most of them with technology arrangements with international firms. The companies produce tractors, ploughs, harrows, harvesting machines, etc. in Mexico and are meeting most of the demand except for very large machines. The new policy of starting a large number of rural "work centres" will create a demand for big machines and the encouragement given to small land owners is expected to create a demand for small tractors. The existing companies can be expected to meet future demand by suitable expansion. (cf. para. 141)

(q) Other equipment for specific industries

22.10 This group includes printing, book-binding and allied equipment. Printing machinery, except simple machines which are already being made, is highly sophisticated and it will be advisable not to enter this line for some more time. Besides, the quantity required, does not justify economic production. (cf. para. 142)

(i) Electrical equipment

23. The electrical equipment industry in the capital goods sector (as distinct from durable consumer goods and light equipment) cater to the needs of:

(i) the electric supply systems for generation, transmission and distribution of power;

(ii) the general industry for motors, drives, control equipment and transformers, rectifiers and switchgear.

As the Mexican power system (CFE) is, and will be, growing at a rate of 12 per cent per annum, larger and more sophisticated equipment will be in demand and it is estimated that during 1976 - 1980 the CFE will be importing about 10,000 million pesos of equipment. While the simpler products such as those used for distribution are available nearly to the full extent, manufacturing capacity of equipment for generation and transmission of power shows a wide gap of about 90 per cent in value. Only certain types of medium size transformers, motors and switchgears are being produced in limited quantities and the entire range of heavier equipment is being imported. As a result of the team's study a number of individual items of equipment has been identified as suitable for establishing new facilities for manufacture. (cf. paras. 145 - 146)

Generating plant and equipment

24. In regard to generating plant and equipment, the future needs of Mexico will comprise most thermal (steam) power plants and to some smaller extent, atomic power plants as the hydro-electric resources would have been fully developed by 1980. Any plans for setting up new manufacturing facilities will, therefore, have to provide for large high pressure boilers, steam turbines, turbo generators and auxiliary equipment, of capacities of 300/500 MW conforming to the present and future plans of the CFE. It is considered that the production of large high pressure boilers will be justified from all points of view. New facilities to the tune of 350 million pesos, would result in an annual production value of 300 million pesos by 1980. This industry has good growth potential and it can meet the full needs of the Mexican power system and also take on some export orders. In later years fabrication of simpler components (like heat exchangers, etc.) for atomic power stations should also be possible

24.1 The manufacture of large steam turbines for power plants is not considered desirable for the present in view of its high sophistication and the need to import over 50 per cent of the components (such as castings, forgings, blades, etc.) for a long time. The production of large turbo-generators is being suggested for the second stage of a motor and generator project.

24.2 Creation of facilities for manufacturing reactors and other equipment for atomic power plants is not justifiable at this stage. A number of power station auxiliaries (both for conventional and atomic power plants) would be made in the various existing metal fabricating industries, by expanding their facilities. (cf. paras. 147 - 152)

Transformers, circuit breakers, motors and insulators

24.3 Although the production of distribution type transformers meets internal demand fully, only a small portion of the demand for medium and large power transformers is being met by local production from a single company. Having regard to the future demand for large transformers of 230 kv and 400 kv, the establishment of new manufacturing facilities for the production of an aggregate demand of 4,000 mva per year around 1980 (with scope for expansion thereafter), appears justifiable. This would involve an investment of 150 million pesos to give an annual output value of 160 million pesos around 1980.

24.4 As no manufacturing facilities exist for circuit breakers and switchgear for high voltage and extra high voltage operations, the setting-up of new facilities for this product line would be justified involving a capital investment of 150 million pesos for an annual production of 150 million pesos around 1980.

24.5 The electric motor industry (including small and medium generators) in Mexico is in early developmental stage as only fractional and small motors suitable for durable consumer equipment are in production. Only two or three firms are making some simple types of medium size motors up to 2,000 hp. There is a very large gap in this field which will widen as plans for capital goods industries take shape. Creation of new facilities with an investment of 150 million pesos would appear necessary which would result in an annual production of 170 million pesos per annum around 1980. While planning these facilities, provision should be made in advance for taking up the manufacture of large turbo-generators in the second stage of the project.

24.6 The manufacture of generators and motors for the diesel locomotive production and also motors for the metro (underground) system in Mexico appears worth while. The new facilities for this purpose, which could be combined with those under paragraph 1.7 above, or could be set up separately, will require an investment of 100 million pesos for the production of 100 million pesos worth of traction electric equipment per annum by 1980, (cf. paras. 153 - 156).

24.7 Large quantities of porcelain insulators are required for transmission lines of the Mexican power system and also high voltage porcelain bushings and other components for transformer, switchgear and other electrical apparatus. There are only two manufacturers who manufacture porcelain insulators for the lower voltage systems. Hence, there is justification for setting-up new facilities for the production of high voltage porcelain products involving a capital investment of about 100 million pesos for an annual production value of 150 million pesos. (cf. para. 157)

24.8 A number of miscellaneous items of equipment such as cables, wires, capacitors, rectifiers, electric tools, measuring and control instruments, etc. are being produced either partially or fully by a number of electrical firms. Some of the products are in the nature of durable consumer goods and some are components or peripherals for heavier capital goods. By and large, it is expected that the future demand for these items will be met by normal expansion of the existing companies. In the field of telecommunications, adequate manufacturing capacity seems to exist except for microwave and VHF equipment which are being fully imported and their production in Mexico may have some justification. (cf. paras. 159 - 164)

24.9 The quantum of suggested new manufacturing facilities in all the identified items of heavy electrical goods referred to above, is based on a reasonable approach of aiming for a production of 50 per cent of the market demand, leaving 25 per cent for imports and the 25 per cent for existing companies to take up by expansion programmes. The approach will allow time for technology and skills to be built up in the initial years and prepare the ground for greater effort in the subsequent stages. (cf. para. 165)

Policy considerations in capital goods manufacture

25. Import substitution in the capital goods sector has been relatively limited, partly because of the special nature of such manufacture and partly because of fairly liberal facilities for imports of machinery and equipment at concessional duties. The continuance of existing policies without certain modifications would result in the growth pattern remaining largely unchanged, with relatively slow growth of capital goods production and technological sophistication, besides high-cost manufacture geared mainly to internal demand. (cf. paras. 172 - 173)

25.1 The development of the capital goods sector requires that (i) adequate investible resources are channelled to this sector, (ii) domestic production achieves competitive efficiency and (iii) adequate export orientation takes place. (cf. para. 179) Technology, quality and product prices of the capital goods must meet the requirements of domestic and foreign potential users of the equipment. For (i), a dynamic investment promotion programme is necessary. The preparation of investment profile sheets and the establishing of contacts with suitable foreign manufacturers and interested domestic entrepreneurs were undertaken as a first step in this direction. For most projects detailed pre-investment studies will be required.

It is important to ensure adequate utilization of existing capacity. Wherever identified production gaps can be efficiently covered by expansions of existing establishments this should therefore be duly considered. Investment proposals should be examined as to the ability to meet the technological, economic and specific export requirements.

25.2 The policy towards foreign capital investment is of great importance in this context. Most capital goods projects require fairly large outlays and complex technology and a liberal and flexible policy is therefore necessary. Although foreign equity investment ranging from 30 to 49 per cent would be considered as appropriate, foreign majority ownership may also have to be considered where manufacturing technology and know-how cannot otherwise be obtained. In such cases it is recommended provision may be made for majority ownership to be converted to minority holdings within a specified number of years and linked with expansions. (cf. para. 179) To raise domestic finance to cover 51 to 60 per cent of equity may present a problem. At 60 per cent, the finances required for stage I of manufacture of identified products is estimated at 1,770 million pesos mainly during 1974 - 1978. In addition loan funds and working capital

would have to be provided. In a number of cases, particularly where governmental agencies are the principal purchasers of the manufactured equipment, financial participation would be necessary through NAFINSA and other banks and agencies, to the extent of 49 per cent of equity. (cf. paras. [illegible])

25.3 The locating of suitable local partners for joint ventures is very important. CFI and NAFINSA are to give necessary lead and assistance so that the most suitable local enterprises or parties can be associated with particular capital goods projects. (cf. para. 175)

25.4 In respect of foreign technology agreements for the capital goods sector, the broad guidelines that can be recommended are as follows (i) a flexible approach should be used regarding royalty payments though the computation formula should provide for deduction of value of imported components obtained from licensors; (ii) the duration of agreement would need to be longer than in other industrial sectors; (iii) while restrictive clauses regarding exports should be avoided, exceptions need to be made for countries where the licensor has similar manufacturing facilities or has given exclusive rights; (iv) component supplies should be made at competitive prices; (v) full patent rights should be covered; (vi) trade marks and trade names should be secured for export markets. (cf. paras. 181 - 183)

25.6 The selection of appropriate technology is also of vital significance and facilities for assisting domestic parties through a Technological Information Centre are necessary. (cf. para. 183)

Development of indigenous R and D local designs and technological services is also very important and these aspects should also be taken into consideration in technology agreements. The development of domestic consultancy services is of great significance in this context. (cf. paras. 184 - 185)

25.7 The principal policy instruments used at present by the Government to foster industrial development are (i) protection and import controls, (ii) measures to bring about domestic integration and (iii) various financial and fiscal facilities and incentives, including export incentives. (cf. para. 1)

25.8 The established import control system has resulted in a considerable protection and consequently in high domestic prices of certain industrial products including major inputs for capital goods production. Imports of capital goods have, on the other hand, been permitted quite liberally, especially for the public sector. Imports of machinery and components are subject to concessional duties (Regulation No. 14).

In order to stimulate growth of the capital goods sector the import regulations should be revised. Import controls for specific types of capital goods for adequate periods of time should be introduced in order to secure the domestic market for these capital goods. Such protection should, however, be conditional on local manufacture at comparable costs and quality. An upper limit of the overall price differential for domestically produced capital goods should be 20 to 25 per cent In order to reduce manufacturing costs of capital goods to such a level a gradual move away from the rigid import controls and an increased flexibility for the imports of major material inputs would be required. In cases where prices of local inputs exceed those of imports by more than 25 per cent, imports should be permitted on "actual user" basis to capital goods manufacturers for six-month periods.

25.9 The continuance of concessional duties on imported machinery and components, (Regulation No. 14) needs to be reviewed. An ad valorem duty of 20 per cent should be considered for machinery imports. The tariff on imported components should not be higher than for the complete equipment. (cf. paras. 191 - 195)

25.10 It is recommended that great care is exercised in regard to imports of used or second-hand complete plants and items of equipment. In the case of used plants, imports should be linked to substantial export commitments. (cf. para. [illegible])

25.11 Greater flexibility is necessary in determining the level and pace of domestic integration and this should be determined on the merits of each case in capital goods manufacture (cf. para. [illegible])

25.12 It will be necessary to ensure greater procedural co-ordination in respect of various governmental approvals required for foreign investment, technology agreements, phasing of domestic integration and issue of import permits, so that there is no undue delay. (cf. para. [illegible])

25.13 Increased administrative and technical support is necessary. A separate branch of Directorate needs to be set up in SIC for overall co-ordination in respect of the capital goods sector. It would also be desirable to set up a Bureau on Prices for Industrial Equipment and Materials in SIC. (cf. paras. [illegible])

24.13 Increased production of ancillary items and components is essential for the growth of the capital goods sector. This could be effectively continued with development of Mexican-owned manufacture. This would also widen the entrepreneurial base in Mexico. (cf. paras. [illegible])

25.14 In respect of credit and financing, it would be necessary to provide much greater institutional financial assistance and two new funds, the Fondo Nacional de Fomento Industrial (FOMIN) and the Fondo de Equipamento Industrial FONEI), would need to play a significant role. Some relief in respect of the interest structure on a differential basis for capital goods industries also needs to be considered. (cf. para. [illegible])

24.15 The volume of foreign supplier credits has increased considerably. Gradually, these credits should be replaced by domestic institutional credits covering foreign exchange requirements also. Facilities for deferred payments to domestic purchasers should also be extended through institutional support. (cf. para. [illegible])

24.16 With regard to tax incentives, the concessions provided in the Decree of 20 July 1972 appear, by and large, to be adequate. If selective differentiation in tax relief is applied in future, capital goods manufacture should be treated as a priority sector. The tax rebate allowed in respect of import substitution supplies for CF , P MEX, railways and [illegible]TCO should however also be extended to other domestic purchases of capital goods. (cf. paras. [illegible])

25.17 The development of capital goods exports is of major importance. For this, a continuing assistance to enterprises having export potential is necessary. (cf. paras. [illegible]). A system of additional input permits akin to bonus vouchers should be introduced, particularly for capital goods exports. (cf. para. [illegible]) Further elaboration of the system of tax credits or [illegible]DIS in respect of exports is necessary. (cf. paras. [illegible]) The recent scheme for additional incentives for exports through consortio and export service firms is of particular importance for the capital goods sector. (cf. para. [illegible]) Other export incentives and facilities, particularly port-handling facilities and shipping freight rates, need further review or elaboration. The regulatory mechanism could also be used to a greater extent for export development. (cf. paras. [illegible]) The programme of border industries should be suitably re-oriented and adjusted towards increased capital goods manufacture. (cf. para. [illegible])

25.19 There is considerable scope for greater regional co-ordination in capital goods manufacture. This could be done at the level of (i) common machinery industries and (ii) special capital goods manufacture. It would be very useful to initiate a more detailed study in this regard, possibly under UN auspices. (cf. paras. [illegible])

26. While various policy measures have been discussed in terms of their general application on the capital goods, the impact of specific measures would differ considerably in respect of particular projects and need to be separately considered for each major manufacturing project in the various sub-sectors in the next phase of this study. Policy measures have to be viewed in the context of overall socio-economic policies and objectives of the country and the above recommendations and suggestions have been made against this background. (cf. para. [illegible])

ANNEX V

Classification of Capital Goods

Non-electrical equipment used in various production sectors

(a) Power generating machinery other than electric
(b) Machine tools
(c) Other metal working machinery
(d) Packaging, spraying and weighing machinery
(e) Heating and cooling equipment
(f) Pumps, centrifuges and compressors
(g) Lifting, loading and conveying equipment
(h) Other machinery
(i) Machinery parts and accesories

Non-electrical equipment used in specific production sectors

(j) Equipment for manufacture of iron, steel and non-ferrous metals
(k) Mining, construction and cement production equipment
(l) Pulp and paper production equipment
(m) Sugar and food processing equipment
(n) Equipment for production of chemicals, petro-chemicals and fertilizers
(o) Textile production equipment
(p) Agricultural equipment
(q) Machinery parts and accesories

Electrical Equipment

Electric power generation machinery
Transformers, circuit breakers and motors
High voltage porcelain insulators, bushings, etc.
Telecommunications equipment
Electrical measuring and control instruments

Electrical and other tools

Electric furnaces, electric welding and cutting apparatus

Other electrical equipment

Capital goods not specifically identified

VOLUME II

Features of Mexican Industrial Development

INDUSTRIAL GROWTH PATTERN AND POLICY BACKGROUND

1. Features of industrial growth

27. The period from 1940 to 1970 constituted, by and large, a period of dynamic industrial and economic growth in Mexico with acceleration of the growth rate during the 1960's. The economy grew at an annual rate of over 6.5 per cent, with per capita growth of over 3.7 per cent. Increase in GDP (at constant prices) averaged 7.1 per cent during the decade 1960 - 1970. The industrial growth rate rose from 7.5 per cent in the 1950's to 8.4 per cent during the 1960's, and the share of industrial production (manufacturing, mining and petroleum) in GDP rose from 25.2 per cent in 1940 to 29.2 per cent in 1960 and over 33 per cent in 1970* with over 25 per cent in the manufacturing sector in 1970. Employment in industry rose from 2.1 million to 3.0 million, constituting 21.5 per cent of the labour force. The gross domestic product (at 1960 prices) rose from about 97 thousand million pesos in 1950 to 150.5 thousand million pesos in 1960 and 298.7 thousand million pesos in 1970. The high growth rate was slowed down considerably in 1971 with increase in GDP of only 3.7 per cent. During 1972, however, there was a very significant recovery and GDP increase was over 7 per cent. There was a marked rise in wholesale prices during 1970, averaging 5 per cent over 210 items. This came down to about 3.4 per cent in 1971**, and increase has been able to be controlled to below 3 per cent. The currency has been stable since 1954 in relation to the dollar and the peso-dollar

---

* Banco Nacional de México - "Review of Economic Situation of Mexico, August 1972"

** Banco de México - "Informe anual 1971". Subsequent figures in this paragraph and in Table I are also from the "Informe anual 1971" and "Informe anual 1972".

exchange rate* has been maintained consequent on the last dollar devaluation. Despite unrestricted freedom in foreign exchange transactions, reserves rose [illegible] million by the end of 1972. There has, however, been continuous deficit in the current account of the balance of payments. This can be seen from the following table.

Table 1**

Summary Current Account of Balance of Payments
(In million dollars)

	1968	1969	1970	1971	1972 1/
Exports of goods and services	1,909	2,506	3,142	3,377	3,973
Imports of goods and services	2,285	3,139	4,057	4,080	4,827
Deficit on current account	376	633	909	703 2/	853

1/ Preliminary
2/ Preliminary figures. (later corrected to US$ 714 million)

Increased imports during 1972 largely related to imports of capital goods equipment for various sectors. This figure rose from about US$ 413 million to about US$ 540 million for the manufacturing sector, registering an increase of 30.7 per cent over the previous year. Capital goods imports in 1972 were also considerable in the case of transport equipment (US$ [illegible]4.7 million), machinery for services (US$ 122.9 million), electrical equipment (US$ 5[illegible]0.3 million) machinery for the agricultural and mining sectors (US$ 57.2 million) and construction equipment (US$ 55.7 million). As against total capital goods imports of US$ 1,061.3 million in 1972, imports of intermediate goods and products amounted to US$ 1,388.1 million.

---

* 12.5 pesos = 1 US dollar

** Banco de México - "Informe anual 1971". Subsequent figures in this paragraph and in Table 1 are from the "Informe anual 1971" and "Informe anual 1972".

28. The country's industrial growth has been characterised by certain significant features. Despite the absence of any formal economic planning, great emphasis has been laid on industrial development. A wide range of promotional measures have developed, including various incentives and facilities and a relatively low overall tax incidence on middle and higher income levels on the one hand and import controls and protective tariffs on the other. Industrial expansion has largely taken place through the private sector which has displayed considerable initiative in most industrial branches. Public investment in 1971 rose to about 30 thousand million pesos out of 77 million pesos with major outlays principally in the electrical, steel, petroleum and fertiliser sectors, constituting about 40 per cent of such public investments.

29. Direct foreign investment has played a significant role in industrial growth and, at present, controls a significant share in many sectors. Average net foreign investment was about 1,370 million pesos annually during 1950 to 1966* but has averaged over 2,000 million pesos including reinvestments during the last five years. The liberal approach to direct foreign investments in the past has resulted in foreign subsidiaries and affiliates acquiring both a dominating position in many manufacturing sectors and participating extensively in marketing and distributing activities, including direct merchandising. The share of such subsidiaries (over 50 per cent foreign owned) in total gross production during the period 1964 - 1965 amounted to 65.5 per cent in transport equipment, 57.2 per cent in chemical products, 54.2 per cent in non-electrical machinery, 55.8 per cent in electrical and electronic machinery, 49.9 per cent

---

* Source: Secretaria de Industria y Comercio - "Octavo curso industrial de 1965".

in capital and durable consumer goods and 30.0 per cent in basic metallic industries.* These percentages, by and large, appear to hold good in 1970 also, though a more accurate picture would emerge after the results of the 1970 industrial census are available. Notable exceptions are the petroleum, basic petro-chemicals and certain other sectors where state owned enterprises have assumed a pivotal role. While considerable inflow of foreign technology has taken place, both through foreign subsidiaries and through licensing arrangements, the overall payments for such technology have increased considerably. Foreign remittances on account of royalties and technical services rose from US$ 14.7 million in 1953 to US$ 80 million in 1969** as against payments of dividends to foreign subsidiaries which rose from US$ 56.9 million in 1953 to US$ 90 million in 1968. Apart from substantial payments for technology, a considerable degree of technological dependence has developed in Mexican industry and there has been relatively limited efforts for indigenous research and development in most sectors.

30. Industrial growth has been marked by heavy geographical concentration of industry in and around Mexico City and around the urban areas of Monterrey and Guadalajara. The percentage of gross industrial production (in value) in these three urban regions was 57.5 per cent in 1965, with 47.5 per cent concentrated in Mexico City. While social overhead costs are rising rapidly in these areas, regional inbalances in industrial growth in other areas have become increasingly marked.

---

* CEPAL and NAFINSA - "La Política Industrial en el Desarrollo Económico de México". México, 1970

** CEPAL and NAFINSA, Ibid.

2. Industrial growth pattern

31. The industrial growth pattern, particularly during the 1960's showed very dynamic trends in respect of certain production sectors. While agricultural production and that of certain consumer goods items has grown steadily, the growth of petroleum products and of metal fabrication has been very rapid, together with infra-structure sectors such as electricity, transport and construction. The changing picture, in terms of gross production value, during this period, may be seen from the following table:

Table II

Gross Product Value of Various Sectors 1960 - 1970

(in thousand million pesos at 1960 prices)

Type of activity	1960	%	1965	%	1970 (Preliminary)	%
1. Agriculture	24.0	15.6	30.2	13.9	34.7	11.3
2. Mining	2.3	1.5	2.4	1.1	2.8	0.9
3. Petroleum, including refinery and basic petrochemicals	5.1	3.3	8.0	3.7	12.6	4.1
4. Food products, beer and tobacco	10.6	6.9	14.4	6.6	19.8	6.5
5. Textile and textile products	5.4	3.5	7.-	3.6	11.3	3.7
6. Forestry products, including paper and paper products	2.3	1.5	3.7	1.7	5.1	1.7
7. Chemicals and plastics	3.2	2.1	5.3	2.4	9.3	3.0
8. Non-metallic minerals	1.2	0.8	1.7	0.8	3.0	1.0
9. Basic metals	1.8	1.2	2.9	1.3	4.6	1.5
10. Fabrication of metal products	4.3	2.8	9.0	4.2	14.9	4.9
11. Construction	6.1	4.0	8.5	3.9	13.6	4.4
12. Electricity	1.5	1.0	2.8	1.3	5.3	1.7
13. Commerce	46.9	30.5	67.4	31.1	96.3	31.5
14. Transport and communications	5.0	3.3	6.4	3.0	9.4	3.1
15. Services	32.2	21.0	44.0	20.3	59.5	19.5
16. Adjustments for banking services	1.5	1.0	2.3	1.1	3.6	1.2
Total (figures rounded off)	153.4	100	216.7	100	305.8	100

Source: Banco de México, "Informe anual 1970".

32. In the manufacturing sector, the growth pattern during the 1950's was largely dominated by the production of various consumer products, including certain consumer durables, in response to rising consumer demand and a strong protectionist policy. During the 1960's, production shifted to consumer durables and intermediate products to a greater extent, including relatively less sophisticated capital goods items. The change in the production pattern can be seen from the following table:

Table III*

Pattern of Industrial Growth (1950 - 1969)
(in thousand million pesos - 1960 prices)

		1950 - 1952	1967 - 1969
A.	Non durable consumer goods	11.9 (70%)	19.9 (52.9%)
B.	Intermediate products	3.8 (22.4%)	18.9 (32.9%)
C.	Durable consumer and capital goods	1.3 (7.6%)	8.6 (14.7%)
	Total Manufacturing Industry	17	58.4

The above growth pattern is likely to pose certain problems over the next decade unless some structural changes are brought about. Demand growth for various consumer products, particularly durables is likely to be much slower than in the past and expansion of production will need to be covered by exports or by new products to a

---

* CEPAL and NAFINSA, Ibid.

much greater extent. At the same time, industrial expansion is likely to greatly accelerate the demand for capital goods and intermediates and components. To the extent that such demand has to be covered by imports, the pressure on the balance of payments is bound to increase substantially and the deficit on current account, which is already considerable, may increase still further.

33. While there has been considerable growth of machinery manufacture in recent years, the capital goods sector continues to remain comparatively under developed in terms of output while, in terms of volume of exports, the performance is relatively insignificant. The growth of this sector in Mexico, in fact, compares quite favourably with growth trends in Brasil, Argentina and India which can be considered to be in comparable stages of development. While the percentage of the manufacturing sector in gross GDP rose from 17.0 per cent in 1940 to 25.2 per cent in 1970, the share of machinery manufacture out of this figure was very small and amounted to only 1.7 per cent in 1967. The fabrication of metal products represented, in total, a GDP value of 14.5 thousand million pesos in 1970*, i.e. about 4.8 per cent out of total GDP. This percentage, however, includes a large volume of durable consumer goods and their components and the share of capital goods production continued to be extremely small. Since most production figures for the machinery sector include the production of durable consumer goods and auxiliary items and components, it is difficult to accurately assess the production of capital goods as such. From the present available data, however, it is estimated that the production of capital goods items was of the order of 4.75 thousand million pesos in 1970. The growth rate fell in 1971 owing to general slackening of industrial activity, but there has been considerable upsurge again in 1972 which is reflected in a much better order book position of machinery manufacturers.

---

* Banco de México - "Informe anual 1970".

3. Trade Structure

34. The industrial growth pattern, coupled with strong protectionist policies, had a significant effect on the country's trade structure and resulted in traditional import substitution of consumer products to a considerable extent. During the 1960's, as domestic industry extended to intermediate products, the proportion of such imports also declined, but imports of capital goods increased rapidly with the machinery needs of a fast growing economy. On the export side, there was a gradual increase in production of manufactured and semi-manufactured products. The changing structure during 1950 to 1969 may be seen from the following table.

Table IV*

Pattern of Imports and Exports of Goods
1950 - 1952 and 1967 - 1969

(in percentages)

	1950 1952	1967 - 1969
Imports		
Consumer goods	19	12
Intermediate products	52	45
Capital goods	29	43
Total imports	100	100
Exports		
Primary goods	68	59
Manufactured and semi-manufactured products	32	41
Total exports	100	100

* CEPAL and MAPTIMA, Ibid.

35. The pattern of Mexico's trade in terms of specific categories of goods during 1970 - 1972 may be seen in Table V. The share of manufactured goods in total exports rose to over 40 per cent in 1971, the growth rate - being over 15 per cent annually in value since 1955. As for imports, there has been ra[illegible] increase both of machinery and equipment and for components and intermediate products.

Table V

Principal Exports and Imports by Categories

1970 to 1972 (in million pesos)

Principal Exports 1970 - 1972			
TOTAL Exports	1970 17,169	1971 18,431	1972 22,654
1. Primary agricultural products	1,397	1,603	1,920
2. Processed agricultural products	5,203	4,986	5,887
3. Extractive industries	1,104	1,157	1,194
4. Manufacturing industries	8,210	7,857	10,609
a. Electrical machinery, equipment and materials	764	885	939
b. Components and spares, incl. for transport vehicles	869	1,326	1,970
c. Petroleum and derivatives	388	344	247
d. Refined lead	296	215	227
e. Steel sheets	259	365	413
f. Hormones, natural and synthetic	224	263	217
g. Printed material	210	142	156
h. Other manufactured products 1/	3,201	4,318	5,840
5. Unclassified products	477	539	646

Principal Imports 1970 - 1972			
TOTAL imports	1970 30,770	1971 30,[illegible]	1972 [illegible]
1. Consumption goods	[illegible]	[illegible]	[illegible]
a. non-durables	1,052	[illegible]	1,[illegible]
b. durables	[illegible]	544	[illegible]
2. Production goods	24,552	24,764	[illegible]
a. Primary materials, intermediates and components	12,035	[illegible]	[illegible]
i. Organic chemicals	1,784	[illegible]	[illegible]
ii. Steel and iron castings	1,[illegible]	1,[illegible]	1,[illegible]
iii. Automobile components	1,[illegible]	[illegible]	[illegible]
iv. Automobile spares	[illegible]	[illegible]	[illegible]
v. Others etc.	1,428	5,[illegible]	[illegible]
b. Machinery, etc.	12,523	12,[illegible]	14,[illegible]
i. Mechanical equipment	[illegible]	7,04[illegible]	[illegible]
ii. Electrical equipment	3,[illegible]	3,000	4,024
iii. Measuring and precision instruments	[illegible]	74[illegible]	1,[illegible]
iv. Other machinery	1,5[illegible]	1,250	1,454
3. Non classified items	[illegible]	4,1[illegible]	[illegible]

1/ Including lead oxide, metallic mercury, processed copper, steel and copper tubes, copper products, wood furniture, leather goods and material for shoe manufacture, ready-made clothing and musical instruments and parts.

Source: Nacional Financiera, "El Mercado de Valores, 7 February 1973 and 19 February 1973"

36. The geographical pattern of Mexico's trade highlights the very close trading links with the USA, which continues to be Mexico's principal trading partner. Imports from the USA during 1972* were US$ 1,721 million, constituting over 60 per cent of total imports respectively. Exports to the USA amounted to US$ 1,082.9 million in 1972, averaging about 70 per cent of total exports. Exports to LAFTA countries and to the Central American Common Market rose to US$ 172.7 million for 1972, constituting over 10 per cent of total exports. While the trade deficit with the USA was the highest (US$ 638.1 million in 1972), there was also a considerable deficit vis-a-vis the EEC countries (US$ 372.2 million in 1972). In respect of the LAFTA and CAMC countries, Mexico had a small trading surplus of US$ 48.1 million.

37. An important feature of Mexican exports of manufactured products to the USA is comprised by "border industries". This programme provides for duty-free, temporary imports of raw materials, components and other inputs, besides initial machinery and equipment for the manufacture of products which would mainly be exported. Foreign investment up to 100 per cent is permitted, although in fact only about half these enterprises have foreign majority ownership. The programme, which was initially introduced for an area up to 20 kms. from the border and along the coast has been extended to the whole country since November 1972. The number of such "border industries" or "maquiladores" as they are called, rose to 310 enterprises by February 1973, while value of machinery rose to over 620 million pesos by this date. These units have largely developed along the Mexican-US border, with the highest concentration in Ciudad Juarez (71 units), Tijuana (65 units), Mexicali (55 units), Matamoros (47 units) and Nuevo Laredo (29 units). The total number of employees in the "maquila" enterprises was 38,682 in February 1973. Since the extension of the "maquila" facilities to the whole country, 23 enterprises have also been approved

---

* Banco de México, "Informe anual 1972"

in other areas. The total exports in terms of value added through these units amounted to 1,500 million pesos in 1971 and to over 1,748 million pesos for the annual period ending February 1973. The principal sectors of manufacture ... garments, electronic items and components, light electrical products, textile and food products, sports goods and toys and other products, including automobile parts and accessories. This programme, which enables the use of much cheaper Mexican labour (10 - 15 per cent of US labour costs) for labour-oriented production for the US market, has brought considerable employment opportunities along the Mexican-US border. While the production volume and export earnings from such industries is likely to continue to grow fairly rapidly, it would be necessary to consider in the future as to how the range and sophistication of production could be extended, so that increasingly high value production could be undertaken. The principal sectors where "maquila" enterprises have developed, together with other features of such units is given in Table VI below:

Table VI

Principal characteristics of "maquiladoras" enterprises by branch of activity, approved up to end February 1973

(in thousand pesos)

Branch of activity	No. of enterprises	Persons Employed	Value of Machinery	Annual salaries and wages	Added annual value
1. Electrical and Electronic goods	123	21,299	272,025	376,956	856,410
2. Textile products	58	5,397	29,487	102,206	193,317
3. Food products	9	1,191	6,776	15,535	53,035
4. Sports goods and toys	9	3,163	19,480	55,482	51,059
5. Wood products	15	696	11,231	16,404	72,420
6. Other manufactured products	97	6,636	281,569	123,946	522,321
Total	310	38,682	620,568	690,529	1,748,562

Source: Secretaria de Industria y Comercio

Background of industrial policies and instruments

38. A very significant role in the realisation of the industrial growth pattern briefly described above must be ascribed to application of various fiscal and industrial policy instruments in Mexico. Rapid industrial development has constituted a principal cornerstone of Mexican economic policies over the last three decades. Since industrial growth has primarily taken place through private enterprises, policies have largely concentrated on maintaining a favourable climate for domestic investments and sales. Public-sector investments have increased considerably in the last decade. They have largely concentrated on infrastructure such as power generation, railways and highway construction and maintenance, but substantial investments have also been made in some basic industrial sectors such as steel, mining and petroleum and petrochemicals.

39. The policy pattern has been directed at general industrial growth, with a basic orientation towards import substitution. An elaborate system of import controls and tariffs have created a highly protected market for domestically produced goods. This has been combined with tax benefits and incentives and extensive facilities for the establishment of new enterprises. The policy approach has undoubtedly generated considerable domestic manufacture in various sectors to meet growing domestic demand, but the sheltered nature of the economy has also resulted in high costs of the domestically manufactured goods. There has also been little exercise of selectivity in promoting and channeling new investments into priority sectors and policy instruments have not consequently had a major impact on the sectoral structure of industry and sectoral resource allocations.

40. The policy trends and development since the advent of the new presidential regime in 1970 are indicative of the gradual emergence of a more comprehensive policy and a new orientation to the country's future industrial growth. Apart from simplified classification of

imports and import duties, export and other incentives, a number of institutions such as Instituto Mexicano del Comercio Exterior (IMCE) and funds for financial assistance have been established. The Decree of 20 July 1972 with regard to industrial decentralisation, has prescribed a new pattern of tax and other incentives, designed to move industrial activities away from the areas of heavy industrial concentration in the Federal District and industrial belts in the states of Mexico, Nuevo León and Jalisco. Legislation of far-reaching significance has come into effect (from 29 January 1973) for the regulation of inflow of foreign technology and commercial use of patents and trademarks. A legislation for the regulation of foreign investment will also come into effect shortly. The most important economic objective of governmental policy is, however, to maximise employment opportunities and this will necessitate major resource mobilisation and deliberative efforts for increased investments in labour-oriented production. The development of exports, particularly of manufactured products is another important goal and increased institutional assistance is being given in this regard.

41. It is necessary to briefly consider the principal features of the new policy measures embodied in the legislation for foreign investment and acquisition of foreign technology and other regulatory instruments in use at present, together with the incentives and facilities provided for in the Decree of 20 July 1972 and other promotional measures for new industries and for exports. These would have significant impact on the policy aspects of growth and programming of the capital goods sector, which are specifically discussed in Chapter VI.

42. The basic principle in respect of foreign investment is that such investments should be supplementary to domestic investment and must be fitted within an overall policy framework. The policy framework has now been defined through the new law for foreign investments which, by and large, formalises the existing policy towards such investments.

The law provides that certain sectors are reserved for the Government, viz. petroleum and hydo-carbons, basic petrochemicals, radio-active minerals and certain mining activities, electricity, including generation of nuclear energy, railroads, telegraphic and radio communications and other activities covered in different laws. Certain sectors have been exclusively reserved for Mexican companies without foreign shareholding, viz. radio and television, automotive transportation, airways and maritime transportation, forests, gas distribution, other activities such as banking, insurance, etc. specified in other laws, and ownership of land and waters within 100 kms. from the borders and 60 kms. from the coast. Foreign capital participation in the remaining sectors should not exceed 49 per cent, except in some sectors, viz. secondary petro-chemicals and automobile parts where it would be 40 per cent and in national mining resource areas where it would be limited to 34 per cent. Proposals would be considered by a National Commission for Foreign Investment, which could also allow higher participation in certain cases in the interests of the economy. A number of criteria have been set out which would determine whether a particular proposal would be approved, along with the percentage of capital participation.

43. The limit of 49 per cent foreign capital ownership has been in practice for many years and does not constitute any significant modification. The setting up of a National Commission, which would determine each case, represents a considerable improvement over existing procedures as the various concerned departments would be represented on the Commission. An important provision, however, is that the approval of the Commission would be required by foreign companies or foreign controlled companies before they acquire more than 25 per cent of equity capital or 49 per cent of the fixed assets of Mexican enterprises. It has also been prescribed that foreign shareholding must be in the form of nominative shares. The provisions of the new legislation however do not appear to constitute any disincentive or discouragement to foreign investment in fields where this

is considered necessary for the country's development. The impact of the foreign investment law would largely depend on the manner of its implementation and the guidelines that are developed for consideration of particular proposals. While a pragmatic and flexible approach would presumably be followed, the various criteria prescribed in the legislation would also inevitably introduce an element of selectivity, which has not been conspicuous in the past. A selective approach would probably be chosen also regarding the extent of foreign ownership in fields such as internal marketing and distribution and manufacture of consumer goods and relatively unsophisticated intermediate and machinery products, both at the stage of initial establishment of such enterprises and when major expansions are undertaken. The latter aspect is covered in the new legislation by the fact that permission of the Commission would be required before an existing foreign controlled enterprise undertakes the manufacture of new products or takes up new lines of activity.

44. The recent law on foreign technology makes it mandatory for all future and existing agreements relating to acquisition of foreign technology, patents and trademarks to be registered within defined periods of time in a registry set up for the purpose in the Secretaría de Industria y Comercio. Such registration would, however, be denied and the agreements thereby rendered null and void, if these contain clauses which violate certain principles and criteria set out in the law. While some of these principles are quite specific, such as the avoidance of clauses restricting the Mexican licensee from exporting or acquiring technology from other sources or binding the licensee to purchase of intermediate products and components from the licensor, there are also fairly broad and discretionary provisions, including the denial of registration if the cost of the technology is considered to be excessive. While the law would enable the effective regulation of foreign technology its impact would largely depend on the manner in

which it is interpreted and implemented. The guidelines and policies which would determine the approach of the technology registry in particular cases need to be formulated with great care. A pragmatic and fairly uniform approach is essential. Inflow of sophisticated manufacturing techniques is very necessary in a number of sectors. At the same time, acquisition of non-essential technology at high cost and availing of foreign trademarks on substantial payments only to exploit domestic consumer preferences can well be regulated to great advantage for the economy. Such regulation could also be directed towards the creation of a stronger domestic base for absorption and adaptation of imported techniques within shorter periods of time.

45. Existing procedures in Mexico also provide for certain other types of indirect regulatory control in respect of new enterprises. These controls are largely exercised by SIC and take the form of (i) approval of specific investment propositions received in response to the issue of "invitations" by SIC for setting up enterprises in particular fields, (ii) approval of the programme of integration and (iii) issue of import permits, together with the procedure of "closing the border" for domestically manufactured products.

46. In certain cases "invitations" are issued by SIC for submission of schemes for manufacture of particular products within a specified period. On receipt of the proposals, only the most suitable scheme, or schemes, are accepted. Since the invitation for submission of proposals is usually in response to a request from an enterprise interested in a particular sector or product, this can give such an enterprise a considerable advantage as it may not be possible for other companies to submit suitable alternative proposals within the stipulated period. While this procedural mechanism may be able to meet the problem of over-capacity in certain sectors, there is the danger that the market may be shut out to better offers from the

viewpoint of technology and exports. Moreover, local monopolies or semi monopolies may develop. It is important that a right balance is struck between avoidance of over capacity and utilisation of approved existing capacity on the one hand and encouragement of new proposals which are in the country's overall long-term interests on the other.

67. The insistence on approval of the phased integration programme (programas de fabricación) stems from the need for ensuring that maximum domestic integration is achieved as speedily as possible. Such approval is necessary in order to qualify for incentives and governmental assistance in various forms. The various criteria taken into account for approving the programme of integration include that (i) the product price should not be higher than 25 per cent above FOB prices of comparable imported products, except for machinery industries (20 per cent) and certain special industries such as automobiles where it is substantially higher, (ii) the materials and components should be at least 60 per cent of Mexican origin in terms of direct costs, with some allowances in the case of initial production years or export oriented enterprises, (iii) capital ownership should be at least 51 per cent Mexican origin, (iv) royalties for foreign patents and know-how should not exceed 3 per cent of net sales value per year, (v) products are of similar quality as similar imported products and services are provided according to comparable standards. While certain of these aspects would now be covered by the agencies set up under the new laws for foreign investment and technology, the approval of the manufacturing programme would still be an important requirement for new enterprises. The need for such approval, which extends to 1,086 enterprises at present, undoubtedly enables the Government to play a significant directional role and has been increasingly utilised in recent years. At the same time, it is important to allow a certain flexibility, particularly in regard to such sectors in which the price of domestic materials and inputs is unduly high.

48. The need for obtaining licenses for most imported products has developed into a powerful regulatory instrument for protection of domestic industry. The grant of import licenses rests with the Secretaria de Industria y Comercio but is channeled through a large number of import advisory committees on which manufacturers are represented. Once domestic production of an item is undertaken, the manufacturer can move the Government to "close the border" for that product. While certain criteria are considered at this stage, including the volume of domestic production in relation to demand and the domestic prices to be charged, the procedure nevertheless lends itself to the creation of a highly sheltered domestic market. An inevitable consequence has been a high price structure for most domestically manufactured items with correspondingly limited emphasis on productive efficiency. While the official policy approach is that protection would not exceed 25 per cent over the price of comparable imported products, this is not taking place in practice for a very large number of products. In order to achieve greater competitiveness in international markets and to decrease prices through greater productive efficiency, it is necessary to reduce import controls gradually to the more reasonable level which has been pronounced to be the official policy.

49. It will be seen that the regulatory mechanism and procedures outlined above constitute in effect, an indirect form of investment licensing. The industrial licensing mechanism has been utilized in some developing countries quite effectively, to direct investible resources away from non-essential sectors and fields where existing production capacity is adequately developed. Such a system, whether direct or indirect, as in the case of Mexico, has certain drawbacks in the form of bureaucratic delays and bottlenecks and unnecessary regulatory control in a number of cases. At the same time, in most developing countries of the size and present stage of development of

Mexico, it is difficult to visualise the operation of a completely free market mechanism. What is essential, however, is to ensure that the various regulatory measures are effectively co-ordinated both in terms of policies and procedures.

50. One of the principal policy features in Mexico has been a strong protectionist policy over the last two decades. While protective tariffs played a significant role during the post-war period and the early 1950's, the emphasis gradually shifted to import controls as an instrument for achieving import substitution. Nevertheless, the tariff structure is of importance and may become increasingly so in future, not only as a source of revenue but as a policy instrument.

51. The pattern of tariffs remained relatively constant since 1954 though the rates for individual products were modified in many cases during this period. The Decree of 27 December 1971 (Decreto que modifica la tarifa del Impuesto General de Imporación) brought about considerable simplification of import classifications and tariffs and a major modification was the imposition of an uniform ad valorem duty of 20 per cent on over 1,200 items, in place of the system of specific duties, which was earlier imposed in addition to an ad valorem content which was linked to an "official price" modified from time to time. For machinery items an "official price" of five pesos per gross kg. has been prescribed and greater uniformity provided in respect of spare parts and accessories.

52. An earlier study* of the average level of tariffs for various sector groups, which was based on the input-output matrix of 1960, brought out the fact that the average nominal tariffs (33 per cent) for the manufacturing sector exceeded the average rates of implicit

---

* Gerardo Bueno - "The structure of protection in Mexico" Unpublished manuscript, 1970.

nominal protection (25 per cent) though the figures varied considerably from industry to industry. For the machinery sector, however, the tariffs were only 11 per cent, against a price differential of about 29 per cent. In terms of effective protection, which exceeded the nominal implicit protection in most industries, the level has been very high for consumer durables (101 per cent), high for basic chemicals, wool, pulp and paper, etc. (from 49 to 91 per cent) and relatively low for certain items such as pharmaceuticals (10 per cent). The effective rate of protection in the machinery and transport equipment sector was about 41 per cent, but this figure emerges largely due to the high level of protection on basic imports (74 per cent on basic metals). By and large, the level of protection for capital goods and machinery items has tended to be very low and is, in any case, covered by Regulation 14 which provides for a 65 per cent subsidy on import duties on machinery, apparatus and parts used directly by industrial enterprises including new units. In fact, low duties on capital goods, supplemented by the above subsidy, has been treated as an important incentive for industrial development.

53. While tariffs in recent years have been increasingly used as a primary source of revenue, the most important instrument of protection is provided through import controls, which now extend to over 75 per cent of value of imports in most production sectors. The consequences of a highly regimented system of import control along with the procedural mechanism for issue of import licenses have been briefly discussed in an earlier paragraph. The gradual replacement of strict import controls by reasonable protective tariffs in most sectors other than luxury goods and non essential products where such controls could continue, would appear to be an essential step for developing greater production efficiency and lower costs in most manufacturing sectors.

54. On the promotional side, it is necessary to consider firstly the availability of domestic industrial finance. While total banking finance for industry increased from 42,044 million pesos in 1965 to 89,849 million pesos in 1970, the general financing pattern has nevertheless been that almost 70 per cent of capital requirements for industry has had to be raised through self financing by the enterprises, with bank credit covering about 15 to 20 per cent and the balance being covered by direct foreign investments or external credits. In many developing countries, institutional finance is available to a far greater extent than has been available in Mexico until recently. Apart from availability of finance, interest rates in Mexico are much higher than in many developing and industrially developed countries. Although the official interest rate charged by banks is 12 per cent, commissions and other charges generally raise the operative interest rate to 15 - 18 per cent.

55. In recent years, greatly increased facilities have been provided for institutional financial assistance. The Nacional Financiera S.A., which has performed a key role as the country's industrial development bank, continues to discharge this function both through equity participation and loan finance for various critical sectors. A new fund, the Fondo Nacional de Fomento Industrial (FOMIN) has been created and is administered by Nacional Financiera to provide both capital participation and long term credit to assist the establishment and expansion of medium sized enterprises. The Fondo de Garantia y Fomento a la Industria Mediana y Pequeña provides credit for small and medium industry through various banking institutions. The Fondo de Equipimiento Industrial (FONEI) has also recently been created, with assistance from the International Bank for Reconstruction and Development, primarily to financially assist export oriented enterprises. Besides, institutional finance has been provided for certain specific purposes such as the Fund for Development of Industrial Areas and Zones (Fideicomiso para Estudios y Fomento de Conjuntos, Parques y Ciudades Industriales) and the fund for pre-investment studies

(Fondo Mixtos Revolventes para Estudios de Preinversión). A special fund for assisting exports, the Fondo de Fomento para Exportaciones (FOMEX) discharges a very useful role in export development, which is discussed in a later paragraph.

56. Tax concessions given to "new" or "necessary" industries under the Law for Development of New and Necessary Industries have constituted an important policy instrument for many years, the period of exemption ranging from 5 to 10 years, depending on whether the industry was considered to be secondary, semi-basic or basic. Enterprises qualifying for such incentives are required to have a domestic manufacturing content of 60 per cent and a minimum added value of 10 per cent*. These incentives have been usually granted expost facto and because of this, together with the large element of administrative discretion involved, such incentives often did not affect initial investment decisions as such. The Decree of 20 July 1972, which has linked such tax concessions to different geographical locations in the country, has provided a welcome degree of certainty regarding the extent and nature of available tax incentives. Intended primarily as an instrument of industrial decentralisation, the Decree has prescribed tax exemptions from import duties (from 50 - 100 per cent), stamp duties (50 - 100 per cent), income tax on global income (10 - 40 per cent), federal sales tax (50 - 100 per cent), tax on property gains if re-invested in zones 2 and 3 or in the same zone (60 - 100 per cent) and accelerated depreciation. The tax exemptions vary for each of the three zones and for different categories of industries within the above ranges. The period of exemptions is generally five to ten years in Zone 3 and from three to seven years in Zone 2, while it is two to five years for industries that rationalise production and increase efficiency so as to reduce the final price by 5 per cent for at least two years. The Decree provides that such exemptions would be extended to firms (i) which are 51 per cent Mexican owned

---

* For a more detailed discussion of tax concessions prior to July 1972, reference is invited to the Report of Phase IA, pages 71 - 76.

and have a majority of Mexican directors; (ii) which pay foreign royalty of 3 per cent or below, and (iii) whose domestic content is at least 60 per cent or subject to an approved integration programme. Non-fiscal incentives for general dispersal of industries include the provision of credit on favourable terms for the less developed zones and advisory services for small and medium industries.

57. Viewed as a measure which clearly defines the scope and extent of tax incentives in different regions, the Decree undoubtedly represents a considerable advance over earlier policies and procedures. Although the detailed pattern of incentives varies for the seven broad categories of industries defined in the Decree, it is now possible for possible investors to assess the likely tax benefits they would receive before making their investment decisions. The major tax benefits of course accrue to industries which are new to the country and are located in zones 2 and 3 as these qualify for all the above incentives. In most other categories, such as industries that are new to the region where they are set up or which cover production gaps by more than 20 per cent or which are labour oriented and based on agricultural and other local raw materials, the incentives which would be available would be other than the income tax rebate.

58. One of the major objectives of present governmental policy is the development of exports, particularly of manufactured products. Institutional finance and other assistance is provided through FOMEX and the new fund, FONEI, both of which are administered by the Banco de México. FOMEX has played a key role in recent years in financing exports through its re-discounting facilities. Guarantees against export risks are provided by the Compañía Mexicana de Seguros de Crédito (COMESEC). Export finance provided through FOMEX rose to 2,418 million pesos in 1971 and 3,272 million pesos in 1972, of which 75 per cent was in short-term credit of less than 180 days. Pre-shipment finance covering financing of production and

inventories of Mexican companies rose to 500 million pesos in 1971 and 758 million pesos in 1972. Export credits are provided by FOMEX for periods up to 7 or 8 years. The Fund for Industrial Equipment (FONEI) was set up in 1972, for promoting the establishment, expansion and modernisation of enterprises which are export oriented. This institution would be in a position to finance up to 65 per cent of capital cost requirements of new, export oriented projects and up to 72 per cent in the case of expansions. For the co-ordination and servicing of export programmes, the Instituto Mexicano de Comercio Exterior (IMCE) was created in 1971. This organisation has already extended its field operations to a number of countries and is playing a key role in export development.

59. Considerable financial assistance in the form of tax concessions is also given for exports. Tax refunds are in the form of certificates, called Certificados de Devolución de Impuestos Indirectos, or CEDIS. Such CEDIS extend now up to 10 - 11 per cent of the value of actual exports, provided domestic integration is not below 60 per cent. Refund of indirect taxes (Federal Sales Tax) is also allowed to the extent of 50 per cent where domestic integration is 50 per cent of direct costs and up to 100 per cent where integration is 60 per cent and above. In March 1971, the regulations regarding assistance for exports were comprehensively revised, covering the latter provisions, together with facilities for temporary imports of materials and components for exported products and for the Border Industries programme.

60. An important scheme for additional tax concessions in respect of exports has also been introduced recently. This provides for additional reimbursement of up to 4 per cent of indirect taxes payable by exporting firms, provided that such exports are channeled through either a consortium of firms or by an export service firm.

This tax incentive would, however, be conditional to annual increase of exports by a certain minimum percentage. It is also envisaged that this tax relief would be utilised for specific export promotion and marketing activities by the consortia and export service units.

61. The principal features of industrial growth in Mexico and the pattern of fiscal and industrial policies and policy instruments have been outlined in the above paragraphs. These policies and procedures inevitably have very great significance for the growth of the capital goods sector. The specific implications of various policies and policy instruments on capital goods industries, together with recommendations regarding policy measures considered necessary for the rapid and sustained growth of this sector are discussed in Volume IV.

TRENDS AND FEATURES OF CAPITAL GOODS PRODUCTION IN MEXICO

62. The rationale for a specific development programme for the capital goods sector in Mexico stems from the fact that the growth of this sector has not kept pace with general industrial expansion and that a structural imbalance is tending to develop. As pointed out earlier, industrial growth has largely concentrated on production of consumer products, including durable consumer goods in recent years, while the growth of capital goods has lagged behind. With rapid industrialisation, this lag will tend to get increasingly accentuated.

1. Need for capital goods manufacture

63. The growth of producer goods manufacture needs to be viewed as an important stage in the industrial growth of rapidly developing countries such as Mexico. With progressive industrialisation, demand for capital goods invariably tends to increase at an accelerated pace, together with demand for processed raw materials, components and intermediate products. Apart from the increasing import burden that would consequently devolve through post intermediate growth stages, the technological aspects of capital goods manufacture in themselves need to be absorbed in the process of growth of technical knowledge, skills and aptitudes. The relatively higher application of the labour factor in producer goods manufacture, as compared to sophisticated process technologies in other sectors, also has considerable relevance in terms of greater employment opportunities, both in the final production stages and in the manufacture of sub-assemblies, components and intermediate products through ancillary plants. Balanced industrial growth necessitates the growth of machine building industries on a pattern which bears a close and consistent relationship with overall industrial expansion.

64. The co-ordinated growth of the capital goods sector constitutes an important link in the chain of future technological progress in Mexico. The production of more sophisticated machinery and machine tools is essential for the development of domestic skills and the building up of skilled manpower resources in greater precision manufacture, apart from constituting a base for absorption and future adaptation of technology and manufacturing techniques in the heavy machinery field. The planned growth of this sector would also enable concentration on those machinery branches in which the country has a comparative advantage, particularly in terms of labour costs and aptitudes. The production of heavy machinery and capital goods equipment acts as a strong catalytic agent for the growth of the metal transformation sector in general, particularly in respect of a wide range of intermediate products.

65. The determination of an appropriate pattern for capital goods development at a particular growth level is a complex task, as various economic and technological factors have to be taken into account. Whereas infra-structure facilities and basic industries such as steel and aluminium are relatively easier to plan for, the capital goods sector requires a comprehensive, selective and co-ordinated approach to problems of investment, resource-allocation and inflow of technology. The relatively limited investment in this sector in the past by domestic industry due to the complex nature of capital goods production and the long gestation period is indicative of the need for not leaving the future growth of this sector to market forces alone. The identification and selection of capital goods, which can be domestically produced on a competitive basis, has to follow a careful evaluation of future domestic demand and export prospects. In the formulation of specific projects also, aspects of governmental policy and entrepreneurial initiative, together with the role of foreign investment and technology, have to be carefully dovetailed to a much greater extent than in most other manufacturing sectors. A selective and co-ordinated approach

should ensure not only that the principal production and technological gaps are covered to the extent that this is economically feasible, but that the progressive development of exports of capital goods products can be effectively planned for.

66. The principal factors which so far have militated against the growth of the Mexican capital goods sector have mainly been the limited domestic market and inadequate specific policy support for this basic sector. Investible resources have consequently been directed into more profitable consumer goods production. During the 1960's and to a certain extent even at present, the domestic market for capital goods items has been fairly limited. However, the growth projections of domestic demand being shown in the next chapter indicate that domestic demand is likely to increase rapidly. Besides it is necessary to take into consideration the possibilities of exports to the rapidly growing LAFTA market, and also to the USA, of capital goods equipment together with components and auxiliaries. Capital goods production, involving longer gestation periods, complex technology, high capital outlay and relatively lower initial returns in many cases as compared with consumer goods production, has proved to be less attractive to domestic industry in the past. As brought out in Volume II, Chapter A, no special policy emphasis appears to have been given until recently to the growth of the capital goods sector. In fact, while domestic production of consumption goods, including consumer durables, increased rapidly within the shelter of import controls, the producer goods sector has had, in general, to face strong foreign competition because of facilities for import of initial machinery and equipment and the low tariffs on such imports. The credit arrangements for various projects also rendered it extremely difficult for domestic capital goods manufacturers to compete with foreign manufacturers, particularly in initial years of manufacture. The growth of the capital goods sector in a developing economy does entail an effective, deliberative and co-ordinated policy designed for this purpose and in the absence of such an effective policy and well defined priorities, growth in this sector is bound to be somewhat patchy, as it has been in Mexico hitherto.

2. Growth rate of capital goods manufacture

67. The growth rate for manufacturing industry for 1960 - 1970 was 12.8 per cent*. On a low initial base, the production of machinery increased at a faster rate of over 18 per cent during this period. This percentage, however, includes durable consumer goods and componente, together with the value added portion of the metal transformation sector in the border industries. If the sectoral GDP figures are translated in terms of gross production for the machinery sector as a whole, using broad co-efficients applicable to manufacturing industry, gross production appears to have increased from 14,400 million pesos in 1960 to about 22,500 million pesos in 1970. Of this total figure, the share of capital goods production in terms of non-electrical and electrical machinery and components is estimated to have reached 21 per cent by 1970. The gross production of capital goods items is estimated to have increased from 2,310 million pesos in 1965 to 4,750 million pesos in 1970. The growth rate for this sector is assessed to be over 15 per cent for the period 1965 - 1970.

68. It is difficult to make specific growth projections of the capital goods sector during 1976 - 1980 as this would largely depend on a number of variable factors. On the basis of production trends and known expansion programmes in capital goods enterprises, it is reasonable to assume that the sectoral growth rate during the decade 1970 - 1980 will be about 14.5 per cent. On this basis and calculated at fixed prices (1968 prices), gross production in the capital goods sector is estimated to increase in millions of pesos as follows:

1975	1976	1978	1980
9,348	10,702	14,032	18,392

---

* Banco de México, "Informe anual 1970."

While these projections do not wholly correspond to the projections of capital goods imports in relation to total demand projections for this sector, the difference can be explained by the fact that the classifications used are somewhat different in the two cases. In the latter case, the projections are derived largely from import statistics and application of general co-efficients regarding capital goods requirements in various sectors. In so far as price trends are concerned, a constant increase of 3 - 4 per cent can be assumed. The above projections however, rest on the assumption that investment and production trends follow the pattern as appear to be evident at present.

69. Since the projected increase in demand during 1976 - 1980 is likely to be much higher than the above production estimates, there would continue to be a considerable gap between capital goods requirements and domestic manufacture, largely because of the substantial backlog in capital goods production in relation to overall industrial growth. While this gap itself is quite substantial, as brought out in the next chapter, it is also necessary to take account of export possibilities in this field.

3. Exports of capital goods

70. Exports of machinery products, including components and spares, continue to be relatively small, as can be seen from the following table:

Table VII*

Exports of machinery and parts (1969 - 1972)

(in million pesos)

Category	Value of exports in 1969	Value of exports in 1970	Value of exports in 1971	Value of exports during 1972
1. Machines, apparatus and electrical materials	448 (2.6%)	764 (4.45%)	885 (4.91%)	938 (4.1%)
2. Parts, components and spares, including repairs (but excluding transport equipment and components)	331 (1.9%)	443 (2.58%)	694 (3.58%)	1,103 (4.9%)
Total	779 (4.5%)	1,207 (7.03%)	1,579 (8.58%)	2,041 (9%)

Note: Percentage figures in brackets refer to percentage of total imports.

70.1 The above classification obviously does not relate to capital goods exports as such but covers a wide variety of products and services relating to the mechanical and electrical manufacturing sector as a whole. The item machines and apparatus includes a large number of consumer durables classified as machinery products, while components and spares of such products are included in the next category in the table. The item electrical materials refers to various products such as cables, conductors and the like which are

* El Mercado de Valores, 19 February 1973. (For 1972 figures)

used in the manufacture of electrical goods but which are not included in the capital goods definition adopted for this study. The export figures for parts and components of transport equipment have been specifically excluded, as these are separately categorised in the export classification and are not covered by the present study. The exports of heavy machinery and equipment as such has been relatively insignificant. Certain capital goods items have been exported mainly to Central American countries in recent years. In addition, machinery and components are being exported to the USA, some of them under a special arrangement between the Government and the automobile industry.

70.2 As is seen from Table VII, the growth rate for exports in 1970 as compared to 1969 was 55 per cent and 29 per cent for 1972 as against 1971. The components and spares exported have generally been of comparatively low sophistication, and primarily comprise items where there is a great degree of labour input.

70.3 Exports of components and parts are likely to grow at a fairly rapid pace and a projected growth rate of 15 per cent for these items, together with general machinery products and electrical materials up to the period 1976 - 1980 appears reasonable. This would increase the volume of exports in the categories grouped in Table VII to 3,572 million pesos by 1979 and 6,245 million pesos in 1980. In fact, exports of general machinery products and components and processed materials for consumer durables could increase at an even faster rate if special efforts were made by major domestic enterprises. These above trends can serve only as general indicators and it needs to be emphasised that the categories included above mostly relate to relatively low value items. A more dynamic programme for capital goods production, oriented towards exports of more high value products could achieve far better results on the export front.

4. Features of capital goods production in Mexico

71. The pace of capital goods manufacture has on the whole been relatively slow in Mexico. Yet there has been considerable growth in certain branches.

72. The industrial census of 1965 classifies the production units of machinery and metal fabrication having more than fifty workers as follows:

Table VIII

Classification of enterprises manufacturing machinery items*

Number of Workers	Number of Enterprises			
	Metal Fabrication	Mechanical Machinery	Electrical Machinery and Equipment	TOTAL
(1) Over 500	9	6	15	30
(2) Between 251 and 500	42	27	41	100
(3) Between 101 and 250	134	36	102	272

Of these listed enterprises about 80 are engaged in the manufacture of capital goods (non-electrical and electrical)**. As to their location, machine building plants are largely concentrated in the Federal District and the State of Mexico, together with Monterrey and Guadalajara. Some major fabrication and producer-goods enterprises have also developed in Queretaro, Veracrus and Puebla.

---

* Census of Industry, Mexico 1965.

** Small workshop including small components manufacturers are not included.

73. Domestic capital goods enterprises range from comparatively small engineering and assembly units to large industrial complexes undertaking heavy fabrication and fairly complex machining. While a detailed assessment of domestic manufacturing capacity on the basis of field studies has been made in Chapter B of Volume III, it may be mentioned here that, in the non-electrical equipment sector, domestic manufacture extends to (i) construction equipment of various types; (ii) industrial boilers and chemical equipment, including heat-exchangers, distillation columns, condensers, pressure vessels, etc. up to certain ranges; (iii) miscellaneous industrial equipment for specific industries, such as cement, foundries, packaging, flour-milling, etc. (iv) cranes and heavy steel fabrication, (v) pumps and compressors up to certain ranges, (vi) gears and gearboxes to a limited extent, (vii) handling and conveying equipment, (viii) diesel engines and components up to limited ranges and (ix) certain limited ranges of machine tools such as engine lathes in small and medium sizes and light and medium shears, bending machines, etc. In the electrical equipment field, domestic manufacture extends mostly to medium capacity electrical equipment such as transformers, motors up to certain ranges, switchgear equipment and furnaces up to certain ranges. While the broad coverage of domestic production is fairly wide, the level and range of sophistication varies considerably in the above sub-sectors. By and large, production is confined to relatively unsophisticated machinery items, with a substantial import content. Production has hitherto been primarily geared to the domestic market.

74. A significant feature of domestic capital goods production has been that production costs and domestic prices tend to be considerably higher than international prices for a large number of machinery products. This is despite the fact that labour costs are substantially lower than in industrially advanced countries, particularly the USA. Labour costs in the Mexican metal transformation sector range from 6 pesos to 14 pesos per hour for relatively semi-skilled labour, as compared to

over 62.50 pesos (US$ 5) per hour in the US. Labour productivity has also been fairly satisfactory, wherever adequate in-plant training programmes were undertaken. In some plants, it was noted that in certain operations such as arc welding and in heavy weldments, lower man-hour standards have been achieved in Mexican plants than in those of highly industrialised countries. In some cases, capital goods enterprises stressed the problem of obtaining suitable labour with adequate technical background and this may well necessitate more intensive programmes of technical training by governmental agencies, as also by enterprises themselves. By and large, however, the much lower labour costs and the high level of productivity, subject to adequate in-plant training being provided, constitutes a major factor advantage for capital goods manufacture in Mexico.

75. The main reasons quoted by producer goods manufacturers for higher costs were (a) higher cost of raw materials, (b) higher cost of intermediate inputs, including castings and forgings, components and auxiliary items, and (c) low volume of production. In respect of steel categories, the cost differential is fairly high, flat-rolled products being over 30 per cent above US prices, while the differential on certain special grades of steel and alloys is even higher. On other steel products such as billets, wire-rods, sections and structurals, the cost differential ranges from about 10 - 20 per cent. As for inputs in the form of castings and forgings, standard parts and auxiliary items such as motors, etc., any generalisation is difficult. A few machinery manufacturers are able to obtain castings at competitive prices and have been able to export finished products in substantial quantities, while others complained about the quality of castings and the extra machining that was involved on this account. With regard to standard parts also, difficulties appear to be experienced by many machinery manufacturers in obtaining adequate quantities at competitive prices. On auxiliary items, there appears to be a cost differential of 10 - 20 per cent in respect of a number of items. Thus, while part of

the higher costs are undoubtedly due to higher raw material costs, the major problem to be solved is that facilities for the production of standard parts and high quality castings and forgings will require considerable expansion and improvement.

76. The low production volume of the capital goods industry undoubtedly constitutes a major problem. There is considerable under utilisation of capacity in this sector, with an average shift operation of 1.6 and with most of the plants operating at between 40 - 60 per cent capacity. This is partly due to the fact that installed capacities is higher than the requirements of the domestic market. Much of this equipment was delivered as second hand equipment from abroad (mainly USA).

77. The fact that a large number of capital goods enterprises in Mexico have a substantial degree of foreign capital investment and control has had an important bearing on development of exports in this sector. Many of the enterprises are local subsidiaries and affiliates of multi-national companies, mostly from the USA, and while considerable technology inflow has taken place to meet domestic demand requirements, there was little tendency in the past to develop export markets through the Mexican unit. Undue dependence on the parent company for technological information and developments has also been a relatively common feature and there has been very limited effort in research and development. In cases when Mexican companies obtained technology under licensing arrangements, a clause was often included restricting exports. In many cases, harsh restrictive terms and payment provisions were also incorporated. In some cases, the prices of imported components were unduly high and inflated costs of finished products. While technological inflow is necessary, it must be obtained on reasonable terms and needs to be closely linked with local technological adaptation and development of export markets. This did not take place in Mexico to any material extent. In recent years however, greater efforts for exports have been made by some foreign controlled enterprises, both to the LAFTA countries and, in some cases, to the USA. Among the most successful exporters of capital goods

products, however, are some relatively small domestic enterprises which are not foreign controlled, have wholly domestic investment and hold no foreign technology licenses. It is necessary that, in the coming years, a new pattern of foreign investment and collaboration should develop in so far as this sector is concerned. Apart from minority foreign holdings, such foreign collaboration should be increasingly oriented towards exports and to the establishment of units which are internationally competitive. Technology inflow has also to be increasingly tailored to what is appropriate in the Mexican context and suitable programmes for training and for research and development must be incorporated as essential features of new projects in this sector.

78. An important feature, following from the dependence on foreign technology in this sector, is the inadequate development of facilities for designing and detailed engineering services. Even though fabrication and machining facilities have expanded considerably, machinery and equipment designs still continue to be largely obtained from external sources. Similarly, engineering services for complete plants are still often acquired from foreign agencies. Greater attention is necessary in respect of these aspects, both by capital goods enterprises and by domestic consultancy agencies which should develop greater expertise in planning and designing integrated plants based on domestic manufacturing capability.

79. An aspect related to the use of foreign technological services and designs has been the multiplicity of capital goods equipment imported into the country over the years. A typical example is that of industrial turbines and equipment for the sugar industry where 20 to 25 different types have been imported. Not only does this cause considerable difficulty in obtaining spares and replacements but it places domestic manufacturers at a considerable disadvantage. It is important that a certain degree of variety reduction in the requirements of capital goods equipment for various branches is brought about,

as a measure of policy so that domestic manufacture can be better planned. A similar problem is posed in respect of the standards system, particularly in respect of capital goods equipment. Multiplicity of standard measurements is creating an increasing problem. It would be desirable if machinery imports and local manufacture could be based on the metric system and in accordance with ISO (International Standards Organisation) standards. If certain fields are not covered by ISO standards, the DIN (Deutsche Industrienorm) standards could be applied. Existing enterprises are not yet following the metric system in a number of cases and it would be desirable to adopt this system over a period of time.

80. The growth of the capital goods sector in Mexico has not followed any co-ordinated pattern. To a large extent, it has been the result of pressures of limited import substitution, combined with coverage of a protected, domestic market and achieved through transfer of used plants and equipment. There has also, however, been commendable initiative and enterprise on the part of a number of Mexican entrepreneurs in this sector, together with modernisation of machinery and manufacturing processes in a number of units. Though some of the transferred plants continue to use machinery and techniques which have become obsolescent in a highly competitive sector, the majority of capital goods enterprises can achieve international competitiveness, provided suitable improvements and expansions are undertaken. The quality of equipment manufactured is, in most cases, comparable by international standards and the problem is primarily that of reducing costs.

81. The pattern and features of capital goods production in Mexico highlight the need for (i) identification of the major production and technological gaps in producer goods manufacture, (ii) evolving a scheme of priorities intended to cover such gaps as are economically feasible to undertake, both from the viewpoint of selective import

substitution and export growth, and (iii) preparation of a co-ordinated development programme to bring about a higher level of manufacturing efficiency, so that products can effectively compete in international markets. This must necessarily take the form of more selective specialisation by Mexican plants, with advanced technology and manufacturing techniques, suitably adapted to local conditions and factor advantages.

82. The nature and scale of capital goods production necessitates manufacture on an internationally competitive basis and Mexico's growing domestic demand can, at best, serve as a strong foundation. At the same time, the country's factor endowments in terms of rapid growth, geographical location, relatively cheap labour, infra-structure development and other resource advantages and facilities could undoubtedly enable the effective growth of this basic manufacturing sector on a primarily export oriented basis, provided selectivity and co-ordination can be adequately ensured.

VOLUME III

Identification of Capital Goods Sector Growth Potentials

A. PROJECTIONS OF DEMAND AND IMPORTS OF CAPITAL GOODS

83. For identifying the major gaps likely to emerge in the capital goods sector, an assessment of machinery requirements in Mexico was made for the period 1976 - 1980 at two levels. Firstly, macro projections were made of machinery needs for the domestic market, based largely on the growth trends in the industrial branches which constitute the main users of the machinery. Secondly, fairly detailed projections have been made of the requirements of specific machinery for the principal user branches, together with likely imports of such items during 1976 - 1980. In this chapter, projections have been made of the likely imports of various categories and types of capital goods during 1976 - 1980, on the assumption that the present production pattern of such manufacture remains largely unchanged and that no special efforts are made for resource channeling into this sector together with necessary policy adjustments. Account has, however, been taken of increased production in existing enterprises for the period up to 1980, along with expansion proposals which are under consideration. The import projections serve to highlight the machinery branches where major production gaps are likely to emerge in the next few years from the viewpoint of domestic demand, and would constitute the basis for examining manufacturing possibilities which are discussed in the next chapter.

1. Growth projections of industrial branches

84. The macro projections of capital goods requirements were based primarily on the projected investment in fourteen major industrial and other production sectors, viz. iron and steel, non-ferrous metals (particularly aluminium and copper), mining, construction, cement, pulp and paper, sugar, chemicals and petro-chemicals, food processing, textiles, machine tool manufacture, electrical and electronic industries,

as well as agriculture and electric power generation. An assessment was made of likely new investments and expansions in each of these sectors up to 1980*. The growth trends naturally varied considerably for the various sectors. Steel production, for example is anticipated to increase from 4.9 million tonnes** in 1971 to 6.5 million tonnes in 1975 and 10 million tonnes in 1980, the latter figure being achieved through the second phase of the proposed Las Truchas complex and expansion of other steel plants. Production of aluminium is expected to rise from 40,000 tonnes in 1971 to 140,000 tonnes in 1980, while copper production is expected to increase from present 72,000 tonnes, by 8.5 to 10 per cent annually. Besides, for the opening of new mines, investment in the mining industry is expected to largely take the form of modernisation of existing mines . The construction industry is expected to continue to grow at a rapid pace, with water works, roads and highways, railroads and river transport accounting for investments of about 6.1 thousand million pesos in 1980. Cement production is anticipated to grow at 7 per cent annually with production reaching 14 million tonnes by 1980, while paper production is projected to increase from 0.9 million tonnes to 1.69 million tonnes in 1976 and to 2.86 million tonnes in 1980, including newsprint. Sugar production is estimated to rise from 2.23 million tonnes in 1970 to over 3.9 million tonnes in 1980, with substantial investments in modernisation and rationalisation of existing capacity. The production of chemicals and petrochemicals is likely to increase from a value of 15.2 thousand million pesos in 1970 to 61 thousand million pesos in 1980, with a high growth rate of over 15 per cent. Textile production is anticipated to rise from 4.79 kgs. per capita in the 1960's to 8.52 kgs. per capita by 1980 with a growth rate of over 8 per cent. Investment in power generation would continue to be very heavy, with annual generation capacity increasing from 26 thousand million KwH in 1970 to 80 thousand million KwH in 1980. The machine tool industry, which is

---

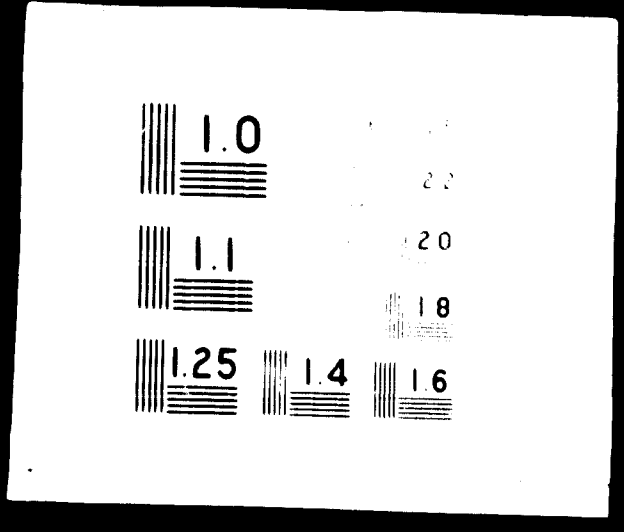
* For a detailed examination of the growth and investment trends in each of these sectors, reference is invited to the report of Phase IA.

** "tonnes" refers to metric tonnes.

76. 04. 27

2 OF 4

05967



relatively undeveloped at present, is expected to show a fairly high growth rate, with annual production rising to about 2[illegible]0 million pesos by 1980. The electrical and electronic industries are also likely to grow rapidly, with production largely in the form of consumer durables. With greater stress on agriculture, investment in the agricultural sector is likely to be much higher during the next few years. The total volume of investment in these fourteen major sectors together with allied branches, is estimated to be about 325 thousand million pesos in total during 197[illegible] - 1980.

2. Capital goods requirements

85. Based on the above investment trends in the principal production sectors, broad estimates were made of capital goods requirements and likely sectoral imports. The sectoral machinery requirements were assessed largely on the basis of co-efficients of machinery investment in each of these sectors, suitably adjusted to the manufacturing pattern of Mexico. The import estimates were arrived at on the basis of import actuals for 1965 - 1969 being projected for 1976 - 1980, through application of co-efficients derived from the investment trends in each sector and on the assumption that domestic capital goods production would, by and large, follow existing trends and patterns. Table IX indicates the projected total figures of capital goods requirements and likely machinery imports, sector by sector, for the period 1976 - 1980 (expressed in 1968 prices).

Table IX

Projections of capital goods requirements and likely imports
1976 - 1980*

(in terms of 1960 prices)

	Selected Sectors	Projections of capital goods requirements 1976 - 1980	Projections of likely machinery imports 1976 - 1980
1.	Iron and Steel	4.63	3.74
2.	Non-ferrous metals	3.38	2.63
3.	Mining	4.50	2.72
4.	Construction	9.40	2.83
5.	Cement	2.34	1.34
6.	Pulp and paper	4.63	3.46
7.	Sugar	3.39	0.70
8.	Chemicals and Petrochemicals	18.00	4.18
9.	Food processing industries	7.42	3.58
10.	Textiles	11.20	11.08
11.	Electric power generation	15.00	10.24
12.	Electrical and electronic industries	2.53	1.86
13.	Agriculture	15.84	3.95
14.	Machine tool industry	.50	0.39
	Total for the above sectors	102.76	52.70

* While most of this table has been adopted from the report of Phase IA, certain adjustments have been made in the last column in the light of additional studies made during this phase.

86. The gross production of the above sectors constitutes about 50 per cent of total gross production. While the above projections are necessarily very approximate, they serve as reasonably good indicators of sectoral machinery demand and likely import trends in 1976 - 1980. It is, however, necessary to also project the above estimates for the economy as a whole. Since the remaining production sectors were not examined in detail, estimates have been made by relating the marginal value of required capital goods with the marginal value of total investment. This ratio is estimated to be 22 per cent for the remaining sectors as against 33 per cent for the fourteen selected sectors. On this hypothesis, domestic capital goods requirements are expected to increase from 102.36 thousand million pesos for the fourteen selected sectors to 174 thousand million pesos (in terms of 1968 prices) for the economy as a whole, during 1976 - 1980. Capital goods imports for the economy are likely to be of the order of 84 thousand million pesos (at 1968 prices) for this period*.

87. It should be noted that the above demand estimates relate primarily to the domestic market and that possible capital goods exports have not been taken into account. Such exports have so far been relatively insignificant and have mostly consisted of machinery components and parts. By 1980, however, the export pattern should have been changed considerably and, though no macro projections have been attempted in this regard, this aspect has been taken into consideration in the next chapter for identification of specific machinery items having adequate manufacturing potential in future.

88. The projected demand and import pattern of capital goods were assessed in terms of specific products and machinery items. For this

---

* In the report of Phase IA, this estimate was mentioned as 83 thousand million pesos. Figures available subsequently have necessitated some changes in individual equipment groups and a slight increase in the total.

purpose, the past import figures for specific machinery products and items were initially projected for the period 1976 - 1980 on the basis of growth trends in the production sectors using such equipment. Thereafter, suitable adjustments were made of these figures in the light of a survey of domestic capital goods manufacturing capacity for most of the specific machinery items, including new investment expansion proposals which were either under implementation or under consideration.

89. The import projections for various capital goods items have been prepared for 26 such groups and products (classified as A to Z categories). The import values, if not mentioned otherwise, are to be understood covering the period 1976 - 1980, and average annual import estimates have to be derived from these figures. The values have been expressed in fixed prices, based on 1960 prices. The classification followed has been that of non-electrical and electrical equipment, the former being further sub-divided into (a) equipment utilised in various production sectors and (b) machinery specifically used in particular sectors. Further classification has been done in respect of specific items and sub-items which could be clearly identified.

90. The period 1965 - 1969 has been assumed as the base period for capital goods import projections, as this period represented a period of fairly dynamic growth in most production sectors, including machinery and capital goods manufacture. During this period, capital goods imports were of the order of 36.9 thousand million pesos*. The past trends in imports and the distribution between mechanical (non-electrical) and electrical equipment can be seen from the following table X.

---

* According to SIC classification.

Table X

Total imports and capital goods imports during 1965 - 1971

(values in million pesos)

Year	Mechanical equipment (non-electrical)	%	Electrical Equipment	%	Total capital goods imports	%	Total imports
1965	4,795	24.6	1,267	6.5	6,062	31.1	19,495
1966	5,040	25.12	1,482	7.38	6,522	32.5	20,065
1967	5,608	25.07	2,018	9.23	7,626	34.9	21,853
1968	5,828	23.8	2,620	10.7	8,448	34.5	24,501
1969	6,227	23.97	2,625	20.11	8,852	34.08	25,975
1970	6,872	22.34	3,245	10.55	10,117	32.89	30,760
1971	7,047	23.42	3,004	9.98	10,051	33.40	30,091
Annual Growth rates:							
1965 to 1970		7.5		21		10.8	
1965 to 1971		6.6		15.5		8.8	

91. The share of capital goods imports increased from 31.1 per cent in 1965 to 32.9 per cent in 1970, the highest share being in 1967 (34.5 per cent). The growth rate of capital goods imports has been higher than that of total imports in recent years. For the periods 1965 - 1970 and 1965 - 1971, the growth rates of imports were 9.5 and 7.5 per cent respectively while the growth rate for capital goods imports were 10.8 and 8.4 percent respectively. In the capital goods sector, the proportion of electrical equipment imports has risen considerably since 1965, because of a larger power generation programme and increased requirements of more sophisticated electrical and electronic equipment. In projecting the likely imports of specific capital goods items and groups also, the period 1965 - 1969 has been taken as the base period and individual growth co-efficients have been applied. The likely trends in demand and imports of specific machinery groups (at 1968 prices) are discussed hereinafter, while the projected imports (expressed in 1968 prices) of specific capital goods groups and items, including major sub-items are given in Schedule II at the end of this chapter. It must be emphasised that these trends and projections are based on existing autonomous growth trends in the economy and do not take into account the additional impact of a specific and comprehensive programme for development of the capital goods sector as may emerge on the basis of this study. The projected imports for various capital goods categories have been further sub-divided for each of the fourteen selected production branches which are major users of capital goods, together with one sub-heading covering "Remaining production activities". This break-up is furnished at Schedule III at the end of this chapter and gives a broad picture of the likely pattern of capital goods utilisation in Mexico during 1976 - 1980.

(i) Non-electrical equipment (common-use)

(a) Power generation machinery (other than electrical machines and equipment

92. This sub-sector covers steam generators (including high pressure boilers), economisers, condensers, super-heaters, gas-recovery units, steam engines, internal combustion engines, water turbines, steam turbines, etc. With the rapid expansion of power generation and pulp and paper, sugar, chemical and petrochemical and other related industries, demand for such equipment would increase considerably. Technologically, a considerable proportion of such equipment could be produced in Mexico, but production has not developed so far due to various reasons. It is expected that imports in this sub-sector would amount to 9.05 thousand million pesos during 1976 - 1980. The import projections for specific items and sub-items including spare parts, are indicated in Schedule II. Both in respect of the specific items and spare parts therefore, there apprears prima facie to be considerable scope for the development of domestic production, except in respect of certain highly-sophisticated equipment in this sub-sector.

(b) Machine tools (for metal working)

The demand for machine tools (both for chip-removing and chipless forming) is likely to grow very rapidly during the next decade. For the period 1976 - 1980, it is estimated that demand, including a relatively small export element, would be of the value of 4.83 thousand million pesos. Production of machine tools is also expected to increase substantially and considerable expansion of some existing units is contemplated at present, besides the establishment of a new project for the manufacture of parallel lathes and milling machines. Nevertheless, taking into account the present proposals for expansions and new enterprises, considerable imports would still be required, both in the categories in production, as well as remaining categories and special

purpose and sophisticated machine tools. The value of machine tool imports during 1976 - 1980 is assessed at 4.59 thousand million pesos. The details of likely imports of various categories of machine tools are given in Schedule II. As against this, domestic production inclusive of the proposed new plant for parallel lathes and milling machines would come to only 1.25 thousand million pesos in this period. There is undoubtedly scope for considerable expansion of domestic machine tool manufacture. The specific categories which could be considered have been discussed in the next chapter.

(c) Other metal processing machinery

While most categories of metal working machine tools have been covered in the previous paragraph, gas-operated welding, cutting, etc. appliances which are commonly used for the machinery industry in general have to be taken into account. The likely imports of such items would be about 56 million pesos for the period 1976 - 1980.

(d) Packaging, weighing and spraying machinery

Excluding packaging equipment such as canning and can-manufacturing equipment for the food industry (sub-paragraph (m)), the principal packaging machinery which are domestically produced are machines for (i) cleaning, drying and filling bottles and packets, (ii) filling and dossificating solid products, including those with registration, (iii) filling, packing and closing in automatic processes, (iv) doing two or more of these functions in one unit, (v) bottle-packing and (vi) gasification of beverages. The total import estimate of packaging equipment for 1976 - 1980 amounts to 1.19 thousand million pesos. Many of the imported items could be domestically produced, largely through expansion of existing enterprises. In weighing machinery, the principal import item is equipment with automatic indicator or with printing mechanism in respect of weights above 1,000 kgs. and likely imports during 1976 - 1980 would be 81.1 million pesos. As for spraying

machinery, this includes equipment for painting or coating surfaces, motor-propelled powderisers, pesticide sprayers, fire extinguishers and aerographic pistols for compressed fluids. Projected imports of spraying equipment during 1976 - 1980 are estimated at 450.0 million pesos. A considerable proportion of these items could be domestically manufactured, as demand is fairly high and as the technology involved is relatively unsophisticated.

(e) Heating and cooling equipment

The principal items imported at present are (i) industrial non-electric furnaces, mainly of weights above 1,000 kgs. and spare parts for such furnaces, (ii) heat treatment and cooling equipment, including double-wall and double-bottom equipment, heat exchangers of high capacity other than those used in the sugar industry, vulcanisers and pre-vulcanisers except for the footwear industry, and evaporators of higher capacity, (iii) industrial air-conditioning equipment, usually above 1,500 kgs. and refrigeration equipment, and (iv) gas generators. While most of the above machinery categories are domestically manufactured up to certain capacities, imports have taken place within these capacities as part of composite machinery supply for certain projects. For the higher capacities, domestic demand may be considered if domestic manufacture is to be undertaken. The total projected imports of heating and cooling equipment during 1976 - 1980 is estimated at 3.86 thousand million pesos, with details indicated in Schedule II.

(f) Pumps, compressors and centrifuges

Although there are a number of plants manufacturing pumps and compressors of various types and ranges, including affiliates of well-known USA manufacturers, imports have been very substantial and are projected to increase considerably by 1976 - 1980. The types of pumps likely to be imported include water pumps with spare parts for engines,

oil pumps and spares, injection pumps and spares, rotary pumps, alternative pumps and other pumps for heavy-duty operations, such as boiler feed pumps, large circulating water pumps, slurry, sand and sewage pumps. Total imports of pumps during 1976 - 1980 is expected to be over 1.[illegible] thousand million pesos. As for compressors, the principal items likely to be imported during 1976 - 1980 are air compressors or motor compressors, integral motor compressors (265 to 1,000 hp), integral compressors (100 to 2,400 hp), turbo compressors for air and other gases and motor compressors for refrigerators. The total imports of compressors is likely to be of the order of 2.87 thousand million pesos in 1976 - 1980. The import of centrifuges (excluding sugar centrifuges) is also likely to be fairly substantial (127.3 million pesos) particularly machines for concentrating, separating and clarifying liquids. A large proportion of these items could be domestically manufactured through expansion schemes, provided the demand could be standardised in weights and capacities of specific equipment, so as to minimise the variety in types and ratings.

(g) Lifting, loading and conveying equipment

Though considerable domestic capacity exists for these items, projected imports during 1976 - 1980 are of the order of 2.35 thousand million pesos. In lifting equipment, the principal items being imported are large bridge cranes, mobile hydraulic cranes, hydraulic jacks (above 12 kgs.), pulleys and tackles and electric and non-electric capstans. As for bridge, tower and travelling cranes, domestic capacity is at present about 55 per cent of requirement (mostly comprising structural parts) which is likely to increase to over 60 per cent. The requirement of escalators is also likely to grow considerably, particularly with major extensions of the METRO system. As for loading equipment, the principal import items are stackers and portable elevators, including heavy handling facilities at ports, which are being expanded considerably.

(h) Other machinery

Various miscellaneous non-electrical machinery commonly used in a wide range of industries would also require to be imported on present ranges of domestic production. These include (i) calendering and similar rolling machinery, (ii) machinery for rubber and plastics industry such as extruding and injection (up to 25 and more) machines, cutting and stamping machines, agitators and mixing machinery and spare parts; (iii) equipment for metal coating and galvanising; (iv) machinery for wood-treatment, etc., (v) presses for general and specific uses, such as hydraulic presses of medium and heavy capacity and multiple presses for tyre re-treading etc. and (vi) mixing and crushing equipment of medium and high capacity.

(i) Machinery parts and accessories

The import of machinery parts and accessories is also likely to be very heavy and is projected to be of the order of 3.70 thousand million pesos in 1976 - 1980. It would largely comprise of (i) powered tools, such as machines for processing wood, glass, plastic materials, etc. and parts and accessories thereof; (ii) ball roller and needle bearings; (iii) moulding boxes and moulds of different types, (iv) taps, cocks, valves and similar appliances, (v) transmission shafts and cranks, pulleys, etc., (vi) gears or friction wheels of different types and capacities; (vii) reducers, multipliers, etc.; (viii) pulleys and clutches; (ix) metal-plastic joints and (x) other non-electrical parts and accessories. In respect of these items, there is considerable scope for increased domestic manufacture, though standardisation of specifications would be necessary in many cases.

(ii) Non-electrical equipment (specific industries)

(j) Equipment for steel plants and non-ferrous metals production

93. With considerable expansion projected in the production of steel, copper, aluminium and other non-ferrous metals, considerable imports of heavy machinery items would be necessary for the period 1976 - 1980.

The total volume of such imports is estimated to be about 1,93 thousand million pesos. The principal capital goods items likely to be imported during 1976 - 1980 excluding the machinery requirements of Phase I of the Las Truchas steel complex are (i) blast furnace and heating equipment, (ii) conveyors, ladles, ingot moulds and casting machines and (iii) rolling mill equipment and rolls thereof. The demand for cast rolls (up to and above 3 tonnes) for existing and projected plants is fairly high.

(k) Mining, construction and cement equipment

Considerable domestic production of construction equipment is taking place and the only items likely to be imported during 1976 - 1980 are: (i) heavy duty perforating machines, which are auto-propelled and weigh more than 1,500 kgs., (ii) scrapers and graders (weighing up to 12 tonnes); (iii) concrete finishers (spreaders). In the mining sector, imports would largely comprise mineral crushing (with ball grinders above 30 tonnes in weight), sorting and moulding machinery, agglomerating equipment for brick production, ceramic stoves, etc., together with glass-working machinery. In the cement industry, the principal imported item would be the rotary kiln of high capacity (750 t/d and above) and gears, as most other items could be domestically produced.

(l) Pulp and paper machinery

There is comparatively little domestic production of pulp and paper machinery in Mexico and most capital goods items in this sector are imported. It is estimated that machinery imports for cellulosic pulp would be of the value of 215.2 million pesos, while equipment for manufacturing paper and cardboard would be imported to the extent of 507.3 million pesos and paper cutting and other machines for making paper and cardboard articles would account for a further 511 million pesos during 1976 - 1980. The spare parts requirements of pulp and paper machinery are also expected to be considerable (182.2 million pesos).

(m) Sugar and food processing equipment

While most items of sugar machinery can be domestically manufactured, turbines and centrifuges continue to be imported, along with gears and some smaller items. The past growth of the industry has resulted in considerable multiplicity in the type of equipment used, and standardisation of turbines, gears and centrifuges is very necessary. As for other food-processing equipment, the principal imported items are (i) cylindrical flour mills, including steel cylinders; (ii) kneading machines; (iii) equipment for biscuit production, (iv) machines for producing spaghetti or cutting meat and fish, etc. and (v) machinery for the tobacco industry.

(n) Chemical production equipment

Most of the equipment for chemicals and petro-chemicals such as pumps and compressors, heat exchangers, evaporators, etc., have been covered in the earlier sub-paragraphs. The only items which need to be specifically incorporated are large storage tanks, which may have to be imported to the value of 324.4 million pesos, if domestic manufacture of such larger sizes is not undertaken by 1976.

(o) Textile production equipment

This large sub-sector is of special significance as almost all the principal machinery is imported. Some years ago, the production of looms was undertaken but had to be discontinued. Imports of textile machinery are likely to be very high, particularly because of the need and likelihood of modernisation of existing units. The likely imports of textile machinery, including leather machinery, is estimated at 8.09 thousand million pesos, the details of which may be seen in Schedule II.

(p) Agricultural machinery

On the basis of existing production, import projections for this sub-sector during 1976 - 1980 are estimated at 2.73 thousand million pesos. This would be mainly in the form of agricultural tractors (both wheeled and caterpillar) though other farm machinery likely to be imported include (i) harrows or graders, (ii) cultivators (ploughs), (iii) threshing machines with packing equipment, (iv) mowing machines, including maize-mowing machines,, (v) dairy equipment, including milking machines, cream separators and other equipment and (vi) various other items such as presses for wine-making, incubators and other equipment. From a technological viewpoint, most of this equipment can be manufactured in Mexico.

(q) Other equipment for specific industries

An important sub-sector not covered in the other sub-paragraphs is printing and bookbinding. Projected imports during 1976 - 1980 are estimated at 1.4 thousand million pesos, mainly on printing equipment, type-making and setting machinery and bookbinding equipment.

(iii) Electrical machinery and equipment

(r) Electrical generators and motors

94. The generation of power by the Comisión Federal de Electricidad is almost entirely undertaken through imported power generation equipment. On the basis of the power development programme up to 1980, imports of large generators are estimated to be of the value of 2.42 thousand million pesos during 1976 - 1980. At present, generators are produced only up to 150 kw in Mexico. As for electric motors, these are manufactured in considerable volume, but for the most part up to 200 hp. only. While larger motors of the AC type are not produced, DC motors are not produced even in small sizes. About 30 per cent of motors are

imported as special components. Likely imports of motors during 197[illegible] - 1980 are estimated to be 1.3[illegible] thousand million pesos, of which almost 50 per cent constitute motors not produced in Mexico at present.

(s) Transformers and circuit-breakers

There is considerable manufacture of transformers in Mexico and by 197[illegible] domestic capacity should be adequate except in respect of high capacity units. If the latter type is not undertaken, likely imports during 197[illegible] - 1980 would be about 1.94 thousand million pesos, mainly of units above 30,000 kgs. weight in respect of [illegible] kw and 400 kv transformers. Some imports of static converters and rotating converters are also projected. The requirement of spare parts is also likely to be considerable. As for circuit breakers, imports are projected at 3.5 thousand million pesos for 197[illegible] - 1980, including relays, section switches, circuit selectors, projection apparatus, splice and connection equipment, resistences, potentiometers and control or distribution boards.

(t) Electrical insulating machinery

The growth of domestic manufacture in this sub-sector has been rather limited and consequently the import projections for 1976 - 1980 based on existing trends are quite high. Estimated imports during 1976 - 1980 are about 7[illegible] million pesos, the major imported items being ceramic suspension insulators for power lines and insulator fittings for electrical equipment such as transformers, circuit-breakers, etc.

(u) Telecommunication equipment

In recent years there has been considerable growth in this sub-sector. New projects are under implementation for telephone and telegraph equipment by two major manufacturers. Nevertheless, demand for VHF and external communication equipment and spare parts for existing installations is increasing rapidly and imports of two thousand million pesos are projected during 1976 - 1980.

(v) Electrical measuring and control instruments

This sub-sector covers a number of items, most of which are manufactured in Mexico up to certain levels. Nevertheless, unless existing capacity is supplemented, likely imports in 1976 - 1980 would be of the order of 1.3 thousand million pesos. The principal items which may be imported are three-phase watt hour meters, multimeters, voltmeters, oscilloscopes and amperemeters, besides measuring instruments for non electrical magnitudes, regulation or analysis.

(w) Electrical and other tools (including hand-tools and cutting tools)

Considerable production of hand-tools is taking place in Mexico at present, the total volume being estimated* at over 157 million pesos in 1970 and constituting 60 per cent of requirements. A small volume has also been exported. With demand growth, the likely gap in production is estimated to be of the value of 624 million pesos during 1976 - 1980 which would have to be covered by imports if additional domestic production does not take place. Electro-mechanical hand-tools (with motors) would constitute about 1 per cent of this amount. The manufacture of cutting-tools has also grown rapidly in recent years, with domestic production of 100 million pesos in value by 1970. With growth of the machinery industry, demand would grow more rapidly in coming years and is likely to increase to 295 million pesos in 1975 and 344 million pesos by 1980. If the present growth rate for this sub-sector continues up to 1976, most of the demand increase can be covered by domestic production. It is, however, estimated that there would be a production shortfall of 25 per cent in 1975 and about 20 per cent in 1980, which would imply imports of 310 million pesos during 1976 - 1980. In addition, the demand for inter-changeable tools, including dies, would grow considerably, with rapid expansion of the machine tool and hand tool industry. The imports of such tools is estimated to be of the order of 1.19 thousand million pesos during 1976 - 1980, unless substantial domestic production is taken up of such items.

---

* Banamex - "Herramientas de Mano"

(x) Electric furnaces and electric welding and cutting apparatus

While domestic capacity for electric furnaces has been created in Mexico, this is limited to certain ranges only. With the growth of the machinery sector, it is estimated that likely imports of furnaces and of electrical cutting and welding tools in 1976 - 1980 would be of the value of over 575 million pesos. The principal items likely to be imported are arc furnaces, other furnaces for thermic treatment, welding and cutting machines of generator or transformer types and machines for resistance seam welding.

(y) Other electrical equipment

This sub-sector is intended to cover miscellaneous electrical equipment such as X-ray apparatus, accumulators, thermionic valves and tubes, photocells, transistors, diodes, electromagnets, capacitors, electrical carbons and insulated wires and cables. Demand for such items is projected to grow rapidly and on the basis of existing manufacturing capacity with trend increases, the likely imports of such items during 1976 - 1980 estimated to be 1.48 thousand million pesos.

(iv) Summary of Import Projections

95. The above projections are summarised in the table below.

Table VI

Import estimates for capital goods (by categories) during 1976 - 1980 (in thousand million pesos)

Non-electrical equipment (common use a. - i.)		
a.	Power generation machinery (other than electrical machines and equipment)	9.05
b.	Machine tools (chip removing and chipless forming)	4.5?
c.	Other metal working machinery (for welding, cutting, etc.)	0.5?
d.	Packaging, weighing and spraying machinery	1.95
e.	Heating and cooling equipment	3.??
f.	Pumps, compressors and centrifuges	5.?
g.	Lifting, loading and conveying equipment	?.35
h.	Other machinery	3.73
i.	Machinery parts and accessories	?.??
Non-electrical equipment (specific use other than a. - i.)		
j.	Steel and non-ferrous metal production	1.93
k.	Mining, constructing and cement industries	4.?9
l.	Paper and pulp manufacture	1.41
m.	Sugar and food production	1.13
n.	Chemical production	0.3?
o.	Textile manufacture	9.09
p.	Agricultural machinery	?.73
q.	Other equipment for specific industries	1.90
Electric machines and equipment		
r.	Electrical generators and motors	3.?9
s.	Transformers and circuit breakers	5.44
t.	Electrical insulating equipment	0.77
u.	Telecommunication equipment	2.00
v.	Electrical measuring and control instruments	1.36
w.	Electrical and other tools	2.1?
x.	Electric furnaces and electric welding and cutting apparatus	0.97
y.	Other electrical equipment	1.48
z.	Unidentified capital goods items	4.32
	TOTAL	83.65

96. The above projections of capital goods imports are by no means exhaustive but they serve to highlight the principal machinery manufacturing branches where substantial imports may be necessary on the basis of trends in demand and in domestic manufacturing capacity. The break-up of principal items and sub-items under each of these categories, which is shown in Schedule II gives a more detailed indication of the likely pattern of machinery imports. Working on the basis of the import classification, it has not, however, been possible to separately project the imports of some components and processed materials, as these are not separately classified and are usually grouped together under accessories or spares. Consequently, import projections in respect of castings and forgings, or particular components such as gears, have not been made separately and these have to be assessed directly from the survey of domestic machine building capacity.

97. It is important to stress that the above demand and import projections are not intended to provide any conclusions regarding the practicability of undertaking domestic manufacture of one or other of the products where substantial imports have been projected. What does, however, emerge is the fact that the level of machinery imports of various categories is likely to be of considerable magnitude during the latter part of this decade. Whether or not this would justify the establishment of additional domestic production capacity in particular capital goods branches would depend on the economic and technological feasibility of manufacturing various machinery items efficiently and competitively by international standards.

98. It also needs to be reiterated that the above projections do not take into account the likely export possibilities of particular machinery items. Export projections have necessarily to be related to specific products and only some general conclusions are possible and have been made in a later chapter, regarding exportability of machinery manufactured in Mexico. At the same time, the likely export potential in respect of particular items would play a vital role in the determination of economic viability of specific machine building projects.

SCHEDULE II

Detailed Classification of Capital Goods Import Projections for period 1976 - 1980

(Figures in million pesos at 1969 prices)

Classification according to SITC	Description	Projection 1976 - 1980 Broad Items	Detailed items
711.1	Steam generators including high pressure boilers for thermal power stations	1955.7*	
711.2	Boiler-house plant (including economisers, superheaters, condensers, soot removers, gas recoverers, etc.	405.4*	
711.3	Steam engines, including stationary steam engines with self-contained boilers and steam turbines for thermal power stations	1974.7*	
711.5	Internal combustion engines, other than for aircraft	4811.5	
	Main items:		
	Out-board engines		113.3
	Diesel engines 250-6, 500 hp. for boats		199.7
	Diesel engines 250-6, 500 hp. for other purposes		606.7
	Other larger diesel engines		376.3
	Explosion engines (gasoline engines)		387.9

* These three items include estimated amounts of 1,500, 300 and 1,500 million pesos of import values of boilers, boiler-house equipment and steam turbines respectively for thermal power stations deduced from the projections of CFE's future programmes.

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items	
	Spare parts:			
	Monoblocues, cylinder heads (diesel engines)		151.9	
	Monoblocues, cylinder heads (gasoline engines)		137.8	
	Carburattors		114.6	
	Valves and their auxiliary parts (supports, guides, rotors)		210.1	
	Cylinder skirts		131.2	
	Spare parts exclusively for agriculture tractors		88.5	
711.6	Gas turbines other than for aircraft	118.1		
711.8	Engines n.e.s. (wind, hot air engines, water wheels, water turbines)	883.5		
711.81	Water turbines and other water engines		161.6	
711.89	Other engines n.e.s.		321.9	
715.1	Machine tools	4582.0		
	Main items: (other than those for automotive industry)		3437.0	
	For chip removing:			
	Lathes			915.0
	Milling machines			430.0
	Shaping, clotting and broaching machines		150.8	
	Grinding machines		630.0	
	Sawing machines		71.8	
	Drilling machines and boring mills		365.0	

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items	
	Threading machines		52.0	
	For chipless forming:		1145.0	
	Group I: Drop hammers, excentric presses, stamping presses and machines of similar type			509.3
	Group II: Bending machines, roller machines, shears, perforating machines			195.5
	Group III: Rivetting, wire stranding, straightening and cutting machines, machines producing washers, clips, clamps, etc.			440.2
719.2.2	Pumps, centrifuges and compressors	5346.4		
	Pumps, motor pumps or turbo-pumps for liquids		1483.1	
	Main items:			
	Injection pumps for oil, for diesel motors and spare parts for motors			47.7
	Water pumps and spare parts for motors			78.9
	Oil pumps and spare parts for motors			108.4
	Centrifuges			227.0
	Pumps, motor pumps or turbo-pumps for air and vacuum		2870.0	
	Main items:			
	Ejectors or vacuum pumps			79.1
	Turbo compressors for air and other gases			136.5
	Motor compressors for refrigerators hermetic, more than 18.5 Kgs. and 1/3 hp.			89.5

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items
	Motor compressors for refrigerators semi-hermetic, with electric motors and compressors in the same cast body; weight 200 Kgs. and less		141.6
	The same as above, but weighing more than 200 Kgs.		63.1
	Air compressors or motor compressors		700.7
	Motor compressors (integral) with 4 and more cylinders; 265-1,000 hp; Weight 10 to 40 t.		207.0
	The same as above but weighing up to 100 t. with 2,400 hp.		186.7
	Spare parts for pumps and compressors		280.5
719.2.3	Centrifuges (other than cream separators), filtering and purifying machinery for liquid and gases	993.3	
	Main items:		
	Concentrating, separating and clarifying machines		127.3
	Refination turbines for sugar industry		109.7
722.1	Electric power machinery	5717.8	
	Generators	2422.9	
	Main items:		
	Generators up to 2,500 Kgs.		345.6
	Generators more than 2,500 Kgs.		1539.0
	Generators for alternating or direct current		258.2

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items
	Motors	1360.3	
	Main items:		
	Not produced in Mexico		519.9
	Motors up to 2 Kgs.		25.4
	Motors from 2 - 20 Kgs.		52.0
	Motors from 20 - 3,000 Kgs.		406.3
	Motors more than 3,000 Kgs.		235.4
	Convertors (rotating)	47.6	
	Transformers (static)	921.8	
	Main items:		
	Not produced in Mexico (transformers)		81.4
	Transformers up to 5 Kgs.		38.2
	Transformers from 5 to 30,000 Kgs.		330.8
	Transformers more than 30,000 Kgs.		374.0
	Converters (static) or bobbins for reactance or auto-induction	212.2	
	Spare parts	640.1	
712.1	**Agricultural machinery and appliances for preparing and cultivating soil**	438.2	
712.2	**Agricultural machinery and appliances for harvesting, threshing and sorting**	839.5	
712.3	**Milking machines, cream separators and other dairy equipment**	60.7	
712.5	**Agricultural tractors (other than road tractors for tractor-trailer combinations)**	3538.3	

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items
712.9	Agricultural machinery and appliances n.e.s. (presses for wine making and other agricultural machinery)	149.5	
715.2	Equipment for steel and non-ferrous metal production	1986.9	
715.21	Convertors, ladles, ingot moulds and casting machines		261.1
715.22	Rolling mills and rolls thereof		1669.8
715.23	Gas operated welding, cutting, etc. appliances		56.0
717	Textile and Leather machinery		
717.1	Textile machinery	8087.4	
717.11	Spinning, extruding, etc. machines		3265.9
717.12	Weaving, knitting, etc. machines		2507.7
717.13	Machines auxiliary to 717.12		1080.5
717.14	Machinery for the manufacture or finishing of felt		31.1
717.15	Textile bleaching, washing, dressing, coating, printing, etc. machinery (excluding domestic washing machines)		1202.2
717.2	Machinery (excluding sewing machines) for preparing, tanning or working hides, skins or leather	276.0	
717.3	Sewing machines	736.6	

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items	
	Machines for special industries			
718.1	Paper mill and pulp mill machinery, paper cutting machinery and other machinery for the manufacture of paper articles	1416.7		
718.11	Machinery for making or finishing cellulosic pulp paper or paper board		905.2	
	Machinery and apparatus for production and processing of pulp			215.8
	Machinery and apparatus for production and processing of paper and paper board			507.3
	Spare parts for both foregoing items			182.1
718.12	Paper cutting machines and other machinery for manufacture of articles of paper pulp, paper or paper board	511.3		
718.2	Printing and bookbinding machinery	1806.3		
718.21	Bookbinding machinery		157.9	
718.22	Type making and setting machinery, etc.		310.3	
718.29	Other printing machinery, n.e.s.		1338.1	
718.3	Food processing machinery	856.9		
718.4	Construction and mining machinery, n.e.s.	2597.6		
718.41	Road rollers, mechanically propelled		[illegible].1	

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items
718.42	Excavating, levelling, boring, etc. machinery		2591.5
	Main items		
	Perforating machines		980.4
	Scrapers		160.4
718.5	Mineral crushing, sorting and moulding machinery, glass working machinery	1382.0	
718.51	Mineral crushing, sorting etc. machinery		1159.3
	Main items		
	Classificating, screening or washing machines		84.9
	Crushing machines		524.0
	Mixing machines (construction machinery)		91.9
	Aglomerating machines (brick producing machines, ceramic stoves, etc.)		145.9
718.52	Glass working machinery		222.7
719.1	Heating and cooling equipment	4068.9	
719.11	Gas generators		65.6
719.12	Air conditioning machines		200.5
719.13	Furnaces, burners, mechanical strokers, etc.		148.9
	Main item: burners for liquid or gaseous combustibles.		110.3
719.14	Industrial and laboratory furnaces and ovens, non-electric		1363.9
	Main items: furnaces of larger weight than 1,000 Kgs. (with exception of bakers' furnaces and spare parts)		908.6

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items	
719.15	Refrigerators and other refrigerating equipment, whether or not electrical		159.3	
719.19	Other apparatus for treating materials with heat or cold		2130.7	
	Main items:			
	Heating or refrigerating equipment with double walls or double bottom for heating or cooling liquids			143.6
	Heat exchangers, coils and similar equipment, other than those used in sugar industry			39?.0
	Vulcanizers, incl. prevulcanizers except those used in shoe industry			115.8
	Evaporators			109.6
719.3	Mechanical handling equipment	2354.7		
719.31	Lifting and loading machinery		1974.7	
	Main items:			
	Tackles (polipasto) (one or two rails)			121.8
	Capstan or hoists, electric			102.7
	Capstan or hoist, non-electric			88.2
	Jacks, hydraulic, up to 12 Kgs.			49.5
	Jacks, hydraulic, more than 12 Kgs.			85.9
	Cranes, bridge cranes			136.0
	Cranes, auto-propelled			36.6
	Escalators, Electro-mechanical			79.6

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items
719.32	Fork lift trucks and other industrial trucks of a kind used for moving goods within a plant		380.0
	Main items:		
	Stackers, portable elevators		217.6
719.5	Powered tools, n.e.s.	1352.2	
719.51	Machines for working minerals (glass)		176.9
719.52	Machines for working wood, plastics, etc.		325.5
719.53	Motorised hand tools, non-electrical		317.1
	Main items:		
	Pneumatic tools for putting in or extracting screws, etc.		32.5
719.54	Parts and accessories for powered tools		533.5
	Main items:		
	Chucks, toolholders for lathes		51.8
	Spindles		24.6
719.6	Other non-electrical machines	2176.0	
719.61	Calendering machines and similar rolling machines, n.e.s.		226.6
	Main items:		
	For textiles or plastics		84.7
	For paper and cardboard		61.8
	For paper and cardboard cylinders		4.6
	For paper and cardboard, spare parts		3.5
	For rubber treatment		13.4

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items
719.62	Machines for cleaning or filling bottles or other containers, packing machinery, etc.	1193.1	
	Main items:		
	Machines and apparatus for cleaning or drying bottles		255.4
	Machines and apparatus for packing milk, butter, cheese		38.7
	Machines or apparatus for filling and dosing machines for solid products		37.0
	Filling and dosing machines with registration		91.9
	Other machines for filling or packing goods		304.9
	For complete automatic process filling, closing and packing liquids		113.7
	Doing two or more functions		99.1
	Bottle packing machines		44.4
	For gasification of beverages and doing operations		105.4
719.63	Weighing machinery and weights therefor (excluding sensible weights - 0.5 g.)	275.4	
	Main items:		
	Weights of discontinuing weighing with automatic indicator, and printing mechanism or weight with capacity of 1,000 Kgs. and more.		81.1

Classification According to [illegible]	Description	Projections 1976 - 1980 Broad Items	Projections 1976 - 1980 Detailed Items	
719.6.4	Spraying machinery		600.9	
	Main items			
	For painting or coating (with liquids)			52.4
	Powderisers propelled by motor (engine)			21.5
	Pesticides spraying machines (agricultural)			66.[illegible]
	Fire extinguishers			90.6
	Aerographic pistols or similar apparatus for compressed fluid			60.0
719.7	Ball, roller or needle roller bearing	1591.6		
	Main items			
	Ball-roller bearings		721.3	
	Conic-roller bearings		117.6	
	Barrel-roller bearings		91.7	
	Cylindric-roller or needle-roller bearings		131.8	
	Clutch collars		47.6	
	Spare parts.			
	Balls or sphere rolls of 1-10mm. diameter		90.4	
	Balls or sphere rolls of 10-50 mm. diameter		7.9	
	Balls or sphere rolls of 50-100 mm. diameter		2.1	
	Tracks		100.7	

Classification according to SITC	Description	Projections 1976 - 1980 Broad items		Detailed items
719.8	Machinery and mechanical appliances, (except those suitable for use only or principally as parts of other machines or apparatus) not falling within any other heading of this chapter	41[illegible]	179.1	
	Machines and appliances for oil, soap or grease industry		205.0	
	Machines and appliances for rubber and artificial plastic industries		1367.7	
	Main items			
	Extruding machines			211.0
	Injection machines (25 t. and less)			197.0
	Injection machines (more than 25 t.)			96.7
	Blowers			44.1
	Cutting and stamping machines			57.0
	Agitators and mixing machines			175.5
	Spare parts for this group			64.0
	Machines and appliances producing ropes and cables		175.0	
	Main items:			
	Winding machines for metallic wire			57.9
	Machinery and appliances for public works and similar		114.5	
	Concrete finishers (spreaders)			20.9
	Machinery and appliances for metal treatment		228.1	

Classification according to NIC	Description	Projections 1970 - 1980 Broad items	Detailed items
	Main items:		
	Machinery for galvanising and coating with other metals (incl. non-metallic materials)		108.9
	Machinery and appliances for treatment of wood, cork or similar materials (production of impregnating machines	77.9	
	Machinery and appliances for the tobacco industry	161.1	
	Presses for general utilisation or for industries not mentioned in the previous items of this chapter (for cotton, electric action)	120.7	
	Main items:		
	Hydraulic presses		211.0
	Multiple presses for centering the forms used for renovating rubber tyres		18.1
	Machinery and appliances for production of pianos (brushes)	19.9	
	Other machinery and appliances (for pharmaceutical industry, for balancing wheels of cars)	1296.8	
	Main items:		
	Mixing machines and reactions machines		162.6
	Pneumatic or hydraulic apparatus for automation of machines		97.0

Classification according to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items
719.9	Parts and accessories of machinery, n.e.s.	[illegible]	
719.91	Moulding boxes for metal foundry and moulds, other than ingot moulds	564.6	
	Main items.		
	Steel moulds for injection or compression machines transforming plastic materials		162.4
	Steel moulds for injection or compression machines transforming metals		26.9
	Moulds for vulcanisers forming rubber tyres		47.6
719.92	Taps, cocks, valves and similar appliances, n.e.s.	1219.4	
	Main items.		
	Cocks of iron or steel		110.7
	Valves, automatic		258.9
	Valves of iron and steel		361.2
719.93	Transmission shafts and cranks, pulleys, etc.	1903.6	
	Crankshafts for air compressors 1.5 - 12 Kgs.		12.9
	Other crankshafts		201.2
	Camshafts		99.0
	Transmission shafts (of all diameters, majority more than 70 mm.)		93.2
	Flexible shafts		10.1
	Bearing supports and bearings		696.7
	Gears or friction wheels up to 75 Kgs.		92.7

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items
	Gears or friction wheels from 25 - 200 Kgs.		128.9
	Gears or friction wheels more than 2,000 Kgs.		33.9
	Gears or friction wheels for use in industrial tractors		8.9
	Gears or friction wheels for use in agricultural tractors		18.4
	Bearings or sleeves for industrial tractors		11.9
	Bearings or sleeves for agricultural tractors		10.5
719.93	Reducers, multiplicators or variators of velocity:		
	Up to 2,000 Kgs. in weight		68.9
	More than 2,000 Kgs. in weight		113.9
	Flywheels, pulleys, clutches, etc.:		
	Main items.		
	Pulleys (Al. Fr.)		102.7
	Clutches		39.7
	Flywheels		14.4
	For industrial tractors		1.3
	For agricultural tractors		7.5
719.94	Metal-plastic joints (gaskets) (for machinery, vehicles, turbines, etc.)	135.8	
	Metal-plastic joints		64.4
	Metal-plastic joints for industrial tractors		3.4
	Metal-plastic joints for agricultural tractors		2.8

Classification according to BTN	Description	Projections 1976 - 1980 Broad Items	Detailed Items
	Sets or assortments of joints.		
	Main items		
	Sets or assortments of joints		50.[illegible]
	Sets or assortments of joints for industrial tractors		7.5
	Sets or assortments of joints for agricultural tractors		6.[illegible]
719.95	Machinery parts (non-electrical)	456.9	
	Main items.		
	Packings		91.3
	Packings for agricultural tractors		3.4
	Packings for industrial tractors		6.0
722.[illegible]	Electrical apparatus for making and breaking or for protecting electrical circuits (switchgear, control gear, etc.)	496.0	
	Apparatus for breaking circuits and for sectioning, etc. (II), (III)	1250.4	
	Main items:		
	Not produced in Mexico		298.7
	Up to [illegible] Kgs.		131.[illegible]
	From [illegible] - [illegible],750 Kgs.		135.7
	More than [illegible],750 Kgs.		117.4
	Not produced in Mexico		64.9
	Up to [illegible] Kgs.		7.2
	From [illegible] - [illegible],750 Kgs.		72.8
	Relays, not produced in Mexico		88.9

Classification According to [illegible]	Description	Projections 1976 - 1980 Total Items	Detailed Items
	Selectors		[illegible]
	Protection apparatus	274.4	
	Main items		
	Fuses weighing more than 100 [illegible]		45.
	Other circuit breakers		130.[illegible]
	Lightning arresters and rod gaps		10[illegible]
	Circuit breakers (except of B.00[illegible]) not produced in Mexico		425.[illegible]
	Splice and connection apparatus	134.3	
	Main items		
	Not produced in Mexico		[illegible]
	Tape of up to [illegible] Kgs in weight		51.5
722.2	Resistance (non-heating), potenciometers or reostats	129.8	
	Main items		
	Reostats		18.6
	Potenciometers		33.7
	Resistance (non heating)		42.4
	Control or distribution boards	683.4	
	Control or distribution boards for elevators or lifts		81.5
	Not produced in Mexico		117.9
	Others with weight up to 75 Kgs		44.6
	Others with weight more than 75 Kgs.		439.4
	Spare parts	213.8	

Classification according to SITC	Description	Projections 1976 - 1990 Broad Items	Detailed Items
724.1	Insulated wire and cable	[illegible]	
	Main items:		
	Cables insulated with materials other than asphalt, weight up to 4 Kgs.	55.5	
	Cables with metallic coating Al. or Fe.	49.3	
	Cables except 724.00 with weight more than 4 Kgs.	50.9	
723.2	Electrical insulating equipment	777.9	
723.21	Electrical insulators	551.3	
	Main items		
	Suspension insulators, made of ceramic		214.4
723.22	Other insulating fitting for electrical equipment	221.6	
724.9	Telecommunications equipment n.e.s.	3000.0	
724.91	Electrical line, telephone and telegraph equipment	1900.0	
	Main items		
	Telephonic apparatus for external communication		1200.0
	Other telephonic apparatus		100.0
	Telegraphic apparatus		100.0
	Telegraphic apparatus with automatic commutation		100.0
	Spare parts		400.0

Classification According to [illegible]	Description	Projections 1976 - 1980 Broad Items	Detailed Items	
724.92	Microphones, loudspeakers and amplifiers		113.0	
	Main items:			
	Microphones			33.[illegible]
	Loudspeakers			23.[illegible]
	Amplifiers			23.[illegible]
726.2	X-Ray apparatus	320.1		
	Main items:			
	Non-industrial X-Ray apparatus		225.7	
	Industrial X-Ray apparatus		12.3	
729.12	Electric accumulators	96.9		
729.3	Thermionic, etc. valves and tubes, photocells, transistors, etc.	1870.2		
	Main items:			
	Electronic valves not produced in Mexico		206.4	
	Transistors		94.1	
	Diodes of silicium		22.5	
729.5	Electrical measuring and controlling instruments and apparatus	1396.2		
729.51	Electricity, gas liquid meters		28.0	
729.52	Other electrical measuring and controlling instruments and apparatus		1368.2	
	For measurement of electrical magnitudes including watt-hour meters = 141.0			589.9
	For measurement of non-electrical (magnitudes, control etc.)		749.5	

Classification according to SITC	Description	Projection 1976 - 1980 Broad Items	Detailed Items
	Main items:		
	Apparatus for discovering faults, other than ultrasonic		57.3
729.6	Electro-mechanical hand tools (with incorporated motors)	330.1	
	Tool or electro-mechanical hand machine tools		211.4
	Main items		
	Grinding machines		29.9
	Spare parts		12.7
729.91	Electromagnets, permanent magnets and electro-magnetic appliances	129.2	
729.92	Electric furnaces, electric welding and cutting apparatus	575.2	
	Main items:		
	Air furnaces		98.8
	Other furnaces for thermic treatment		147.1
	Welding and cutting machines (generator type)		34.5
	Welding and cutting machines (transformer type)		35.3
	Welding and cutting machines (for resistance seam welding)		11.5
729.95	Electrical condensers (capacitors)	310.9	
729.96	Electrical carbons	147.9	
692.11	Tanks, etc. for storage or manufacturing use of iron or steel (with capacity of more than 300 litres)	324.4	

Classification According to SITC	Description	Projections 1976 - 1980 Broad Items	Detailed Items
695.1	Hand tools of a kind mainly used in agriculture or forestry	39.4	
	Sickles		4.6
695.2	Other tools for use in the hand or in machines	1819.7	
695.21	Hand saws and saw blades		79.2
	Main items:		
	Circular saws		42.1
695.22	Pliers, pincers, spanners, wrenches, metal cutting shears, files, rasps, etc.		303.2
	Main items:		
	Files with triangular section Clamps for electricity workers		52.8
695.23	Hand tools, etc. n.e.s.		129.7
	Spoons for masons		10.4
	Stocks (terrajas) for dies		26.9
695.24	Interchangeable tools for hand or machine tools		1039.1
	Main items:		
	Dies for threading		38.4
	Dies		281.7
	Drills		25.4
695.25	Cutting blades for machines		101.1
	Main item:		
	Cutting blades		98.3
695.26	Tool tips, etc. unmounted, of sintered metal carbines		62.4

Matrix Table of Capital Goods Imports Value Projected and Potential for [illegible] and to '4 Selected Capital Goods Consuming Industries [illegible]

(In Million Pesos

Grouping of Capital Goods according to SITC Name of Group	Grouping of capital goods acc. to SITC	Iron and Steel	Non-Ferrous Metals	Mining	Construction	Cement	Pulp and Paper	Sugar	Chemical	Food Processing	Textile	Electric power	Electric and Electronic	Agriculture	Machine Tools	Total of A to M	Remaining activities	Total
		A	B	C	D	E	F	G	H	I	J	K	L	M	N		Z	
Steam generating boilers	711.1	6.5	5.1	8.6			32.1	34.8	69.1	86.3	27.	1,03[illegible]				[illegible]	[illegible]	1,[illegible]
Boiler house plant	711.2	10.8	2.6	6.8			4.3	4.6	13.8	10.8	3.6	33[illegible]				[illegible]	14.8	405.4
Steam engines and steam turbines for power stations	711.3	15.1	15.4	8.6		4.3	4.3	4.6	8.3	10.8		1,75[illegible]		[illegible]		1,85[illegible]	[illegible]	1,474.7
Internal combustion engines	711.5	2.2	2.6	51.3	41.2	21.4	10.7	7.0	27.6	6.5	11.2	[illegible]		[illegible]		[illegible]	4. [illegible]	4,8[illegible]
Gas turbines	711.6	4.3	5.1	6.8		2.1	4.3	2.3	5.5	4.3		62.6				[illegible]	[illegible]	[illegible]
Engines, n.e.s.	711.8	6.5	7.7	5.1	6.2	4.3	2.1	2.3	11.0	8.6		250.4	4.6	[illegible]		[illegible]	[illegible]	481.5
Agricultural machinery for cultivation	712.1													[illegible]		[illegible]	[illegible]	[illegible]
Agricultural machinery for harvesting, etc.	712.2													834.5		834.5		834.5
Milking machines, milk separators, etc.	712.3													[illegible]		[illegible]		[illegible]
Tractors, other than road tractors	712.5	6.5	10.3	17.1	1,706.4	10.7	6.4		5.5	5.4 6.5	5.6	6.3		1,343.0		[illegible]	436.0	3,538.3
Agricultural machinery and appliances n.e.s.	712.9									25.9				107.4		[illegible]	16.2	149.3
Machine tools for chip removing and chipless forming	715.1	115.1	112.9	117.1	41.2	10.7	10.7	7.0	27.6	10.8	227.9	33.3	69.6	73.0	242.0	[illegible]	[illegible]	4,[illegible]
Equipment for steel and non-ferrous metal production	715.2	864.0	771.0	8.6	4.1				82.9			6.3	4.6	[illegible]		[illegible]	243.8	1,[illegible]
Textile machinery	717.2										7,951.4					[illegible]	[illegible]	8,087.4
Machinery for working hides, skins or leather	717.2																276.0	276.0
Sewing machines	717.3										669.6					669.6	67.0	[illegible]
Paper mill, pulp mill machinery	718.1						1,305.4									[illegible]	[illegible]	[illegible]
Printing and book-binding machinery	718.2																[illegible]	[illegible]

Grouping of Capital Goods according to SITC Name of Group	Grouping of capital goods acc. to SITC	Iron and Steel	Non-Ferrous Metals	Mining	Construction	Cement	Pulp and Paper	Sugar	[illegible]	Food processing	[illegible]	[illegible] power	[illegible]	Agriculture	Machine tools	[illegible]	[illegible]	[illegible]	Total
		A	B	C	D	E	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Food processing machinery (excluding domestic)	718.3									[illegible]									
Construction and mining machinery, n.e.s.	718.4			666.[illegible]			[illegible]												
Mineral crushing machinery, etc.	718.5	64.8	[illegible]	427.[illegible]	103.0	[illegible]			[illegible]										
Heating and cooling equipment	719.1	365.0	326.4	99.8		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]			[illegible]					
Pumps and centrifuges	719.2	885.6	282.7	530.3	258.4	[illegible]	74.[illegible]	[illegible]	[illegible]	144.4	[illegible]	[illegible]		[illegible]					
Mechanical handling equipment	719.3	129.6	154.2	205.2	103.0	[illegible]	[illegible]	4.[illegible]	246.4	108.[illegible]	[illegible]	[illegible]		[illegible]					
Power tools, n.e.s.	719.5	15.1	12.9	15.4	14.4	[illegible]	4.[illegible]	4.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
Other non-electrical machines	719.6	15.1	12.9	6.8	10.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]					
Ball, roller or needle-roller bearings	719.7	43.2	38.6	[illegible]	41.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]				
Machinery and mechanical appliances, n.e.s.	719.8								[illegible]		[illegible]								
Parts and accessories of machinery, n.e.s.	719.9	388.8	385.5	102.7	103.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
Electric power machinery (generators, motors and transformers)	722.1	600.0	200.0	200.0	100.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
Electrical apparatus like switch gears	722.2	106.0	128.[illegible]	119.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					
Insulated wire and cable	723.1	10.8	12.9	8.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					
Electrical insulating equipment	723.2	6.5	7.7	[illegible]					[illegible]			[illegible]	[illegible]						
Telecommunications equipment, n.e.s.	724.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]						
X-Ray apparatus	726.2	[illegible]		[illegible]								[illegible]							
Photocells, transistors, etc.	729.3											[illegible]							
Electrical measuring instruments	[illegible]	[illegible]	[illegible]	[illegible]															

Instruments 729.5

Grouping of Capital Goods according to SITC Name of Group	Grouping of capital goods acc. to SITC	Iron and Steel	Non-Ferrous Metals	Mining	Construction	Cement	Pulp and Paper	Sugar	Textiles										
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Electro-mechanical hand tools	729.6	8.6	7.7	5.1	[illegible]	2.1	[illegible]		5.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Electrical accumulators, engines, furnaces, etc.	729.1(2)																		
" " "	729.9(1)																		
" " "	729.9(2)	19.5	20.6	18.8	24.8	8.4	4.0		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
" " "	729.9(5)																		
" " "	729.9(6)																		
Tanks, etc., of iron and steel	692.11							23.2	[illegible]	[illegible]						[illegible]	[illegible]	[illegible]	[illegible]
Hand tools used in agriculture	695.1													.4		[illegible]	[illegible]	[illegible]	[illegible]
Other tools for use mainly or in machines	695.2	21.6	10.3	13.7	164.8	21.4	21.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL		3,737.0	2,629.0	2,715.0	2,830.0	1,335.0	[illegible]	700.0	4,780.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible] ... in the [illegible] ... from the import [illegible] for [illegible] ... pattern, [illegible] however, [illegible] modified [illegible] the [illegible] which are [illegible] implementation [illegible] capital goods [illegible] and technological [illegible] manufacture of [illegible] sophisticated [illegible] products.

Methodology

10[illegible]. To assess the [illegible] domestic production capacity [illegible] capital goods products, [illegible] the period 19[illegible], extensive field studies were undertaken. These comprised [illegible] visits to a large number of domestic enterprises manufacturing capital goods products in Mexico, besides meetings with important consumers of capital goods items in different branches. In [illegible] manufacturing enterprises were visited. In the course of these plant visits, considerable information was collected regarding the working of each plant, including installed capacity and utilization [illegible] productivity, manufacturing costs, export performance [illegible] expansion programmes contemplated. A questionnaire was [illegible] to a large number of such enterprises, a copy of which is enclosed in Schedule I at the end of this chapter. The extent of detailed information obtained differed from enterprise to enterprise, but [illegible] large, domestic undertakings were found to be extremely willing and co-operative in discussing these aspects, particularly expansion programmes. As for new projects which are under implementation or consideration, necessary information was collected from the Secretaría de Industria y Comercio and various governmental agencies, as also from various Cámaras, associations and

[illegible] very [illegible] heavy [illegible], [illegible], [illegible] [illegible] increments [illegible] programme.

. Product [illegible]

[illegible] The [illegible] are, been [illegible] defined [illegible] these items, care has been taken [illegible] in terms of broad economic [illegible] manufacture in [illegible]. While import substitution [illegible] an essential starting point [illegible], [illegible] be economic and technical [illegible] products. Consequently, [illegible] have been identified which are not only [illegible] well-defined potential for domestic manufacture [illegible], in relation to domestic demand [illegible] export possibilities. Even in such cases, and particularly where [illegible] have been recommended, [illegible] is necessary in the selection of the initial product range. For many of the identified products, therefore, the production programme has been divided into two stages. Depending on the success of the first stage production programme, second stage development could be planned for most of the identified sectors.

102. Manufacture of the identified products [illegible] undertaken either in new plants or through expansion units, though wherever new projects [illegible] been suggested in this chapter, provision has also been made for a proportion of additional production in the identified sub-sectors to be covered by expansions. The setting up of new enterprises and implementation of expansion programmes would of course primarily depend on investment response and the economic feasibility of adding new production

lines in existing plants. It may not, however, be desirable for new product lines to be subdivided among a number of units, as this may be detrimental to the economies of scale and would adversely affect the viability of individual units.

10. Together with the identification of groups and products, a short analysis has also been given regarding present manufacturing capacity, demand projections, broad range of manufacture and the likely magnitude of investments on machinery and equipment in respect of most of the identified groups and items. The investment estimates (at 1968 prices) are, in their nature, broad approximations and serve only to indicate the order of magnitude of the additional outlays that may be required.

11. The basic information regarding each identified group or item has been separately collated in brief "investment profile and information sheets" in respect of most of the groups or items. In all, nineteen such investment profile sheets have been prepared for the information of prospective investors, both domestic and foreign, and are being circulated. The investment profile sheets contain information regarding the present status of manufacture in Mexico, including the range of activities of important existing enterprises, projected domestic production, inclusive of expansion programmes and new projects under consideration, projections of demand, the likely investment on machinery and equipment, together with the comparative factor - advantages of manufacture in Mexico. In addition, a note has been prepared and is being circulated by Nacional Financiera to interested manufacturers and entrepreneurs, which gives a broad picture of capital goods development in Mexico and describes existing policies and procedures, including various incentives and facilities offered by the Government for domestic production and exports.

107. It must be emphasized that the "investment profile sheets" are intended primarily for the purpose of initial investment promotion. In the case of most of the projects identified, it will be essential to undertake detailed pre-investment studies before an investment decision can be reached. Such pre-investment studies would have to include engineering and detailed market studies in a number of cases, including market studies of the LAFTA region and of the USA and Canada in order to assess export possibilities and to determine the scales of manufacture. The pre-investment studies are proposed to be undertaken in Phase II of the capital goods study, which will follow the Phase I covered by this report. These studies would be undertaken either by independent consultancy organisations and individual consultants or by interested manufacturers and prospective investors in collaboration with Nacional Financiera.

108. The succeeding paragraphs contain a brief analysis of the principal capital goods branches and items (other than those relating to the transport sector) which have special significance in the context of Mexico, together with identification of the specific capital goods groups or products which have adequate scope and potential for manufacture in this country.

3. Non-electrical Equipment (common use)

A. Power Generation Industry. (other than electrical machines and equipment)

109. Equipment under this section can be broadly classified in three categories: (a) high-pressure boilers, large steam turbines, hydraulic turbines, etc. and auxiliary equipment used in power stations such as condensers, super-heaters, etc.; (b) boilers and turbines used for industrial processes such as paper, sugar, chemicals and petrochemicals and other industries and (c) industrial combustion engines.

(i) Process boilers

[illegible]. As for the equipment categories [illegible] above, these will be dealt with in detail in section [illegible] of this chapter, together with electrical generators and other equipment, as [illegible] are utilised for electric power generation in central stations.

[illegible]. As for the machinery covered [illegible] above, there are three companies manufacturing process boilers (which operate at much lower pressure than power boilers) in Mexico. All the three manufacturers are operating with technical know-how from well known foreign manufacturers. These enterprises are in a position to fully meet internal demand for such equipment and can also undertake increased exports, particularly to the [illegible] countries, in the next few years.

(ii) Industrial turbines

[illegible]. There is no manufacture of industrial turbines in Mexico at present and there is adequate scope for setting up production facilities for industrial steam turbines. The most important user is Petroleos Mexicanos (PEMEX) which has a total of over [illegible],[illegible]00 small steam turbines up to [illegible]50 hp. in service. On an average, PEMEX import [illegible]0 million pesos worth of new turbines and spare parts, comprising roughly 50 per cent of the Mexican market. The rest of the market demand comprises of turbines for several industries like sugar, textiles, paper, chemicals, etc. and the rating of turbines for these may extend over a wide range, up to possibly [illegible],000 hp.

[illegible].1 Based on import projections, the annual average demand during 1976 - 1980 is estimated at about [illegible] million pesos, which may increase at a rate of over 10 per cent in the subsequent years. Although a variety of sizes and design variations are involved, the industrial-type steam turbine is essentially a relatively simple product and it is expected that the entire domestic demand could be met by local production in stage I during 1976 - 1980. In stage II, production could be planned to include a substantial volume which could also be exported.

11[illegible] There appears to be adequate justification for establishing production facilities initially for an annual output of [illegible] million pesos, corresponding to the demand in the year 19[illegible], allowing for second stage to cater to future needs. The capital investment for stage I for machinery, equipment, power, water and other services but excluding the cost of land, buildings and working capital, would be around [illegible] million pesos. However, if this programme could be incorporated into an existing establishment, manufacturing somewhat similar products such as pumps, compressors, centrifuges, etc., the capital investment would obviously be lower.

112.3 The product range could comprise of industrial-type steam turbines in the range of about 1,000 hp., up to [illegible],000 hp, both of single expansion, extraction type as well as back-pressure type, initially. A limited number of designs in each category will have to be selected for the initial programme, so as to cover the maximum extent of turbines of common use in various industries in Mexico. Provision should also be made for the production of a large volume of spare parts required by PEMEX and other important customers.

112.4 Most raw materials for such manufacture are available in Mexico. At present, medium and large bearings, heavy shaft forgings and special and high-alloy steels are being imported but ever these are likely to be produced within the country in the next few years. It would be necessary to have designs, drawings, material specifications, tools, jigs, fixtures, etc. in the metric system and conforming to ISO standards.

(iii) Internal combustion engines and heavy diesel engines

113. Internal combustion engines (other than for aircraft) constitute an item of large projected imports estimated at [illegible], 12 million pesos during 1970 - 1980. However, the major production gap is in respect of heavy diesel engines (1,000 - [illegible],000 hp.) for motive power generation, pumping and marine and other uses, and there appears to be adequate scope for manufacture of this item. The production of automotive vehicles in Mexico rose to 233,437 in 1972, comprising of 163,378 cars, 67,319 trucks/buses,

[illegible] truck/tractors and [illegible] integrated trucks. The diesel engine requirements continue in many cases to be imported and the demand for heavier diesel engines is likely to increase considerably.

As for domestic production, there are [illegible] companies producing such engines in Mexico. Their present production programme is as follows:

Company No. 1 is producing air-cooled diesel engines, in-line type, 4-stroke, direct-injection, 1, [illegible] cylinders, bore x stroke [illegible] mm., [illegible] cc. per cylinder, [illegible], [illegible] hp. at [illegible] rpm., air-cooled diesel engines, in-line type, 4-stroke, direct-injection, [illegible] cylinders, bore x stroke [illegible] mm., 1,[illegible] cc. per cylinder with [illegible], [illegible] hp. at [illegible] rpm., for pumping, generating, marine-use (pumping, generating), concrete mixing, small mills, etc. The firm is also manufacturing load transmissions for the diesel engines mentioned above. Their total production for 197[illegible] of all types of diesel engines was [illegible],000 units. The annual turnover (diesel engines plus load transmissions) was [illegible] million pesos for 197[illegible]. Their licensor firm is from the U.K. Domestic integration is on the average [illegible] per cent. The utilization against total installed capacity is around 90 per cent.

Company No. 2 is manufacturing air-cooled diesel engines, in-line type, 4-stroke, direct-injection, 1 cylinder, bore x stroke 79.37 x 90 mm., [illegible] cc. per cylinder, 10 hp. at [illegible],300 rpm., [illegible] cylinders, bore x stroke 79.37 x 90 mm., 445 cc. per cylinder, 25 hp. at [illegible],300 rpm., 3 cylinders, bore x stroke 88.9 x 90 mm., 1,080 c.c., 36 hp. at [illegible],500 rpm., under licence agreement with a Swedish company, mainly for industrial (pumping, generating, ventilation, etc.) and marine use. Their present production is 200 - 300 units per year for the above mentioned three models. The national integration is on the average 60 per cent. In 1973, the company is planning to produce at least 1,000 air-cooled diesel engines, in-line type, 4-stroke, direct-injection, 1 cylinder bore x stroke 79.37 x 90 mm, 445 cc., 10 hp. at 2,300 rpm., per annum of a value of 8 million pesos for export to Sweden. Future plan is to start manufacture of marine outboard

diesel motors with 40 hp. and above. Until now all outboard motors are being imported and the total annual import is around 4,000 to 5,000 units. The firm proposes to cover 10 per cent of the market share, i.e., 400 to 500 units per year. The company also produces water-cooled diesel engines in-line type, 4-stroke with quantity control of injection pump and speed governor: 4, and 6 cylinders, bore x stroke 130 x 152 mm., 8,100, 12,170, 16,200 cc., 120 to 400 hp. at 1,500 rpm., for stationary industrial (pumping, generating, ventilation, refrigeration, etc.) and marine use, under licence agreement with a U.K. company. The firm's production programme for diesel engines in the capacity range of 100 to 400 hp., excluding marine engines, is as follows. 1972 - 120 units (sales value 21 million pesos), 1973 - 170 units, 1974 - 250 units. In 1972 the company was covering 10 per cent of the total market share in this capacity range. The national integration is, on the average, 45 per cent. The firm is also producing load transmissions for Volvo Penta and Rolls-Royce engines, and is doing sub-contract work for various companies. The utilization against total installed capacity is however only about 20 per cent. Their theoretical capacity in single shift would be approximately 1,500 Volvo Penta and approximately 800 Rolls-Royce engines per year. Future plan is, to start manufacture of truck engines with 150 to 200 hp. If material costs are not included, the company's prices can compete over the entire production range with international pricing.

Company No. 3 is producing air-cooled diesel engines, in-line type, 4-stroke, direct-injection: 1 cylinder with 10 - 12 hp. and 13 - 16 hp. 2-V cylinders with 17 - 27 hp. for industrial use. Their licensor firm is from West Germany.

Company No. 4 is manufacturing water-cooled diesel engines: in-line type, 4-stroke, direct-injection, 3 cylinders with 45.5 hp. at 2,250 rpm., 4 cylinders with 60 hp. at 2,000 rpm., 4 cylinders with 72.5 hp. at 2,000 rpm. mainly for tractors, water-cooled diesel engines V-6 with 185 hp., mainly for trucks. Their licensor firm is from the USA.

Company No. 3 is producing water-cooled diesel engines, in-line type, 4-stroke, direct-injection, 4 and 6 cylinders with higher hp. range than company No. 4, mainly for trucks and tractors.

Company No. 6 is manufacturing water-cooled diesel engines, in-line, 4-stroke, direct-injection, 4 cylinders with 77 hp. for Ford agricultural tractors. The annual production in 1972 was 1,[illegible] units. The national integration is, on the average, 72 per cent. The utilization against total installed capacity is around [illegible] per cent in one shift, partly two shifts. The firm is also partly manufacturing and assembling the following water-cooled diesel engines: V-type, 4-stroke, direct-injection, 8 cylinders, bore x stroke 111 x 89 mm., 5,770 cc., with 155 hp. at 3,300 r.p.m., with an annual production in 1973 of 3,000 units for medium trucks (chassis and cab), 3.5 to 7.7 tons, 6 cylinders, bore x stroke 11[illegible] x 89 mm., [illegible],700 cc., with 210 and 255 hp. at 3,300 rpm., with an annual production in 1973 of 1,50[illegible] units for semi-heavy trucks (chassis and cab), 5 - 7.5 tons water-cooled diesel engines, in-line type, 4-stroke, direct-injection, 6 cylinders; bore x stroke 139.7 x 152.4 mm. 14,013 cc., with 335 and 400 hp. at 2,100 rpm., with an annual production of 755 units for heavy trucks (chassis and cab). Two out of the four types are available with supercharger, one without and one for industrial use. Apart from their truck and bus production, around 1,470 diesel engines within the range of 210 to 400 hp. have been made in 1972 for other purposes. The national integration for 1974 is anticipated to be around 62 per cent. The utilization against total installed capacity is on the average 70 per cent (machine section one, partly two shifts, engine assembly section, three shifts). Their licensor firm is from the USA. Future plans include a substantial increase at the present production of the V-6 and V-8 types to reach an estimated volume of 10,000 units per year in both types, including exports which would reach approximately 18 per cent of the projected production. Also a V-12 version is under consideration in ranges of 420, 500 and 1,200 hp. for a medium.

The company is also exploring the possibilities of producing engines for 3,000 hp. diesel-electric locomotives, with annual demand of 50 units initially and increasing to 100 units ultimately.

113.2 With the existing capacity and the proposed expansions which are contemplated at present, there is likely to be adequate production of the following diesel engines:

- air-cooled, in-line type, 4-stroke, direct-injection, 1, 2, 3 and 4 cylinders, 7.75 up to 44.5 hp. for pumping, generating, ventilation, marine use (pumping, generating), concrete mixing, small mills, etc.

- water-cooled, in-line type, 4-stroke, direct-injection, 3 and 4 cylinders, 45.5 up to 77.5 hp., mainly for agricultural tractors.

- water-cooled, V-type, 4-stroke, direct-injection, (partly with supercharger), 4, 6 and 8 cylinders, 155 up to 335 hp., mainly for medium and semi-heavy trucks (chassis and cab).

- water-cooled, in-line type, 4-stroke, with quantity control and injection pump and speed governor, 4, 6 and 8 cylinders, 100 up to 400 hp. for stationary industrial (pumping, generating, ventilation, refrigeration, etc.) and marine use,

- water-cooled, in-line type, 4-stroke, direct injection, 6 cylinders with supercharger, 335 up to 400 hp. mainly for heavy trucks (chassis and cab).

- water-cooled, V-type, 4-stroke, direct-injection, 12 cylinders, 420 up to 1,200 hp., mainly for marine, heavy construction equipment and heavy harvesting machines.

113.3 The total projected imports of heavy diesel engines for 1976 - 1980 is likely to be of the value of about 1,623 million pesos. As for spare parts for diesel engines, only mono-blocks and cylinder heads could be identified as major import sub-items covering 152 million pesos. About 400 - 500 million pesos by way of spare parts for larger diesel engines is also likely to be imported. In total, therefore, the larger diesel engines with spare parts and components for assemply represent

an import value of about 2,300 million pesos for the period 1976 - 1980. The annual total market demand for diesel engines with output up to 6,000 hp., including spare parts would, therefore, be about 450 million pesos. It is considered feasible that additional facilities and major expansion proposals can be developed to cover the large anticipated production gap during the period up to 1980, which could be considered as stage I of expansion of this industry.

Table XII*

Production Gap for Diesel Engines

	In Million Pesos
Annual total requirements for diesel engines with output of 250 to 6,000 hp., including spare parts	460
Minus diesel engines for diesel-electric locomotives	- 75
	385
Minus 25 per cent in capacity range 250 to 1,000 hp., likely to be covered by existing domestic producers	- 96
Minus 25 per cent for import of special large and special purpose diesel engines, for which an economic batch-size production cannot be achieved	- 96
Balance to be covered by new facilities	193

* All values are based on 1968 price levels.

The demand for large diesel engines is expected to increase steadily after 1980 at an annual rate of around 10 per cent in the context of rapid development of large and medium industries, establishment of new industries, growth of new capital goods production and gradual replacement of old diesel engines of existing industries.

113.4 The total investment for the stage I production programme in this sub-sector is estimated as follows: machinery, equipment, water supply and other services to be around 150 million pesos, excluding the cost of land, buildings and working capital for new projects. If the proposed manufacturing programme is partly or fully incorporated into existing facilities, the costs would be lower. After 1980, a stage II production programme for this sub-sector would need to be drawn up. A 10 to 15 percentage of export could be projected for this water period in view of the country's factor advantages.

113.5 In view of the above, it is considered that heavy water-cooled diesel engines with output of 1,000 to 6,000 hp., for generation, pumping, marine use, etc., would have potential for manufacture in the country. Raw materials for such manufacture would be largely available in the country. At present, only medium and large special bearings, heavy crankshafts, camshafts, connecting rods, forgings, special and high-alloy steels and some sophisticated electrical components and control instruments are being imported, but in time these are likely to be produced inside the country. It is essential that designs and drawings, material specifications, tools, jigs, fixtures, gauges, patterns, etc., should be in the metric system and conforming with ISO (International Standards Organization) standards. Adequate provision should also be made in the plans for technical services and research and development facilities.

B. Machine tools [illegible] metal-working machinery

111. The machine tool industry in Mexico is in a relatively early stage of development. Although [illegible] enterprises are manufacturing machine tool and metal forming machinery of various types, total production falls considerably short of demand and the range of products is also very limited. Consequently, substantial imports are taking place, which are likely to increase considerably by 1980 unless domestic manufacture is significantly increased. This sub-sector also offers considerable scope for development of exports in view of Mexico's factor-advantages and geographical location and the programming of machine manufacture needs to be oriented suitably. The analysis of this sub-sector has been divided under two broad categories: (i) chip-removing machine tools and (ii) chipless forming machine tool.

(i) Chip-removing machine tools

(a) Demand and production projections:

115. It is estimated that the total demand for chip-removing machine tools, covering parallel and turret lathes, single spindle automatics, milling machines, grinding machines, drilling machines, shaping machinery and sawing machines, would be of the order of 4,687 million pesos during the period 1976 - 1980 in total, excluding machine tool requirements for the automotive industry. The figure includes 10 per cent for exports in the above categories. These categories of machine tools would represent over 67 per cent of apparent consumption of machine tools by 1980. The distribution of this figure in terms of specific categories would be broadly as follows:

Table III

Demand Projections of Chip-removing Machine Tools

	Type	Projected Percentage of Apparent Consumption in 1980 of all Machine tools
1.	Lathes - parallel lathes and others	1.5
2.	Milling machines, including universal vertical and horizontal machines	8.5
3.	Shaping machines	2.6
4.	Grinding machines	12.1
5.	Sawing machines	1.2
6.	Drilling machines and boring mills	11.0
7.	Threading machines	0.9
8.	Unclassified chip-removing machine tool	9.5
	TOTAL	67.3

The total annual market demand for these categories (apparent consumption plus 10 per cent exports) is anticipated to be about 938 million pesos for the period 1976 - 1980. The demand for chip-removing machine tools is expected to increase steadily after 1980 at an annual rate of 10 - 15 per cent in the context of rapid industrial development growth of the capital goods sector and gradual machinery replacement in existing industries.

[illegible] Against [illegible] market demand, [illegible] expected that annual production of chip-removing machine tools would increase to about 250 million [illegible]. [illegible] estimate made by the Group had [illegible] likely [illegible] production [illegible] million pesos by the year [illegible] field investigations this estimate [illegible] reduced. The product categories and likely production [illegible] table below

Table [illegible]

Projections of Domestic Machine Tool Production 19[illegible]

	Product Category	Likely Production Value in 19[illegible] (in million pesos)
1.	Lathes - centre	11[illegible]
2.	Drilling machines and boring mills	50
3.	Milling machines	47
4.	Lathes - other	[illegible]0
5.	Grinding machines	5
6.	Shaping machines	4
7.	Threading machines	3
8.	Sawing machines	2
9.	Off-hand rough grinders	1
	TOTAL	250

(b) Existing plants

There are about ten companies producing chip-removing machine tools and their present production programme is briefly described below*.

---

* A review at the date of going to press indicates that there has been considerable shortfall in the achievement of production targets by most of these companies during 197[illegible] and 1973, both as to quantities and additional types of machine tools.

Company No. [illegible] surfacing and screw cutting lathes in [illegible] centre widths [illegible] mm. with an annual production of [illegible] units, [illegible] with [illegible] centre widths [illegible] mm. with an annual production of [illegible] units in [illegible]. The firm plans to introduce additional [illegible] machine tools into its production programme, namely, sliding, surfacing and screw cutting lathes with centre heights of [illegible] mm. with centre widths [illegible] mm. with an annual production of [illegible] units, universal cylindrical grinding machines with centre heights of [illegible] mm. and centre widths of [illegible], with an annual production of [illegible] units, gear cutting machine with work piece diameter [illegible] mm. and module [illegible], horizontal boring and milling machines with spindle diameters [illegible] mm. with an annual production of [illegible] units. The licensor firm is from Czechoslovakia. The national content is to [illegible] per cent depending on type of machine tool. The total capacity installed at present is [illegible] annual production of [illegible] sliding, surfacing and screw cutting lathes and [illegible] tool room knee-type milling machines.

Company No. [illegible] manufacturing bench drilling machines in various models with a capacity of [illegible] mm. with an annual production of 600 units, round column drilling machines in various models with a capacity of Ø 31.7 mm. with an annual production of 600 units, round column drilling machines in various models with a capacity of Ø 25.4 mm. with an annual production of [illegible] units, upright gang drilling machines with fixed table, with a capacity of Ø 12.7 and 25.4 mm. 2 to 6 spindles in various models with an annual production of [illegible] units. The firm plans to introduce one additional chip removing machine tool into the production programme, namely sliding, surfacing and screw cutting

[illegible] with centre height [illegible] mm. [illegible] centre width of [illegible] mm. with [illegible] annual production [illegible] removing machine [illegible] of the [illegible]. The [illegible] integration of their [illegible] production [illegible] per cent. [illegible] present utilisation [illegible] per cent.

Company No. [illegible] is producing [illegible] and screw cutting lathes [illegible] motors [illegible] approximately [illegible] mm. and centre [illegible] production of round [illegible] for training, maintenance and repair purposes. The firm [illegible] to extend its production programme. Their licensor is from [illegible].

Company No. 4 [illegible] producing [illegible] machines with ram stroke, [illegible], [illegible] and [illegible] mm. bench drilling machines with capacity of Ø [illegible], [illegible] mm., round column drilling machines with capacity of [illegible] mm. [illegible] surface grinding machines with [illegible] table size [illegible] mm., [illegible], knee-type milling machines with table size [illegible]. According to information received, the firm is [illegible] assembling those machines with few components made in their own shops. [illegible], their total production is insignificant.

Company No. 5 appears to be [illegible] assembling bench drilling machines with capacity of Ø [illegible] mm. and round column drilling machines with capacity of Ø [illegible] mm.

Company No. 6 is producing bench drilling machines and round column drilling machines with capacity of Ø 1[illegible].7 and [illegible].4 mm. Their licensor firm is from the USA.

Company No. 7 is manufacturing bench drilling machines and round column drilling machines with capacity of Ø 1[illegible].7 and [illegible] mm.

Company No. [illegible] is rebuilding used machine tools. Overhauling and rebuilding cover the full range mechanical, electrical, electronic and hydraulic. Later, the firm plans production of new machine tools. The production programme is not yet defined.

Company No. 4 is producing horizontal band sawing machines.

Company No. 10 is manufacturing off-hand round grinding machines (floor and bench types).

(c) Expansion plans of existing firms

Company No. 11 is planning to start production of centre lathes with centre height of [illegible] mm. and centre widths of 750, 1,000 and 2,000 mm., equiped with hydro-copying attachment, with an annual production of 100 units in single shift, under license agreement with a French firm. In a later stage, the company is planning to produce universal, knee type milling machines with table size 400 x 1,250 mm.

New firms to be established.

Company No. 12 (a new project) is planning to start production of sliding, surfacing and screw cutting lathes in six different models with centre heights of 125 to 250 mm. and centre widths of 500 to 2,000 mm. with an annual production during 1973 - 1975, 750 units, 1976: 900 units, 1977 - 1978: 1,020 units, 1979: 1,095 units and 1980: 1,145 units, knee-type milling machines in three different models with table size 400 x 1,250 mm. with an annual production in 1973 - 1975 of: 250 units, 1976: 350 units, 1977 - 1978: 365 units, 1979 - 1980: 495 units. Their licensor firm is from Yugoslavia.

Company No. 13 having produced in 1970, single-spindle bar automatics with bar capacity of Ø 16, 25 and 42 with an annual production of 32 units, has given up manufacture. The firm plans to restart production with small single-spindle bar automatics with a new licensor firm.

(d) <u>Manufacturing opportunities</u>

114. With the existing capacity and the proposed expansions which are contemplated at present, there is likely to be adequate production of the following chip-removing machine tools: sliding, surfacing and screw cutting lathes with centre heights of [illegible] to [illegible] mm. and centre widths of 600 to [illegible],000 mm., tool room knee-type milling machines with table size of 240 x 1,[illegible], knee-type milling machines (horizontal, universal and vertical) with table size [illegible] x 1,[illegible] mm., bench and round column drilling machines with a capacity of Ø [illegible], 1[illegible] and [illegible] mm., upright gang drilling machines with a capacity of [illegible] and [illegible] mm. with 1 to 5 spindles.

A detailed market survey has been done by Company No. 1 in respect of its specific range of manufacture. A similar market survey has also been recently completed by a domestic consultancy organisation in respect of turret lathes, surface grinders and single-spindle automatics and the report is expected shortly. For the other categories, similar surveys may be necessary.

115. The above projections of market demand and domestic production by 1980 indicate that there will be a substantial uncovered gap during the period 1976 - 1980, to the value of about [illegible] million pesos annually*. It is considered feasible that new projects and major expansion proposals can be developed to cover about 50 per cent of the larger anticipated production gap during the period up to 1980, which could be considered as Stage 1 of development of the Mexican machine tool industry. It may not be possible to go beyond this figure as economic, batch-size production of a large number of sophisticated, special purpose machines and those with larger ratings, together with

---

* All values are based on 1968 price levels.

special type machine tools for the automotive industry, may not be practicable in [illegible]. [illegible] ver the coverage of [illegible] per cent of the [illegible] manufacture of chip-forming machine [illegible] needs by [illegible], which would [illegible] development programme in this sub-sector.

115.4 [illegible] market research [illegible] in respect of special chip-forming machine tools [illegible] a large number of plant visits in Mexico. [illegible] such investigation, it is considered that the following chip-forming machine tool categories would have possibilities for manufacture in the country.

1. Turret lathes with bar capacity of Ø [illegible], [illegible] and [illegible] mm.
2. Single-spindle bar and chucking automatics with bar capacity of Ø [illegible] mm.
3. Universal cylindrical grinding machines with centre height of [illegible] to 150 mm. and centre widths of [illegible]00, 1,000 and 1,500 mm.
4. Surface grinding machines with table size [illegible] to 400 mm. by 1,000 to 1,[illegible] mm.
5. Universal tool and cutter grinding machines with centre widths of 50[illegible] to [illegible] mm.
6. Heavy duty knee-type milling machines, horizontal, universal and vertical, with table size 315 to 500 mm. by 1,[illegible] to [illegible] mm.
7. Heavy duty pillar type drilling machines with capacity of Ø [illegible], 40, 50 and [illegible] mm.
8. Radial drilling machines with capacity 40, 50, 63 and 80 mm.
9. Shaping machines with ram strokes of 450, 630 and 800 mm.
10. Hacksawing machines with cutting range of Ø 400 mm.
11. Vertical band sawing machines with throat 500 mm.
12. Cold circular sawing machines with saw blade diameters of 400 and 630 mm.

Modern design and [illegible] should be provided with adequate arrangements for training of their own engineers, technicians and workers. It is essential that drawings, material specifications, tools, dies, fixtures, gauges, charts, etc., should be in the metric system, conforming with ISO (International Organization for Standardization) standards. Steps to provide a model base should be taken in the plans for technical services and research and development institutes.

114. The investment during stage I for machinery, equipment and services for the power, gas and water supply for this additional production programme in this sub-sector is estimated to be about 411 million pesos, excluding the costs of land, buildings and working capital for new projects. If the proposed manufacturing programme is partly or fully incorporated into existing facilities, the investment could be reduced. Possibilities of establishing new facilities in more than one location could also be investigated with advantage. After 1980, a stage II production programme for this sub-sector would need to be drawn up. A higher percentage of exports could be projected for this period in view of the country's factor advantages.

115. Most raw materials for this industry are available in the country. Only medium and large bearings, heavy shaft forgings, special and high alloy steels and sophisticated electrical components may need to be imported for some time. With the rapid expansion of the industry, however, specialised foundry capacity will need to be substantially developed, both in terms of output of heavier ranges and quality. This aspect has been dealt with in a later paragraph.

115.1 While the market demand projections have assumed 10 per cent exports during 1976 - 1980, the possibilities of machine tool exports need to be examined in greater depth. This has not been possible in the course of this study and should be taken up in the next phase. Since Mexico appears to have one of the fastest growing markets for machine tools in Latin America, the necessary domestic market base for export

planning would be available. In the LAFTA region, the major potential markets for machine tool exports appear to be Brazil, Argentina and Chile. While manufacture of certain machine tool categories has developed considerably in Brazil and Argentina, there nevertheless appears to be adequate export market for some of the machine tool items identified as having potential for manufacture in Mexico. A substantial market for certain machine tool products would also be provided by the CMEA, provided domestic costs are competitive.

115. The programming of machine tool production necessitates care both in the selection of appropriate technology and in the phasing of domestic integration so that quality and reliability can be ensured from the outset. Since export orientation would be of great significance, the types and makes of equipment selected for domestic manufacture must be such as would effectively penetrate export markets, and also be able to compete in the internal market with other products from Latin American producers. The phasing of domestic integration in this sub-sector must also be adjusted so as to achieve an appropriate balance between increasing domestic content and quality production which could compete in foreign markets from the early stages of production.

(ii) Chipless forming machine tools

116. It is estimated that total market demand (apparent consumption and export value which is anticipated to be around 10 per cent of domestic production) for various types of chipless forming machine tools during the period 1976 - 1980 would be approximately 1,945 million pesos, excluding the requirements of such equipment by the automotive industry.

Market demand would, therefore, be around 389 million pesos annually.

116.1 There are about fifteen companies which are producing chipless forming machine tools in Mexico. Their present production programme is as follows:*

Company No. 1 is producing hydraulic presses.

Company No. 2 is producing bar cutters, guillotines and bending machines.

Company No. 3 is manufacturing hydraulic presses and mechanical eccentric presses with a capacity of up to 200 tons. Their licensor firm is from the USA. They also produce presses of their own design.

Company No. 4 is producing foot operated guillotine shears in two different models with a capacity of 1.5 x 1,321/1,829 mm. respectively, guillotine shears with mechanical underneath driving in various models with a capacity of 1.5 to 3.5 x 1,321 to 3,685 mm., hand operated folding machines in various models with a capacity of 0.75 to 2.6 x 2,038 to 4,775 mm., mechanical press brakes in various models with a capacity of 15, 25, 36/55, 60/90, 100/150, 150/225, 260/400 tons. Export rate is 30 to 10 machines per year to the USA. Their licensor firm is from the USA.

Company No. 5 is producing approximately the same range as company No. 4, but partly in bigger ratings.

Company No. 6 is manufacturing sheet metal benders and shears.

Company No. 7 is producing hydraulic presses.

Company No. 8 is manufacturing mechanical guillotine shears with a capacity of 6 x 3,000 mm. and mechanical press brakes with a capacity of 6 x 3,200 mm. Their annual production in 1972 for both machines together was 39 units. Their licensor is from the USA.

---

* A review at the date of going to press indicates that there has been considerable shortfall in the achievement of production targets by most of these companies during 1972 and 1973, both as to quantities and additional types of machine tools.

Company No. 9 is producing press brakes and manual bending machines.

Company No. 10 is manufacturing open gap hydraulic presses with a capacity of 1[illegible], 25, 50, 100 and 250 tons, hydraulic four-column presses with a capacity of 50 to 1,000 tons.

Company No. 11 is producing hydraulic and pneumatic presses.

Company No. 12 is manufacturing plunger-type thermoplastic moulding machines in three different models with moulding die closure pressure of 75, 150 and 250 tons. The production in 1973 will be around five units for each type. Their licensor firm is from Japan.

Company No. 13 is producing plastic (pipe) extrusion machines.

Company No. 14 is manufacturing plastic injection moulders (bench type) and plastic pipe extruders.

Company No. 15 has started production of plunger-type thermoplastic moulding machines in three different models with moulding die closure pressure of 50, 70 and 110 tons. There are plans to produce 80 units in the first year (1973). Mexico has at present 3,000 to 4,000 units working. The firm hopes to cover in the near future 25 to 30 per cent of the Mexican market. Their licensor firm is from Italy.

It is estimated that domestic production of chipless forming machine tools would be of the order of 160 million pesos annually by 1980, allowing for the planned expansions of existing enterprises. The domestic requirements of the following chipless forming machine tools are likely to be fully covered by 1980: pneumatic presses, open gap hydraulic presses with a capacity of 12 to 250 tons, hydraulic four-column presses with a capacity of 50 to 1,000 tons, mechanical excentric presses with a capacity of up to 200 tons, foot operated guillotines with a capacity of 1.5 x 1,321/1,829 mm., mechanical guillotine shears with a capacity of 1.5 to 6 x 1,321 to 3,685 mm., hand operated bending and folding machines with a capacity of 0.75 to 2.6 x 1,321 to 4,775 mm., mechanical press brakes with a capacity of 15 to 400 tons, plunger-type thermoplastic moulding machines with die closure pressure of 50 to 250 tons, plastic pipe extrusion machines (bench and floor types).

116.2 From the above projections of market demand and domestic production it will be seen that there will be an uncovered annual production gap of about 229 million pesos. The greater proportion of this figure i.e., about 85 per cent would be represented by sophisticated, special type machines with larger ratings which may not be economically feasible to produce in Mexico during the period 1976 - 1980, as batch size manufacture would not be possible. At the same time, it is considered that there is scope for expanding domestic manufacture of chipless forming machine tools so as to cover a production value of approximately 30 million pesos annually by 1980. The demand for such machine tools is likely to increase steadily after 1980 at the rate of 12 to 15 per cent in the context of rapid industrial development.

116.3 The total investment machinery, equipment and services such as power, gas and water supply, etc., on additional programmes to cover the volume of production in this sub-sector up to 1980, is estimated to be about 40 million pesos, excluding the cost of land, buildings and working capital for new facilities. If the proposed manufacturing programme is partly or fully incorporated into existing facilities, the costs would be lower. Possibilities of establishing new facilities in more than one location could also be investigated with advantage. For the period after 1980 a second stage production programme would need to be drawn up in due course, anticipating a higher rate of exports.

116.4 In the course of plant visits, limited market research of chipless forming machine tools was conducted. In the light of this study and in terms of domestic consumer preferences, it is considered that the first stage expansion programme for this sub-sector could cover the following items:

1. Open gap hydraulic presses with capacity of 80 to 250 mm. for straightening, bending, marking, calibrating, deep-drawing, etc.

2. Spark erosion machines with mounting table of 190 x 280 mm. up to 600 x 1,000 mm., including integrators with taper shank Morse 3.

3. Ingot, billet and slab shears (universal iron workers) with shearing strengths of 150 to 1,500 tons.

4. Asymmetric power driven sheet metal bending rolls with capacity of [illegible] mm. plate thickness and working range of 1,500 to [illegible],000 mm.

It is necessary that designs and drawings, material specifications, tools, dies, fixtures, gauges, patterns, etc. should be in metric system conforming with ISO (International Standards Organization) standards. Adequate provision should also be made for technical services and research and development facilities.

116.5 The same considerations would apply in respect of technology selection and phased domestic integration programmes as in the case of chip removing machine tools.

D. Packaging, spraying and weighing equipment

117. There are three medium-sized Mexican owned manufacturing enterprises for packaging equipment, apart from small workshops which take up production and repairs of simple equipment. The first company, which was operating earlier under a license agreement, has expanded rapidly in recent years and is producing up to 50 units annually or automatic, pouch packaging machines, besides bottle packing and other packaging equipment. Domestic content is about 95 per cent and manufacturing costs are competitive. The company has built up substantial exports in the last two to three years, mainly to the USA and South America, such exports going up to 60 per cent of its production. The second company is manufacturing capping machines, automatic liquids filling piston machines, bottle-cleaning equipment and recently entered into a technology agreement with a US company for manufacture of the latter's packaging products, including packing of polyethylene bags. The third company is manufacturing bagging machines for cellophane products and bottling and other packing machinery.

117.1 The import figures for various packaging items and equipment for the period 1965 - 1971, both years inclusive, were as follows.

Table 4V

Imports of various packaging items and equipment during 1965 - 1971

(in million pesos)

1.	Equipment for cleaning and drying of bottles	177.1
2.	Wrapping for different products	113.2
3.	Automatic bottling and packing machines	96.6
4.	Labelling equipment	77.4
5.	Packing with registration	69.3
6.	Equipment for double operation packing	61.9
7.	Aeration equipment	61.9
8.	Bottling or packing equipment for milk or margerine	35.5
9.	Corking and closing equipment	35.4
10.	Packing of bottles	35.0
11.	Other packaging equipment	117.4
		871.7

It is estimated that imports of packaging equipment during 1976 - 1980 could be of the order of 1,190 million pesos, or about 238 million pesos annually.

117.2 This sub-sector has considerable scope for development, both for meeting increased domestic requirements as also for exports of such equipment. The additional production capacity could, for the most part, be covered by expansion of the existing enterprises in this field.

These will, however, need considerable financial assistance by institutional agencies. It is also necessary for these units to acquire suitable foreign technology in the latest packaging techniques in the fields not yet covered adequately.

Spraying equipment

118. This category covers various machinery items including coating and painting equipment, pesticides and other sprayers and aerographic pistols for compressed fluids. While a considerable range of simpler spraying equipment is domestically produced, import projections of 480.9 million pesos during 1976 - 1980 are anticipated.

118.1 Most such equipment is relatively unsophisticated and it should be possible for existing producers to substantially expand production, both for increasing domestic demand and for exports.

Weighing equipment

119. There are two important manufacturers of weighing equipment. The first company is producing bag-filling scales, continuous weighing scales, belt scales and complete weighing systems for certain industries, besides scales for railways and trucks and a wide range of other scales covering over 300 models. The second company is manufacturing portable scales of 500 to 1,000 Kgs., cattle weighing scales, scales for general use, trucks and railways, etc.

119.1 For 1976 - 1980, imports of weighing machinery are anticipated at about 275 million pesos. The main item imported is weighing machinery with automatic indicator or with printing mechanism for weights of 1,000 Kgs. and more, and projected imports of this item would be about 81 million pesos for this period.

119.2 It is considered that expansion of existing units, with suitable technology arrangements for more sophisticated weighing equipment, could be undertaken to cover about 8 million pesos annually in ranges which would otherwise be imported. The additional investment for manufacture of more sophisticated equipment would not be very large if this is undertaken as part of expansion programmes. There is also considerable possibility of exports of such equipment, particularly in the LAFTA region.

. Heating and cooling equipment

120. A variety of equipment fall under this classification. Except for large heat exchangers used in power plants, most other items fall under medium and small range of capital goods. A number of manufacturers are already taking up increasingly sophisticated items in recent years and there has been a steady reduction in imports, as will be seen from the following table

Table XI

Imports of Heating and Cooling Equipment

(in million pesos)

	1965	1966	1967	1968	1969	1970	1971
a. Air conditioners and parts	[illegible]	12.4	9.8	[illegible]	[illegible]	[illegible]	[illegible]
b. Cooling plants	16.0	11.4	14.1	[illegible]	[illegible]	33.9	16.1
c. Burners, etc.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
d. Ovens of different kinds	121.7	10.7	72.1	[illegible]	161.4	94.5	64.0
e. Heat exchangers	[illegible]	53.[illegible]	[illegible]	53.7	[illegible]	55.1	51.4
f. Vulcanising equipment	16.8	5.5	5.[illegible]	[illegible]	15.[illegible]	36.7	18.6
g. Distillation equipment	21.[illegible]	19.4	26.0	[illegible]	7.8	36.9	14.6
h. Dryers	15.7	11.3	7.6	[illegible]	19.6	12.[illegible]	11.3
i. Evaporators	4.3	5.9	18.0	[illegible]	18.6	20.5	9.5
j. Vaporation and steam treatment	3.7	3.3	1.1	[illegible]	3.0	1.4	1.1
k. Parts	13.1	32.0	13.8	21.6	12.3	[illegible]	20.2
TOTAL	310.[illegible]	278.[illegible]	264.1	281.2	356.6	338.1	217.1

120.1 Item (d) ovens and item (e) heat exchangers account for a large proportion of the imports. In the course of the field investigation, it was noted that some of the bigger and more sophisticated heat exchangers required by [illegible] and [illegible] are also being undertaken by some of the major metal fabricators. The large ovens for certain special purposes are also being taken up gradually. It is therefore, felt that adequate indigenous capacity is available, which has the potentiality to meet a high proportion of Mexico's demand in the next few years, except for a few very large and sophisticated items which may not be viable for economic manufacture due to low demand or technological and other considerations.

120.2 Domestically manufactured equipment in this category, such as heat exchangers, pressure vessels and other welded apparatus have considerable export possibilities, including to the USA. A major difficulty in this regard, however, is the non-availability of AMSE (American Society of Mechanical Engineers) certification, as a result of which fabricators in Mexico are also not in a position to meet certain stringent requirements of customers like [illegible], PEMEX, etc. This matter requires a detailed study, with a view to evolve a suitable procedure and mechanism by which the certification could be provided to fabricators locally so that import substitution and exports in this equipment category could be rapidly extended.

F. <u>Pumps, centrifuges and compressors</u>

121. There are about 11 important companies which are producing pumps, centrifuges and compressors in Mexico. Their present production programme is as follows

(a) <u>Pumps and centrifuges</u>

<u>Company No. 1</u> has a large programme of different pumps, rotary pumps with electric motors of 0.[illegible] to 6.8 hp. and with a capacity of 625 to 10,800 lts./hr. at a pressure of 1 to [illegible].5 Kg./cm.^{2}, horisontal ejector pumps with electric motors of [illegible] hp. and a capacity of 363 to 1,060 lts./hr. at a pressure of 1,406 to 3,164 Kg./cm.^{2} to a height of 7.8 to 54 metres; self-starting centrifugal pumps with air or water-

...petrol or diesel engines or electric motors from ... to ... hp. ... capacity of ... to 1,00[illegible] lts./min. at a height of ... to 30 ...res, vertical turbine pumps for deep wells with vertical electric ...re ... to 150 hp. with a capacity of ... to ...,[illegible] lts./min. ...ght of ... to ... metres. The pumps represent approximately ... ent of the company's entire annual sales value equal to ... million pesos. Their market share is about ... per cent.

Table VII

Domestic Production of Pumps 1973

Type	No. of units produced in 1973	Sales value in million pesos
...rental ejector pumps	...	19
...f-starting centri-...l pumps	...,079	
...ry Pumps	...,07[illegible]	
...ical turbine pumps ... deep wells		13

...pany No. 3 has a production programme of different pumps for the ...roleum, chemical and pulp and paper industries. The pumps are ...uced in various materials such as mild steel, stainless steel and ...ss. The annual sales value is around 10 million pesos. The ...ional integration is 100 per cent. The local sales prices of most ...their products is comparable with USA prices, though certain products ... considerably more expensive. The company is planning quantitative ...rease of its production programme and introduction of two more com-...ssor sizes in the near future.

Company No. [illegible] has a large programme of different pumps: rotary pumps for viscous liquids 1.25", [illegible] to [illegible] hp, 150 to 1,[illegible]00 rpm, 0.3 to 3.7 lts./sec., 2", 1.6 to 31 hp., 100 to 1,[illegible]00 rpm., 0.3 to 5.7 lts./sec., 3", 1.4 to 66 hp., 60 to 1,[illegible]00 rpm., 1 to 1[illegible] lits./sec., 4", 4 to 100 hp., 60 to 900 rpm., 1.[illegible] to 19 lts./sec., horizontal centrifugal pumps (steel casting, bronze casting, stainless steel) with a capacity of [illegible] to 140 lts./sec. to [illegible] height of 11 to 67 metres, horizontal centrifugal two-way pumps of [illegible].[illegible] to 1,2[illegible] lts./sec., to a height of 6.4 to 15[illegible].5 metres, vertical turbine pumps with a capacity of 1.26 to 750 lts./sec., to a height of [illegible] metres. The company also manufactures horizontal turbine pumps (steel and bronze castings) with a capacity of 0.[illegible]3 to [illegible].07 lits./sec. to a height of 15 to [illegible]29 metres. The firm's market share for pumps was in 19[illegible], domestic production - 40 million pesos ([illegible]0 per cent), imports - 15 million pesos (25 per cent). The company is planning the introduction of new product lines. The projection for 1973 calls for exports of over 1[illegible] million pesos.

Company No. 10 is undertaking the manufacture of mud pumps for the petroleum industry (for oil wells), with a capacity of 500, 750 and 1,000 hp. The expected sales value is [illegible] million pesos a year. Each year PEMEX needs a replacement of about 10 pumps at a price per unit of 300,000 pesos. The local sales prices of their entire production programme are higher compared with international pricing, mainly due to higher manufacturing (too small batch sizes) and raw material costs in Mexico.

Other manufacturers:

In addition, there are about 50 smaller firms producing pumps of smaller ranges for domestic water supply and irrigation purposes.

(1) Compressors

Company No. 1 [illegible] single [illegible] double stage compressors with electric motors [illegible] rpm., [illegible] to 1,[illegible] rpm., bore & stroke [illegible] mm., with a capacity of [illegible] to [illegible] with air vessels of [illegible] litres [illegible].

Company No. [illegible] [illegible] mobile [illegible] stationary air-cooled, single and double stage compressors [illegible] cylinders with a maximum working pressure [illegible] lbs./square inch, electric motors 50/60 Hz., [illegible] rpm., [illegible] to [illegible] hp., petrol engines [illegible].5 to [illegible] hp., with a capacity of [illegible].1 to [illegible] (100 PSIG) shown in Table [illegible].

Company No. 3 is producing mobile compressors with a capacity of 160, 250 and 600 CFM, with an annual production of [illegible] units, and an annual sales value of [illegible] million pesos, mainly for mining and construction purposes. The firm also produces stationary compressors in 40 different models with a capacity of [illegible] to [illegible],000 CFM (PSIG). (Certain compressors are oil-free types for food processing equipment), with an annual sales value of 30 million pesos as shown in Table [illegible].

Company No. 4 is manufacturing mobile and stationary air-cooled single and double stage compressors with 1, [illegible], V-1 and V-2 cylinders with maximum working pressure of 40, 125, 150, 175 and 300 PSIG, electric motors 50/60 Hz., 450 to 1,735 rpm., 1/3 to 25 hp., petrol engines, 2 to 25 hp., with a capacity of 1.4 to 90.0 CFM (100 PSIG) as shown in Table 3.

Company No. 5 is producing heavy-duty single cylinder, single stage, double acting reciprocating compressors, with bore and stroke 8" x 7", 9.½" x 7", 105 x 7" and 11.½" x 7" and a capacity of 150, 185 and 308 (100 PSIG), with an annual production of 20 to 30 units, and a national integration of 90 per cent; twistair screw compressors

with [illegible] to 95. [illegible], with an annual production of [illegible] units, and a national integration of [illegible] per cent, heavy duty two cylinder, V-type, two stage, double acting reciprocating compressors with [illegible] stroke 11.[illegible]" to [illegible]" x [illegible]", 11.[illegible]" to [illegible]" x [illegible]", 11.[illegible]" to [illegible]" x [illegible]", 14" to [illegible]" x [illegible]", and capacities of [illegible], [illegible], [illegible] and 1,[illegible] CFM (100 PSI), with an annual production of [illegible] to [illegible] units and a national integration of [illegible] per cent. The firm's market share is about [illegible] per cent. Imported price level is [illegible] to [illegible] per cent above the [illegible] prices. Components imported are, connecting rods, valves, lubricating systems (in total 10 per cent of total compressor sales value). The production programme is given in Table [illegible].

Company No. [illegible] is producing mobile single and double stage compressors with locally purchased water cooled Föhler petrol engines, [illegible] hp. and locally purchased water cooled Perkins diesel engines, in-line type, 4-stroke, direct injection, 4 and [illegible] cylinders, up to 125 hp. (the heaviest Perkins diesel engine is imported) with a capacity of 50 to 300 CFM, with an annual production of 144 units, representing a market share of 40 per cent. The firm is planning an annual quantitative increase of 50 to 400 CFM mobile compressors of approximately 20 per cent.

The company also produces stationary single and double stage compressors with electric motors 10 to [illegible] hp. (in special cases with diesel engines), with a capacity of 30 to [illegible] CFM, with an annual production of 165 units, representing a market share of 30 per cent. The firm is planning an annual quantitative increase of 30 to 600 CFM stationary compressors of approximately 10 to 15 per cent. The firm imports per year around fifteen stationary compressors from Sweden with a capacity above 1,400 CFM, as they act as distributors for their licensor firm from Sweden. The company's annual programme comprises of mobile compressors, stationary compressors, rock drilling equipment (imported from Sweden), lighter units (hand-held), with an annual

[illegible]nover of [illegible] units, [illegible] market share of [illegible] per cent, [illegible]avier units (non-[illegible] mill), with an annual turnover of 25 units, representing a market share [illegible] per cent, [illegible] tipped boring bits and extension equipment, bought from a [illegible] manufacturer, and diamond boring bits, imported from Sweden. The annual turnover for [illegible] was [illegible] million pesos. Their export volume, mainly to Argentina, is around [illegible] per cent. Local sales, which are not with international pricing, are about 15 per cent higher, mainly due to higher local raw material and components costs. The production programme is given at Table [illegible].

Company No. [illegible] is manufacturing mobile and stationary, air and water cooled, double stage compressors with [illegible] and [illegible] cylinders and with a maximum working pressure of [illegible] lbs./square inch, electric motors, [illegible] Hz., [illegible] to 1,[illegible] rpm., [illegible] to [illegible] hp. and with a capacity of [illegible] to [illegible]. [illegible] (100 PSIG), shown in Table [illegible].

Company No. 3 is manufacturing stationary mono-rotary compressors with electric motors from [illegible] to [illegible] hp. and with a capacity of [illegible] to [illegible] m^3/min. at a pressure of [illegible] Kg./cm^2, stationary mono-rotary compressors with electric motors of 150 hp. in two models, [illegible] Hz., with a capacity of [illegible] m^3/min. and 50 Hz., with a capacity of [illegible] m^3/min. at a pressure of [illegible] Kg./cm^2. The stationary compressors are sold primarily to industry and mining. The firm also produces mobile mono-rotary compressors with water cooled Perkins diesel engines, in-line type, 4-stroke, direct injection. [illegible] cylinders with 73 hp. at [illegible], 00 rpm., with a capacity of [illegible]0 CFM, at a pressure of 7.04 Kg./cm^2, mobile mono-rotary compressors with water cooled Perkins diesel engines, in-line type, 4-stroke, direct injection: [illegible] cylinders with [illegible]9.5 hp. at 1,[illegible]00 rpm., with a capacity of [illegible]50 CFM, at a pressure of 7.04 Kg./cm^2, mobile mono-rotary compressors with water cooled C.M. diesel engines, in-line type, [illegible]-stroke, direct injection: 4 cylinders, with 123 hp. at 1,900 rpm., with a capacity of 365 CFM, at a pressure of 7.04 Kg./cm^2; mobile mono-rotary compressors, with water-cooled Cummins diesel engines, in-line type, 4-stroke, direct injection: 6 cylinders, with 196 hp. at 1,900 rpm., with a capacity of

600 CFM, at a pressure of 7.03 Kg./cm². The mobile compressors are sold primarily to heavy construction and road building firms. The firm's market share for compressors was as follows: domestic production - 35 million pesos (43 per cent), imports - 47 million pesos (57 per cent). The company shares the market for internal combustion engine compressors with company No. 11, with the latter enjoying the major shares. Plans are in preparation to obtain a fair share of this market domestically and for establishing a sound export base. The export potential of gas field and pipeline compressors is considered to be significant. Their compressor production programme is as shown in Table 7.

Company No. 9 is manufacturing mobile single stage rotary compressors, with water cooled Perkins diesel engines, in-line type, 4-stroke, direct injection, 4 cylinders with 70 hp. at 2,000 rpm., with a capacity of 175 CFM, at a normal pressure of 7.03, maximum 8.43 Kg./cm², with an annual production of 60 units, representing a market share of 20 - 25 per cent, mobile double stage rotary compressors with water cooled Rolls-Royce diesel engines, in-line type, 4-stroke with quantity control of injection pump and speed governor, 6 cylinders, bore x stroke 130 x 152 mm., 12,170 cc., 235 hp. at 1,800 rpm., with a capacity of 600 CFM, at a normal pressure of 7.03 Kg./cm² with an annual production of 30 units, representing a market share of 10 to 15 per cent. The firm is planning an annual quantitative increase of 175 and 600 CFM mobile compressors of approximately 20 per cent. The Company also produces stationary single stage rotary compressors with electric motors 30 and 40 hp., 50 an 60 Hz., 950 and 1,150, and 1,450 and 1,750 rpm., with a capacity of 85 and 100, 125 and 160 CFM at a maximum pressure of 125 lbs., with an annual production of 15 units, representing a market share of 10 to 15 per cent, double stage rotary compressors with electric motors of 100 and 150 hp., 50 and 60 Hz., 950 and 1,150, and 1,475 and 1,750 rpm., with a capacity of 335 and 400; 500 and 600 CFM at a maximum pressure of 125 lbs., an annual production of 14 units, representing a market share of 10 to 15 per cent. The firm is planning an annual quantitative increase

of 85 to 600 CFM stationary compressors in 19[illegible] of 100 per cent and thereafter approximately 10 per cent per year. The company's domestic production value: mobile compressors, stationary compressors, sinker drills (in two models [illegible] and [illegible] Kgs., with an annual production of [illegible] units, representing a market share of [illegible]5 per cent, and a national integration of [illegible] per cent), demolition drills (in two models - [illegible]7.6 and [illegible].5 Kgs., with an annual production of [illegible]00 units, representing a market share of [illegible] per cent and national integration of [illegible] per cent), accessories, hose connections, pipe fittings and lubricating systems, was in 19[illegible] [illegible] million pesos. The firm imports per year one to two stationary compressors from the USA with a capacity above 1,[illegible]00 CFM, as they act as distributor for their licensor firm from the USA. The mobile compressors are sold primarily for heavy construction and road building, the stationary compressors primarily to industry, construction and mining. Local sales prices, compared with international prices are about [illegible]0 per cent higher, mainly due to higher local raw material and component costs. Their compressor production programme is as follows:

Type	Nos.	Maximum woring pressure PSIG	Stages	rpm.	Cooling System	CFM (100 PSIG)	Motor	Hp.	National Integration %
Rotary	1	150	1	1,750	air	160.0	Electric IEM	50	-
Rotary	1	125	1	2,000	air	175.0	Diesel Perkins	70	100.0
Rotary	1	150	2	1,750	air	600.0	Diesel*	-	100.0
Rotary	1	150	2	1,750	air	600.0	Electric	150	100.0

* Remark: various makes

Electric motors are 50/60 Hz.

Company No. 10 is assembling mobile compressors with a capacity of 185, 250 and 600 PH with an annual sales value of 12 million pesos, representing a market share of 25 per cent, mainly for mining and construction purposes. The national integration is 90 per cent. The machining of the components is done by EPN. The company is a sales office and affiliate of a US company. Lately, the firm has started a manufacturing programme for stationary compressors with a motor capacity of 25, 50, 75 and 150 hp. The national integration is estimated to be around 95 per cent.

Company No. 11 is producing reciprocating compressors for gaseous and liquid fluids transport, or for pumping gas into oil wells with a capacity of 400 to 2,000 hp. Their yearly sales average is 16 to 18 units. The only customer so far is PEMEX. The firm's actual capacity would allow for an annual production of 30 units. The domestic price level is 8 to 9 per cent above the landed cost for corresponding units imported from the USA. The company also produces pressure vessels and tanks in mild steel, stainless steel, mild steel with stainless steel and Monel lining, pipe conduits for oil plants, and is joining and connecting sectional air cooler units, which are bought locally, to heat exchangers (air-coolers) with finned tubes for oil plants. The control panels for reciprocating compressors are assembled and inspected in line with imported control instruments. The reciprocating compressors represent approximately 60 per cent of the entire capacity, the remaining products approximately 40 per cent. Imported items are: control instruments, blocks, crankshafts, connecting rods, partly gear wheels. Their licensor firms are from the USA and from the Federal Republic of Germany. Their compressor production programme is as shown in Table .

4.1.1 With the existing capacity and the proposed expansions which are contemplated at present, there is likely to be adequate production of the following:

(a) Pumps and centrifuges

- Rotary pumps, 0.5 to 100 hp., 1,080 to 38,400 lts./hr., 1 to 2.5 Kg./cm²
- Horizontal centrifugal pumps, 1 to 142 lts./sec., 11 to 67 m.

  Horizontal ejector pumps, ½ hp., 263 to 1,060 lts./hr., 1,406 to 3,164 Kg./cm², 7.8 to 54 m.
- Horizontal centrifugal two-way pumps, 6.3 to 1,260 lts./sec., 6.4 to 158.5 m.
- Self-starting centrifugal pumps, 2.25 to 9 hp., 68 to 1,880 lts./min., 18.3 to 30 m.
- Horizontal turbine pumps, 0.63 to 4.07 lts./sec., 15 to 229 m.
- Vertical turbine pumps, 2 to 350 hp., 75.6 to 60,560 lts./min., 3 to 37.2 m.
- Mud pumps, 500, 750 and 1,000 hp.

(b) Compressors

121.2 Demand projection* for pumps and centrifuges for liquids

Pumps and centrifuges for liquids form a very large item of imports with likely imports of 750 million pesos for the period 1976 - 1980, assuming a growth rate of 10 per cent per annum and excluding injection pumps, water pumps, oil pumps and the spare parts thereof for internal combustion engines. The annual imports would, therefore, be about 150 million pesos. It is our opinion that around 50 per cent or 75 million pesos of the pump and centrifuge imports (mainly smaller ranges) could be produced domestically given certain conditions, leaving a so far uncovered gap of 75 million pesos per year of bigger ranges. It is considered feasible that a new project and major expansion proposals can be developed to cover the large anticipated production gap during the period up to 1980, which could be considered as stage I of the Mexican larger heavy duty pump and centrifuge industry, as follows:

---

* All values are based on 1968 price levels

Table XVIII

Production Gaps in Pumps (1980)

	In Million Pesos
- Annual total imports for pumps and centrifuges for liquids	150
- Minus 50 per cent in lower capacity range, likely to be covered by existing domestic producers	- 75
- Minus 20 per cent for import of special large and special purpose pumps and centrifuges, for which an economic batch-size production cannot be achieved.	- 15
Balance covered by new facilities	60

121.3 Demand projection for compressors Compressors for air and other gases and vacuum form a large import item, with likely imports of 1,250 million pesos for the period 1976 - 1980, assuming a growth rate of 10 per cent per annum and excluding hermetic and semi-hermetic electric motor compressors for refrigerators. The annual imports would, therefore, be about 250 million pesos. It is considered that around 35 per cent or 88 million pesos of the compressor imports, mainly smaller ranges, could be produced domestically given certain conditions, leaving a so far uncovered gap of 162 million pesos per year of bigger ranges. It is considered feasible that a new project and major expansion proposals can be developed to cover the large anticipated production gap during the period up to 1,980, which could be considered as stage I of expand heavy duty compressor production.

Table XIX

Production Gap in Compressors (1980)

	In Million Pesos
- Annual total imports for compressors for air, other gases and vacuum	250
- Minus 35 per cent in lower capacity range, likely to be covered by existing domestic producers	- 88
- Minus 26 per cent for import of special large and special purpose compressors, for which an economic batch-size production cannot be achieved	- 42
Balance to be covered by new facilities	120

The demand for larger heavy duty pumps, centrifuges and compressors is expected to increase steadily after 1980 at an annual growth rate of around 10 to 12 per cent in the context of rapid development of large and medium industries, establishment of new industries, growth of new capital goods production and gradual replacement of old units of the existing industries.

121.4 The total investment during stage I, on machinery, equipment and essential services for the above additional production programme in this sub-sector is estimated to be around 72 million pesos for heavy duty pumps and centrifuges and about 135 million pesos for heavy duty compressors. If the proposed manufacturing programme is partly or fully incorporated into existing facilities the costs would be lower. After 1980, a stage II production programme for this sub-sector would need to be drawn up. A 10 to 15 per cent rate of exports could be projected for this period in view of the country's factor advantages.

121.5 It is considered that the following products in this sub-sector would have possibilities for manufacture in the country:

a. Heavy duty pumps, such as for water supply, sewage, boiler feed, mining, petroleum industries and for general industrial use (for liquids, air, other gases and vacuum) and centrifuges, mainly for sugar and chemical industries.

1. Reciprocating pumps 500 to 2,000 hp.
2. Centrifugal pumps 500 to 5,000 hp
3. Positive displacement pumps 100 to 1,000 hp.
4. Turbo pumps 500 to 2,000 hp.
5. Vacuum pumps
6. Centrifuges (mainly for sugar and chemical industries)

b. Heavy duty compressors for mining, petroleum industries and for general industrial use (for air and other gases).

1. Reciprocating compressors 500 to 5,000 hp.
2. Centrifugal compressors 500 to 5,000 hp.

121.6 Modern designs and technology will be required to be obtained with a specific programme to train Mexican engineers, technicians and workers. It is essential that designs and drawings, material specifications, tools, jigs, fixtures, gauges, patterns, etc. should be in the metric system conforming with ISO (International Standard Organization) standards. Adequate provision should be made in the plans for technical services and research and development facilities. A new enterprise or expansion programme could also be advantageously combined with projects for manufacture of heavy diesel engines and steam turbines for industrial use.

G. Lifting, loading and conveying equipment

122. The companies manufacturing different types of lifting, loading and conveying equipment are largely operating under license from foreign companies. The integration of domestic manufacture, is on an average,

about 50 per cent for bridge cranes, 70 per cent for fork-lifts and up to 100 per cent for certain simple types of conveying equipment. The number of companies producing such equipment appears to be too high in relation to total turnover, but some of the larger companies are making these items as additional products line. Most domestic companies are only producing the structural steel parts with the working components, such as gear boxes, hydraulic systems, electric motors and controls, gasoline engines, etc. continue to be imported in most cases. For certain items such as bridge cranes, the existing capacity is claimed to be higher than the local demand. The various categories of equipment are briefly discussed below.

(a) Present production and imports

122.1 Hydraulic jacks. These are manufactured by three firms in the "bottle type" in the range of 2 to 20 tons and in the "slide type" in the range of 1.5 to 10 tons. Some of the larger sizes are being imported as also a large number of smaller capacity jacks below 12 Kgs. in weight the total import value being 12 million pesos during 1971. It is felt that the manufacture of the small type of jacks is economically feasible and one of the three companies should be persuaded to enter this line with a suitable technology agreement. It is expected that the larger size of jacks will be gradually taken up for production in Mexico as the demand increases and justifies economical production.

122.2 Escalators. At present the market in Mexico may not be adequate to justify local manufacture and the demand has been fluctuating, as may be seen from the following yearly import figures:

Table XX

(In Million Pesos)

1965	-	0
1966	-	2.5
1967	-	7.3
1968	-	10.1
1969	-	20.1
1970	-	16.6
1971	-	3.7

The large value of imports during 1968 to 1970 was due to the construction of the Metro (underground) Transport System Construction. The further plans for the extension of the Metro systems have not yet crystallised, but if a large programme is undertaken, one of the local fabricators could be encouraged to take up the manufacture of excalators with suitable foreign collaboration.

122.3 Fork lifts. Three companies are producing fork lifts of small and medium capacities, mostly operated by gasolene engines. During 1972, about 750 units have been manufactured while the import was limited to only 12 to 13 units in the range of 12,000 to 30,000 lbs. The market is well covered and the gap in the higher ranges are also likely to be covered as and when individual products become viable.

122.4 Mobile hydraulic cranes. The market for mobile cranes, which are now being fully imported, comprises 10 to 12 units per year valued at 12 to 15 million pesos. The most common sizes are in the range of 5 to 10 tons, although occasionally a large crane of 100, 200 or 300 tons is also imported for special project works. It is understood that two or three metal fabricating companies are keen to enter this product line with suitable foreign technology.

122.5 Conveying equipment. This is essentially a custom-built equipment of wide variety. Two or three firms are producing some of the simpler types like pallet equipment. During 1971, the domestic production was estimated to be about 10 million pesos while imports were 2 million pesos. Such equipment could be fully made in Mexico with appropriate technology arrangements and the existing companies in this field could be encouraged to expand their respective lines of production.

122.6 Bridge cranes, port handling equipment and tower cranes. For these three items, there is considerable scope for establishing additional or raw manufacturing facilities which are discussed below.

(i) Parts for bridge cranes

Bridge cranes are of increasing interest to the Mexican industry of today. A number of Mexican manufacturers have some production facilities for bridge cranes, but many of the components (the bridge cars, tackles, hoists and especially the electrical equipment with or without speed reducers) continue to be imported. It must be mentioned that present production represents, however, a great number of different makes and sizes.

(ii) Port handling equipment

At present, loading and unloading of ships are mostly carried out with the help of cranes mounted on ships. For example, Veracruz, one of the important ports of Mexico, has hardly any port cranes. Sometimes, the port uses a crane with a lifting capacity of only 45 tons from a neadby shipyard. Major development of the handling facilities in Mexican ports are required in order to reduce the waiting time for cargo ships, and it is expected that there would be significant demand for this line of equipment in the near future.

(iii) Tower cranes for the construction industry

The manufacture of tower cranes was undertaken earlier by only one company, although it appears that their production has since been stopped.

(b) Projections

122.7 Based on investigation made by the UNIDO-NAFIN group, the demand projections appear to be as follows.

(i) Parts for bridge cranes

The total import amounts to 70 to 80 million pesos a year during the last five years of which 50 per cent of the import is for electrical equipment. It is estimated that without any production of imported parts in Mexico, imports will be at least twice the present value by 1980, or approximately 200 million pesos a year. There is therefore, considerable scope for the establishment of additional production facilities for manufacture of the above-mentioned parts.

(ii) Port handling equipment

More detailed investigations are required in order to estimate the specific demand for various items of port handling equipment but there appears to be considerable scope in this field.

(iii) Tower cranes for the construction industry

It is expected that following considerable increase in building activity in Mexico, the demand for tower cranes will increase, although at present it is not possible to indicate the volume of demand in precise numbers.

(c) 122.8 Range of products which could be manufactured

(i) Parts for bridge cranes

With the exception of structural fabrication which can be produced in existing facilities, it is considered that additional facilities could be established to produce components such as bridge cars, tackles, hoists and similar components for port handling equipment and, to some extent, for types of lifting and handling equipment.

(ii) Port handling equipment

With reference to port handling equipment, new facilities would be necessary.

(iii) Tower cranes

Establishment of new production facilities, which will result in an annual additional production value of 200 million pesos (on 1968 prices) during 1976 - 1980 will be justified and a capital investment of approximately 200 million pesos (on 1968 prices) will be required for machinery, equipment and services, but excluding land, building, etc. It is considered that these facilities could be provided by expanding preferably one or more factories already producing this line of products.

122.9 Modern designs and technology will be required to be acquired for these types of products, together with training programmes for Mexican technicians and engineers in design, engineering and manufacturing techniques. It is the view that designs and drawings should be in the metric system conforming to international standards. It is important that both in the production of components as well as of main equipment, there should be maximum extent of standardisation and variety reduction. Adequate provision should be made in the plans for technical services and research and development facilities applicable to this line of products.

As components will have to match a wide variety of designs, it is also essential to standardise the types and ratings of components and these must be included in the scope of any know-how arrangement as represents a demand of about 50 per cent of the total imports.

122.10 Except for large bearings, heavy duty hooks and steel cables which are imported, most other raw materials are available in Mexico.

H. Other machinery

123. A wide variety of machinery of a miscellaneous nature has been categorised under this group. Some of the more important industries and processes in which they are used, are listed below:

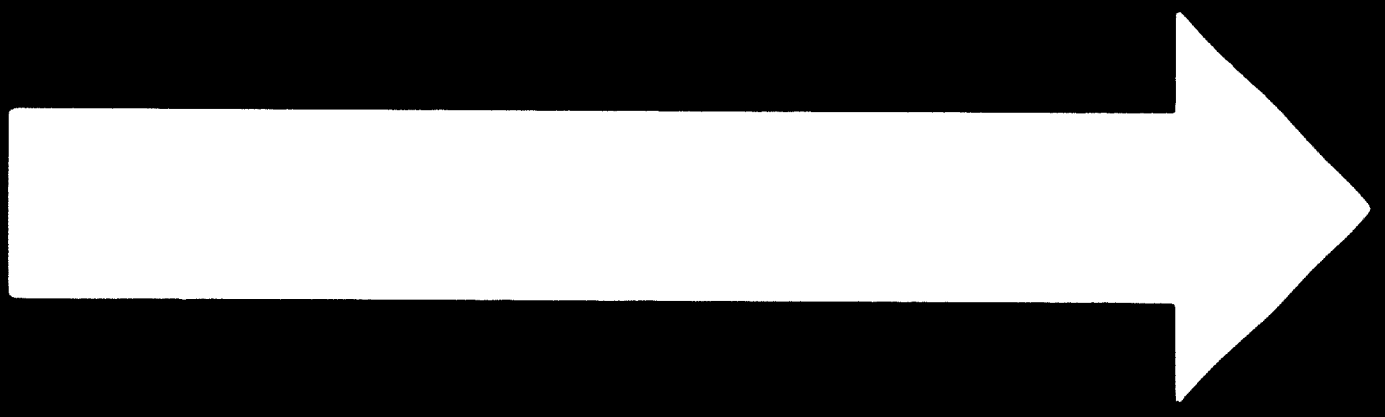
1. Oil, soap and grease
2. Rubber and plastics - extrusion, injection moulding, etc.
3. Agitators and mixing operations
4. Ropes and cables
5. Wire drawing and winding operations
6. Galvanising and coating with other metals
7. Treatment of wood, cork, etc.
8. Presses for general purposes (other than metal forming)
9. Machines for balancing wheels, shafts, etc.
10. Mixing and masticulating operations
11. Pharmaceutical industry
12. Tobacco industry
13. Pneumatic and hydraulic apparatus for automation

Many more items similar to the above can be added when various industrial operations are analysed, as each industry has certain specialised needs for which versatile equipment of different kinds have been evolved. Taken together the imports would amount to a considerable figure. Projections for 1976 - 1980 have been assessed at about 4,300 million pesos. Under the group "machine tools - chipless forming", certain types of machines like hydraulic presses, press brakes and

injection moulding machines have been considered and it was concluded that 85 per cent of those machines are too sophisticated and too few in a particular type to be taken up for manufacture in Mexico. This reasoning also applies to most of the specialised types of machinery referred to above. A small percentage may be of a type which are required in a number of similar applications in several industries and in such cases fabricators who are making machines of a similar kind would find it worthwhile to take up such manufacture with imported technology to the extent required. To assess the possibilities in this area, some of the branch institutes (Cameras) of the concerned industries could usefully undertake special surveys and studies.

I. Machinery parts and components

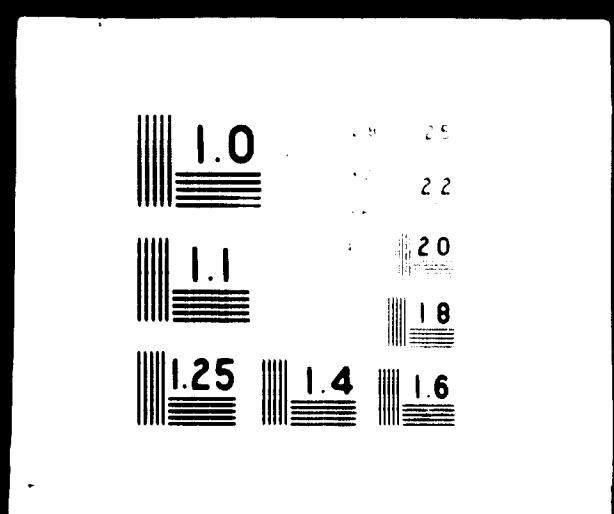
124. An essential aspect of capital goods development is the manufacture of machinery components and processed materials of requisite quality and in adequate quantities, as these inputs have an important bearing on the quality and price of finished machinery products. While there has been significant increase in domestic production of such items, considerable imports have nevertheless been projected. If most of the machine building projects identified in this study are implemented, the production gap in respect of such components and processed materials would, however, increase substantially and there would be major shortfalls both in quantitative terms and in quality requirements. While certain of these items, such as ball roller and needle bearings where four enterprises with requisite technological support have taken up manufacture, are likely to be produced in adequate quantities, the fields where sizeable production gaps are expected to occur are (a) gray iron castings of medium and heavy weights, (b) gears, including reducers, multipliers, etc., (c) precision forgings, (d) standard parts and (e) measuring instruments. Items (b) and (c) have been dealt with together in paragraph 124 below. These items would not only be necessary to sustain a major expansion programme of



76. 04. 28

3 OF 4

05967



of capital goods manufacture but have considerable export potential. Some exports, particularly of automotive components and parts, are already taking place, as pointed out earlier, but this could be expanded considerably in this sub-sector. Consequently, specific manufacturing projects have been identified in the above fields, which could serve as a nucleus for major expansion in this sub-sector.

(i) Gray-iron castings

125. While there are a large number of foundries in Mexico, there are very few units capable of manufacturing medium to heavy gray-iron castings. The existing foundries are also, for the most part, heavily loaded, especially with repeat items and are usually operating with old equipment and without the latest technological developments, resulting in large percentage of rejections. Physical and chemical testing facilities, wood and metal - pattern and wood and glass fibre (epoxies tester) core box production, sand preparation, melting and moulding facilities, preventive service, repair and maintenance service are not adequately available and there is absence of standardisation at various levels.

125.1 With the rapid projected growth of the machine building sector, the supply of medium to heavy gray-iron castings is likely to be very inadequate and may constitute a serious bottleneck. It is, therefore, considered necessary to set up an additional large gray cast iron foundry, equipped with the latest techniques for castings up to single weights of 15 tonnes, particularly for various capital goods projects such as. (a) heavy diesel engines, (b) machine tools (chip removing), (c) machine tools, (chipless forming), (d) continuous weighing equipment, (e) heavy duty compressors, (f) material handling equipment,

(g) manufacture of standard parts, (h) heavy duty pumps and centrifuges, (i) textile machinery and equipment, (j) electric motors and (k) high pressure boilers for power stations. The gray-iron casting requirements for the above mentioned projects is estimated to be around 2,475 million pesos in value, for the period 1976 - 1980. It is considered feasible that additional facilities and major expansion proposals can be developed to cover the large anticipated production gap during the period up to 1980, which could be considered as stage I of the expansion programme for medium to heavy gray-iron castings production. This can be seen from the following table

Table XXI

	Million Pesos
- Likely annual requirement on medium to heavy gray-iron castings for proposed capital goods projects	495
- Plus approximately 20 per cent on medium to heavy gray-iron castings, reserved for Mexican producer and consumer industries	100
Balance to be covered by new facilities	595

The demand for medium to heavy gray-iron castings is expected to increase steadily after 1980 at an annual growth rate of around 10 to 15 per cent in the context of rapid development of large and medium industries, establishment of new industries, growth of new capital goods production and gradual replacement of machinery and equipment of the existing industries.

125.2 The investment during stage I, on machinery, equipment and services such as power, gas and water supply for the additional production programme in this sub-sector is estimated to be around 55 million pesos, excluding the cost of land, buildings and working capital of new projects. It may not be practicable to incorporate the proposed production programme in the existing facilities, except to a very limited extent. After 1980, a stage II production programme for this sub-sector would need to be drawn up, to cover continuously increasing demand.

125.3 The gray-iron foundry would need to incorporate latest foundry techniques and would comprise of the following items:

A. Auxiliary production:

- wood pattern shop
- metal pattern shop
- core box shop
- maintenance and repair department
- electrical department
- pouring ladle and furnace-lining section
- chemical, physical and sand testing laboratories
- carpenter's shop
- packing and despatch department

B. Main production.

- core making section
- moulding and continuous casting section
- moulding sand and core sand preparation and re-claiming plant
- melting department
- stress-free annealing section
- shot and sand blast and cleaning department
- quality control department
- degreasing, immersion and spray painting section
- tool cribs, pattern and core box stores, central and departmental stores, raw material yard.

C. Range of production:

- Medium to heavy gray-iron castings up to single piece weight of 15 tons.

The foundry capacity is foreseen as follows, on 250 working days/year, melting department on three shifts, the rest two shifts per day (assuming an average sales price of 5.50 pesos per kilo and an average rejection rate of 5 per cent). 227.4 tons of clean grav- ron casting per single shift, or 454.8 tons of clean grav-iron castings per working day.

125.4 Most raw materials for this industry are available in the country. At present, imports of haemetite, special additives, high alloy and special steels are taking place, together with some quantities of pig-iron and scrap, but most of these items would be adequately available in coming years.

125.5 It will be neces ary to avail of the latest innovations and techniques in this field. Technology arrangements would also have to over training of Mexican engineers, technicians and workers. It is essential that designs and drawings, material specifications, tools, gauges, patter s, core boxes, etc. should be in the metric system conforming with ISO (International Standards Organization) standards. Adequate provision should be made in the plans for technical services and research and development facilities as are applicable. It would need to be determined whether it would be more economical to establish two plants, one for the production of medium grav iron castings (200 lbs. to 3 M.T.) and one for heavy gray iron castings (3 M.T. to 15 M.T.) in the light of careful assessment of the existing market, as also of the prospective market created by new capital goods projects and expansions.

(ii) Gears, speed reducers and precision forgings

126. Apart from the manufacture of gear wheels for the automotive industry, there is little gear production in Mexico, particularly in medium and heavy capacities. Inadequate domestic production is accompanied by high prices and irregular deliveries. Consequently, there is heavy import of gears in many manufacturing branches.

126.1 The few existing firms mainly concentrate on gear boxes, speed reducers, transmissions, gear rings, helical and double helical gears, conical gears, spur gears, sprockets, shanks, flexible couplings for electrical motors, cement, rubber, food, transport and lifting equipment industries in small batch-sizes, largely against customers orders, and operate with old machinery and equipment and insufficient heat and surface treatment, besides inadequate inspection facilities.

126.2 Transmission shafts, flexible shafts, sleeve bearings, gear or friction clutches, speed reducers, speed multipliers or variators, pulleys and clutches (other than used in the automotive industry) form a very large item, with likely imports of 1,160 million pesos for the period 1976 - 1980. A further volume of approximately 635 million pesos has to be anticipated by way of demand for gears of various types for capital goods projects proposed, such as: (a) heavy diesel engines, (b) steam turbines, (c) machine tools for chip-removing and for chipless forming, (d) continuous weighing equipment, (e) heavy duty pumps and centrifuges, (f) heavy duty compressors, (g) material handling equipment, (h) textile machinery and equipment and (i) electrical equipment for diesel/electric locomotives for the period 1976 - 1980.

126.3 It is considered necessary that additional facilities and major expansions be developed to cover the large anticipated production gap during the period up to 1980, which could be considered as stage I of the expansion programme for gear production in Mexico.

Table XXII

Gap in Production of Gear and Precision Castings

	Million Pesos*
- Likely annual imports, (without the additional programme proposed	232
- Minus 40 per cent for imports, represented by sophisticated, special types and larger ratings which may not be economically feasible to produce in Mexico during the period 1976 - 1980, as batch size manufacture would not be possible	- 93
- Minus 10 per cent, represented by simpler, normal types and smaller ratings, likely to be covered by existing domestic producers	- 23
- Plus annual requirement for projected new projects	+ 127
- Plus 10 to 15 per cent on precision forgings, reserved for Mexican producers and consumer industries	+ 32
Balance to be covered by new facilities	275

* All values are based on 1968 price levels.

The demand for gears of various types is expected to increase steadily after 1980 at an annual growth rate of around 10 to 15 per cent in the context of rapid development of large, medium and small industries, establishment of new industries, growth of new capital goods production and gradual repair and replacement of old and worn out units of the existing industries.

126.4 The total investment during stage I, on machinery, equipment and services such as power, gas and water supply for the additional production programme in this sub-sector is estimated to be around 395 million pesos, excluding the cost of land, buildings and working capital for new projects. It may not be practicable to incorporate the proposed additional programme in existing facilities. After 1990, a stage II production programme for this sub-sector would need to be drawn up. A 10 to 12 per cent amount of export could be projected for this period in view of the country's factor advantages.

126.5 The plant for manufacture of gears, speed reducers and precision forgings would comprise the following items:

A. Auxiliary production:

- tool, jig, die, fixture and gauge department
- metrology
- heat treatment section
- surface treatment section
- test laboratory
- maintenance and repair department
- electrical department
- carpenter's shop
- packing and despatch department

B. Main production:

- incoming material inspection department
- materials preparation section
- forging, trimming, cleaning department
- profile bending, rolling, butt welding and torch cutting section

- machine department
- running and final production control department
- tool, cribs, jig, dies, fixture, gauge stores, central and departmental stores

To produce: chain wheels, straight, bevel, helical and worm gear wheels, pinions and wheel shafts, pulleys, brake and clutch assemblies, etc.

To machine: gear, speed reducer, speed multiplier, speed variator, transmission housings and covers, etc.

To supply. precision forgings to local producer and consumer industries.

The range of precision forgings could be limited for stage I to a maximum diameter of 630 mm.

126.6 It will be necessary to obtain latest innovations and techniques for forging blanks, machining and gear cutting, heat treatment and surface treatment procedure, tool production, metrology and inspection methods. The technology arrangements would also have to cover training of Mexican engineers, technicians and workers. It is essential that designs and drawings, material specifications, tools, jigs, fixtures, gauges, patterns, etc., should be in the metric system, conforming with ISO (International Standards Organization) standards. Adequate provision should be made in the plans for technical services and research and development facilities.

(iii) Standard parts

127. An important aspect of domestic manufacture noted during the field investigations was that presently all factories and sub-contractors manufacture their tools, jigs, dies, fixtures, moulds, gauges, patterns, etc., piecewise, according to their own or the licensor firm's design and specifications, following various measuring systems and standards. Moreover, parts

which are manufactured in large quantities in special factories in the highly industrialized countries, are for the greater part, not available in Mexico. As a result, all consumer firms are forced to produce those standard items according to their own demand in great variety of types and sizes, piece by piece, and usually with inadequate machinery and equipment. This existing situation leads to the following main disadvantages,

- lack of inter-changeability
- absence of standardization
- a large diversity of different tolerance systems
- improper raw material selection
- large variety of different types and executions
- high percentage of rejections
- heavy labour input on adjustment operations
- impossibility to manufacture in economical batch-sizes
- waste of raw and sundry materials
- disturbance of running production work
- highly skilled labour is wasted by producing such standard parts instead of being utilized for main and sophisticated tool and pattern making work

Consequently, the production costs of the items are extremely high and quality is low.

There are some small shops which have recognised the above mentioned disadvantages and have started production of such items in different varieties and small quantities. These do not, however, follow an uniform measuring and standard system, such as the metric and the ISO.

127.1 With the rapid projected growth of the machine building sector, the supply of standard parts for production of tools, jigs, dies, fixtures, moulds, gauges, patterns, etc., is likely to be very inadequate and may constitute a serious bottleneck. It is therefore considered necessary to set up additional facilities equipped with the latest techniques for the manufacture of these standard parts, to cover the anticipated production gap during the period up to 1980, particularly for various capital goods projects.

127.2 It is considered feasible that additional facilities and major expansion proposals can be developed to cover this production gap during the period up to 1980, which could be considered as stage I of the expansion programme for standard parts used for tool and pattern production. This could broadly cover the following:

Table XXIII

Production Gap of Standard Parts

	Million Pesos
- likely annual requirement on standard parts for tool and pattern production for proposed capital goods projects	25
- plus approximately 100 per cent on standard parts for tool and pattern production, reserved for Mexican producer and consumer industries	25
Balance to be covered by new facilities	50

The demand for standard parts for tool and pattern production is expected to increase steadily after 1980 at an annual growth rate of around 10 to 15 per cent in the context of rapid development of large, medium and small industries, establishment of new industries, growth of new capital goods production and gradual replacement of tools, patterns, etc. of the existing industries.

127.3 The total investments on machinery, equipment and certain essential services for the additional production programme in this sub-sector is estimated to be around 65 million pesos, excluding the cost of land, buildings, and working capital for a new project. It may not be practicable to incorporate the proposed production programme in the existing facilities, except to a very limited extent. After 1980, a stage II production programme for this sub-sector would need to be drawn up to cover continuously increasing demand and an anticipated export rate of around 10 per cent.

127.4 A production plant for manufacture of standard parts for production of tools, jigs, dies, fixtures, moulds, gauges, patterns, etc. would consist of:

A. Auxiliary production:

- tool, jig, die, fixture and gauge department
- metrology
- heat treatment section
- surface treatment section
- test laboratory
- maintenance, repair and electrical department
- carpenter's shop
- packing and despatch section

B. Main production.

- incoming material inspection department
- material preparation section
- general machining section

- air conditioned special machining section
- running and final production control department
- tool, crib, jig, die, fixture and gauge store, central and departmental stores

To produce: profile tools and cutters, templets, punching blocks, punch holder plates, plunger retainer plates, standard punches, pivots, matrix plates, positioning, centering, guiding, fixing, clamping, operating elements, catch and ejector pins, liners, V-blocks turning and grinding, mandrells, drills and reamer bushings, guide bushes, index plates, gauges, mould and core cooling fittings, match plates, pattern and core box elements, heating elements, etc.

To machine. continuous casting profiles and steel profiles for jig, die and fixture body elements, die and mould blocks, etc.

127.5 It will be necessary to avail of the latest technology in this field. Arrangements would also have to be made for training of Mexican engineers, technicians and workers. It is essential that designs and drawings, material specifications, tools, gauges, patterns, core boxes be in the metric system conforming with ISO (International Standards Organization) standards. Adequate production should be made in the plans for technical services and research and development facilities

(iv) Measuring tools

128. There are two important companies producing measuring tools in Mexico.

Company No. 1 is producing tape measures in 14 different models, 6.5, 13, 16 mm. x 2,000, 3,000 mm. with a national integration of 75 to 80 per cent and an annual production in 1972 of 1,500,000 units, representing a market share of 65 per cent. The firm is planning an annual quantitative increase of tape measures of approximately 20 per cent.

They also produce carpenter squares in four different models: 150, 250 mm. x 200, 300 mm. and combination type with a national integration of 95 per cent, and an annual production in 1972 of 80,000 units, representing a market share of 100 per cent. The firm is planning an annual quantitative increase of carpenter squares of approximately 20 per cent. Additional measuring tools of their production programme are, rules in two different models 13, 30 mm. x 150, 300 mm. with a national integration of 60 per cent and with an annual production in 1972 of 30,000 units, representing a market share of 100 per cent. The firm is planning an annual quantitative increase of rules of 20 to 30 per cent. They also produce vernier calipers (stainless) in three different models, 1/20 mm. x 150 mm., 1/10 mm. x 150 mm., 1/20 mm. x 200 mm. and vernier calipers (plastic Makrolon), 1/10 mm. x 120 mm. with a national integration of 95 per cent and with an annual production of 15,000 units, representing a market share of 100 per cent. The firm is planning an annual quantitative increase of vernier calipers of approximately 25 per cent. The company's annual turnover in 1972 was (measuring tools, plus hand tools and hand saws (150,000 units in 1972), plastering trowels (15,000 units in 1972) and scrapers (4,000 units in 1972)) 9.5 million pesos. Their licensor firm for vernier calipers is from the Federal Republic of Germany. The company's export rate so far was 3 per cent of total sales value (exports to Chile and Brazil). There are plans to increase exports, especially to the USA and Europe. Local sales prices are equal to international pricing. Utilisation of total installed capacity is about 30 per cent.

Company No. 2 is producing tape measures. Their market share is about 35 per cent.

128.1 In addition, there are a few small shops producing a limited number of snap and limit gauges, mostly on customers orders, and without following a uniform measuring and standard system.

128.2 With the rapid projected growth of the machine building sector, the supply of measuring tools of various types, is likely to be very inadequate, unless special efforts are made to set up local production. It is therefore considered necessary to establish facilities equipped with the latest techniques for the manufacture of measuring tools of various types.

128.3 Stage I of the proposed expansion programme for measuring tools for various types would be based on the following estimates:

Table XXIV

	Million pesos
- Likely annual requirement on measuring tools of various types (exoluding highly sophisticated and special type measuring tools and those with larger ratings, for which an economically batch-size production cannot be achieved) for proposed capital goods projects	10
- Plus approximately 200 per cent on measuring tools of various types, reserved for the Mexican producer and consumer industries	20
Balance to be covered by new facilities	30

The demand for measuring tools of various types is expected to increase steadily after 1980 at an annual growth rate of around 10 to 15 per cent due to rapid development and establishment of industries, growth of new capital goods production and gradual replacement of measuring tools in existing industries.

128.4 Total investment for machinery, equipment and essential services for the additional production programme in this sub-sector is estimated to be around 40 million pesos, excluding the cost of land, buildings and working capital for a new project. After 1980, at stage II production programme for this sub-sector would need to be drawn up to cover the continuously increasing demand and an anticipated export rate of around 10 per cent.

128.5 Broad market research was conducted in respect of specific measuring tools in the course of a large number of plants visited in Mexico. In the light of such study, it is considered that a production plant covering the following items could be set up:

A. Auxiliary production:

- tool, jig, fixture and gauge department
- metrology
- heat treatment section
- surface treatment section
- test laboratory
- maintenance, repair and electrical department
- carpenter's shop
- packing and despatch section

B. Main production:

- incoming material inspection department
- material preparation section
- punching section
- general machine section
- air conditioned special machining section

- wax-macerate and photochemical macerate division
- circular and longitudinal engraving section
- pre-assembly department
- final assembly department
- running production control, gauging and final inspection department
- tool crib, tool, jig, die, fixture and gauge store, central and departmental stores

To produce: shrinkage allowance tape measures, squares, rules, vernier calipers and depth gauges for pattern makers, machine scales, precision marking plates, marking gauges, spotting straight edges, precision spirit levels, precision squares, precision protractors, depth gauges, thread plugs, thread rings, snap gauges, limit gauges, feeler gauges, block gauges, pupitasters, dial indicators, thickness gauges, compasses, inspection mandrels, measuring magnifying lenses, dial gauge stands, etc.

128.6 Modern design and technology will be required to be provided by a foreign company, with a specific undertaking to train Mexican engineers, technicians and workers. It is essential that designs and drawings, material specifications, tools, jigs, fixtures, gauges, patterns, etc. should be in the metric system conforming with ISO (International Standards Organisation) standards. Adequate provision should be made in the plans for technical services and research and development facilities.

4. Non-electrical Equipment (for specific industries)

J. Equipment for steel and non-ferrous industries

129. The projected expansion of steel production in Mexico to 7.5 million tonnes in 1975 and 10 million tonnes by 1980 is envisaged to be achieved through expansion of existing steel and the establishment of a new complex viz. the Lazaro Cárdenas - Las Truchas plant. The latter complex comprises two phases, the first designed to produce 1.5 million tonnes

by 1976 and the second phase for an additional 1.5 million tonnes by 1980. For the first phase of the Las Truchas complex and for other steel plant expansion programmes under way, most of the heavy equipment such as blast furnace, oxygen converter, continuous casting units, rolling mill equipment, etc., would require to be imported. Equipment to be domestically supplied would largely be confined to pumps, motors and certain ranges of cranes and structurals, as there is no production of heavy steel plant equipment at present in Mexico.

Table XXV

Demand Projections of Heavy Equipment for the Iron and Steel Industry

1976 - 1980

	Million Pesos (1968 prices)
Heavy equipment required for:	
(i) sponge iron production	18.1
(ii) pig-iron production	96.4
(iii) production of ingot steel	160.4
(iv) production of rolled products	847.8
	1,122.7

129.2 Apart from steel plant equipment, there would also be considerable capital goods requirements for the aluminium, copper and other non-ferrous industries, which are projected to expand considerably by 1980. For the aluminium industry, capital goods requirements during 1976 - 1980 in terms of heavy equipment would be about 319 million pesos (1968 prices) for the aluminium manufacturing industry, including rolled and extruded products. For additional copper production, heavy machinery requirements are projected at over 39 million pesos

during 1976 - 1980 for electrolytic copper, about 74 million pesos for copper and copper alloys and about 129 million pesos for copper conductor production.

129.3 While total demand for heavy machinery items in these branches would be quite considerable, it will be difficult to build up substantial domestic production capacity in this sub-sector by 1976 - 1980. There is undoubtedly considerable scope nevertheless for gradual domestic manufacture of a large number of heavy fabrication items. Some existing manufacturers of cranes and heavy structurals could expand their capacity to cover certain heavier and more sophisticated products. An important recent development has been the establishment of a local company sponsored by one of the major domestic steel plants in collaboration with a well-known foreign manufacturer (FRG) of steel plant and heavy equipment. Detailed studies are being undertaken by the new company to identify specific products which could be locally manufactured in the next two or three years and over a longer period. In view of this development and the fact that detailed techno-economic studies are proceeding in this regard, the UNIDO-NAFINSA team did not examine the manufacturing possibilities in this sub-sector in any further detail. After the detailed investigations are completed, it would be desirable to closely co-ordinate the manufacturing programme of the new company with those of other major fabricating units in the country, so that the coverage of the domestic manufacturing programme for such heavy equipment could be extended gradually as far as possible, both for domestic requirements and for exports.

K. Mining, construction and cement equipment

(i) Mining equipment

130. Mining equipment requirements comprise the following major types:

(a) Compressors
(b) Crushers and grinding mills
(c) Rotary drills or crawler or wheel tractors

(d) Rotary drills of weights up to and above 5,000 Kgs.
(e) Rock drills of various types
(f) Cutting machines for coal mining
(g) Hoppers, feeders, screens, conveyors, etc.

130.1 Air compressors have been discussed in section 7 of this chapter. Crushers and grinding mills, which are common both to mining and construction industries will be considered under paragraph 133 of this section. Regarding the other items, there are four or five companies which are manufacturing some of these in the simpler ranges. Mobile drilling equipment is being imported to the full extent and it is understood that one company is intending to take it up, as there are prospects of heavier tractors (both crawler and wheel type) being made in the near future with larger sized diesel engines. Sizeable imports are taking place as may be seen from the following figures for 1971.

Rotary drills on crawler tractors	-	More than 10 units
Rotary drills on wheel tractors	-	More than 100 units
Rotary drills up to 1,500 Kgs.	-	About 100 units
Rotary drills between 1,500 and 5,000 Kgs..	-	About 50 units
Rotary drills above 500 Kgs	-	Below 50 units

Total value - approximately 50 million pesos

130.2 As most of the companies have technical collaboration with well-known foreign firms, it is expected that they will increasingly take up manufacture of mining equipment. The position needs to be watched during the next two or three years and if there is no appreciable progress, efforts should be made to promote other projects in this field with a view to filling up the gap more effectively.

(ii) Construction equipment

131. The manufacture of construction equipment in Mexico is making rapid strides and the total production increased from 55 million pesos in 1964 to 150 million pesos in 1969 and to about 200 million pesos (estimated) in 1971. The total market (internal production and import) was as high as 350 million pesos in 1966. There was a temporary set-back during 1967 - 1969 when demand fell to 210 million pesos, but it has since picked up. Based on import projections studies, the demand will rise to 600 million pesos in 1980 or possibly more if the pace of public and private construction activity is kept at a high level. A number of companies are expanding their facilities and also taking up new products in heavier ranges and they are working for some export orders also. It is anticipated that during 1973 total production in Mexico may reach a figure of 300 million pesos, as large Government orders have been received. The major items of construction equipment will be considered in detail under the following headings:

1. Excavators
2. Crawler tractors
3. Industrial tractors on wheels
4. Motor graders
5. Scraper levellers
6. Compaction equipment
7. Mixing and distribution equipment
8. Tower cranes
9. Crushers

131.1 Excavators. There are four companies producing excavators of which two have large share of the market. The leading company plans to build 95 machines of which 30 are intended for export. It is understood that the internal demand is being fully covered without recourse to import and the same position is expected in future with the possibility of rise in export. The national integration has reached 72 per cent.

131.2 Crawler tractors: At present, there is no local production of this item. The demand arises not only for construction purposes but also for large scale agricultural operations*. The imports have been steadily increasing from 29.7 million pesos in 1965 to 177.6 million pesos in 1971. The power for heavy duty tractors varies from 200 to 1,200 hp. and at present 500 hp. machines for handling 50 ton loads are in large demand. A light duty tractor of 75 hp. is also being considered by one of the companies as a suitable product for Mexico for certain types of construction. In view of a potentially large market, (estimated at 500 units per year) some Japanese and US firms are showing active interest in entering this field. The project to fill this gap should be actively pursued for effective and expeditious implementation.

131.3 Industrial tractors on wheels (front loaders): There are two producers of this machine, one covering 60 per cent of the market and the other 40 per cent. Except for a few very heavy sizes of over 4,250 Kgs., imports have been small. The local production during 1971 was 200 units valued at 40 million pesos. An important US firm producing other construction machinery has plans to enter this field in 1974. The tractors now under manufacture are in the range of 70 to 200 hp. with dipper sizes of 1.9 cu.yd.

---

* See sub-section P, paragraph 142

It is expected that there will not be any gaps in production in future and there are possibilities of export as well. The present level of national integration is 70 per cent.

131.4 Motor graders: There is only one firm making this machine and it is able to meet the entire market. Total demand is estimated at 95 machines in 1972 and 200 in 1973, as a result of a large Government order. This firm is expanding its facilities and is hopeful of meeting the increased demand. One other company is also planning to enter this line in 1974 with an initial production of 10 units. The machines in common demand are of 140 hp. (85 per cent of the market) and 170 hp. (15 per cent of the market). It can safely be hoped that future demand could be met by internal production with possibilities of some export.

131.5 Scraper levellers: There has been a steady import of value varying from 20 to 31 million pesos per year from 1965 to 1971. No information is available as to the extent of local production or any plans of companies manufacturing other construction equipment. It is felt that this equipment could be made by companies already manufacturing motor graders or compaction equipment and they should be encouraged to enter this line.

131.6 Compaction equipment: Six companies are in this field. In 1969* total value of production was 32.5 million pesos and imports were 10.9 million pesos. It is understood that certain types of road preparation equipment are still being imported, costing about 12 million pesos, while all other items are being manufactured inside Mexico. During 1972, the demand for compaction equipment on metal wheels was 120 units in 4 to 14 tons weight. Machines on pneumatic wheels of 13 tons weight are also in production, but no details are available. The position seems to be satisfactory and some of the companies should be encouraged to take up the machines which are still being imported.

---

* Figures for later years are not available

131.7 Mixing and distributing equipment. This group includes the following major types

1. Concrete mixers
2. Asphalt mixers
3. Pavement equipment
4. Asphalt spreaders
5. Concrete spreaders
6. Concrete distributors

Seven companies are making some of the simpler items of equipment. One of them is making truck-mounted concrete mixers and meeting most of the market demand. Asphalt mixers are being imported fully which amounted to about 10 million pesos in 1971 and all other items amounted to 5 million pesos. One company is planning the manufacture of asphalt mixers and if the plan materialised, a big part of the gap could be filled and it is possible that other machines, now being imported, will also be made locally.

131.8 Tower cranes This is an important lifting device for building tall structures and there is scope for manufacture in Mexico. This item has been included under sub-section C, paragraph 124.7

131.9 Crushers Five companies are producing crushers for construction and mining operations. The value of local production was 29 million pesos in 1969*. The corresponding import figure is 36 million pesos. Imports for 1971 increased to 48 million pesos, presumably in respect of certain large sizes and of special type. It should be possible that by standardising types and sizes, a substantial part of the imports could

---

* Figures for later years are not available

be met by local manufacture and a study of this possibility could be commended to the Camara for this industry. The present market demand roughly comprises:

Jaw crushers from 5" x 5" to 40' x 40"	-	50 units
Roll crushers from 16" x 16' to 30' x 36"	-	20 units
Hammer mills from 16' x 31' to 16' x 36'	-	15 units

131.10 By and large, the industry is in good shape and should be encouraged to take advantage both of the rapidly growing internal market and export possibilities. Some of the companies, which participated in export bids have found their prices competitive with US quotations. This is a good sign and local companies need to further improve production and technological efficiency so as to increase export potential, which is considerable in this field. This aspect needs to be watched carefully and special efforts should be made to encourage the industry to go to higher levels of production and technology.

(iii) Cement equipment

132. Machinery and equipment for cement manufacture was largely imported till recently. In recent years, fabrication of certain components has been undertaken in some of the large workshops in Mexico. The proportion of indigenous manufacture ranges from about 60 to 90 per cent in the case of small plants (500 tons/day) to about 30 to 40 per cent in respect of large plants (1,000 to 2,000 tons/day) depending upon the extent of rolling, pressing and machining facilities available with the fabricators, which are severely restricted in respect of over-sized and heavy components. While a number of auxiliary equipment could be locally fabricated, the major part of the specific equipment relating to the manufacture of cement, such as feeders, primary crushers, ball mills, rotary kilns (except parts of small and medium sized kilns), electrostatic filters and clinker coolers which together may amount to

about 70 per cent of the cost of the equipment for a cement plant, are not being manufactured in Mexico. In the context of increasing demand for cement, there is need for filling up this gap in the fabricating capacity of cement machinery.

132.1 Future demand for cement and the production capacity required to meet it could be estimated as follows:

Table VI

	Demand (consumption) Million tons	Capacity required Million tons
1972	8.2	10.0
1975	9.9	11.7
1980	14.0	16.5

In addition to the creation of new capacity, allowance will have to be made for replacement of old plants, which has been estimated at 0.4 million tons during 1972 to 75 and 2.5 million tons during 1976 - 1980. Total capacity addition will therefore amount to 2.1 million tons during 1972 to 1975 and 7.3 million tons (4.8 plus 2.5 million tons during 1976 - 1980). If domestic demand is to be fully covered, this would require average additional capacity of 1.5 million tons per year or say, 3 modern plants each of capacity of about 1,500 tons/day (500,000 tons/year) or two plants each of 2,250 tons/day to be commissioned every year. The growth in capacity after 1980 is expected to maintain a rate of about 7 per cent per year.

132.2 For a capacity of 1.5 million tons per year of cement production, roughly 20,000 tons per year of metal fabrication is likely to be required excluding bought out items like cranes, electric motors, controls, pumps, compressors, fans, etc. Assuming that about

40 per cent could be fabricated with the facilities available with existing workshops by sub-contracting the balance of 12,000 tons which will have an ex-factory value of about 150 million pesos on 1968 price levels. To fabricate this, new facilities will have to be established exclusively to deal with the more important components referred to earlier. These facilities should include heavy duty bending rolls, presses, special welding equipment, vertical lathes, boring mills, etc., capable of manufacturing a near complete cement plant in the range 1,000 to 2,500 tons/day with scope for dealing with larger sizes in future as required. Items like synchronous motors, speed reducers, etc., of large sizes, even though not being made in Mexico at present, are most likely to be produced in the next 5 to 6 years, following increased growth of the capital goods industry.

132.3 The capital investment required to provide the facilities for the fabrication of equipment for cement production of 1.5 million tons per year as indicated in the above paragraph, would be roughly 100* million pesos in the first stage, with a further investment of about 50 million pesos to meet the increasing demand for cement producing equipment beyond 1980. These figures are merely indicative of the order of investment which may be required, but should be worked out more precisely by interested investors based on equipment costs prevailing at the time, with necessary adjustments for the future. As these facilities are primarily for metal fabrication and machining work for large mechanical equipment, the possibilities of utilising them for similar type of equipment required in other industries should be considered so that a wider range of products could be manufactured resulting in a larger output. The capital investment would be somewhat less if the new facilities are installed as an expansion of an existing metal working plant which is already engaged in fabricating large industrial equipment of an allied nature.

---

* The investment covers only machinery, equipment and factory services but not land, buildings, etc.; 1968 prices.

132.4 Although some of the existing heavy metal fabricators have limited arrangements with foreign companies to get design and drawings for components, it is felt that complete design and engineering know-how and technology will have to be provided by the foreign company to support the manufacture of all the sophisticated components and also to assemble and commission a complete cement plant. Furthermore, a team of Mexican engineers and draughtsmen should be trained in project engineering of large cement plants so that bids for complete cement projects could be made incorporating the equipment made in Mexico, supplemented by imported components to the extent required. Although in the past a variety of cement plants in small and large sizes have been installed, the possibility of standardization should be stressed and initially designs for two or three optimum sizes of plants could be selected for manufacture. This approach will have to be evolved in consultation with all the concerned parties.

132.5 At present, only medium and large bearings, heavy shaft forgings, large size gears, large motors and controls are being imported, but in time, these items are likely to be produced inside the country. All other raw materials and components are available locally.

L. Pulp and Paper Machinery

133. Imports of machinery for this sector during the period 1968 to 1971 has been varying between 103 to 146 million pesos per year and have been mostly for paper making equipment. The machinery for pulp making is being fabricated locally on the basis of designs and drawings furnished by foreign companies. The capacity of factories producing pulp is rather small and out of 25 plants, only 9 have a capacity of more than 30,000 tons per year. As the demand for pulp would increase in future, many of the old units will have to close down and be replaced by large and more efficient plants. Except for certain simple auxiliary items of

equipment, the main paper-making equipment including winders, (which constitutes about 70 per cent of the total cost of plant and equipment for a paper mill) is not being manufactured in Mexico. In the context of increasing demand for paper (including newsprint), there is need for filling up this gap in the fabricating capacity for paper machinery.

33.1 There are at present 36 plants producing paper, 11 plants producing pulp and 14 plants producing both pulp and paper. In the last ten years, 8 new continuous paper machines and 17 used machines imported from different sources, have been installed. The present and future demand for paper and the corresponding manufacturing capacity to meet it would be broadly as follows.

Table XXVII

	Demand (consumption) (million tons)	Capacity (million tons)
1970	1.16	1.02 (existing)
1975	1.71	1.70 (anticipated)
1980	2.67	2.87 (required)

The existing capacity is being utilized to about 88 per cent as consumption is much greater than internal production, there has been an import of about 20 per cent of total consumption. Nearly 90 per cent of imports in this sector is in the form of newsprint. Based on the above figures, new capacity of 1.17 million tons will have to be created during 1976 - 1980. Moreover, it is estimated that during this period, replacement of old plants of 0.23 million tons will be required, making a total of 1.4 million tons. Of this, the capacity for newsprint production is estimated at 0.4 million tons. If domestic demand is to be fully covered, this would require average additional capacity of 0.28 million tons per year or say, three plants each of a capacity of about 300 tons/day (or 100,000 tons/year) of which one plant should be for newsprint production and the other two for industrial writing and special papers.

133.2 For a paper mill of 300 tons per day of production capacity, approximately 15,000 tons of equipment of all kinds are required. Excluding bought-out items like boilers, electric motors, water supply systems, etc. and simpler items of equipment which could be sub-contracted to jobbing shops, the new item will be the paper machine including winders and a few other special parts of the order of 5,000 tons. For three such mills, the total fabrication work would be 15,000 tons per year, which will have an ex-factory value of about 250 million pesos on 1968 price levels. To fabricate this, it will be necessary to create new facilities exclusively, which should include special rolls, presses, welding equipment and a variety of machine tools capable of manufacturing a near-complete paper machine and winders, with import of only special electronic control devices and certain other precision components which may not be economic to manufacture in the first stage.

133.3 In order to manufacture the paper machines and other special components as indicated in the above paragraph, it is estimated that additional manufacturing facilities would require a capital investment of approximately 200 million pesos based on 1968 values of plant and equipment. This figure is merely indicative of the order of capital investment involved and will need to be worked out precisely, based on equipment costs prevailing at the time, with necessary adjustements for the future. As these facilities are primarily for metal fabrication and machining work for large mechanical equipment, the possibilities of utilising them for the manufacture of similar type of equipment for other industries should be considered, so that a wider range of products could be handled resulting in large output. The capital investment would be somewhat less if these new facilities are installed as an extension to an existing metal working plant already engaged in fabricating large and sophisticated industrial equipment.

133.4 The complete design and engineering know-how and technology will have to be provided by a foreign company to support the manufacture of all major components (except sophisticated electronic controls and some precision parts) and to assemble and commission a complete paper making machine, including the winders. Further, a team of Mexican engineers and draughtsmen should be trained in project engineering of complete pulp and paper mills, so that composite bids for complete projects could be made incorporating all the equipment made in Mexico, supplemented by imported components to the extent required. Although in the past, a variety of pulp and paper plants (new and old) have been installed, the possibility of standardisation could be kept in mind and initially designs for two or three optimum types and sizes of plants could be selected for manufacture. This approach will have to be evolved in consultation with all the parties concerned.

133.5 At present, only medium and large bearings, heavy shaft forgings are being imported, but in time these are likely to be produced inside the country. All other raw materials and components are available in the country and there is a possibility of getting small and medium type DC motors for variable speed drives as well, as plans are now being made for producing them in Mexico.

N. Sugar and Food Processing Equipment

134. Equipment for sugar production - There are 74 sugar mills in the country, most of them being small units and a few large units. About 88 per cent of the total production comes from large mills with a capacity of 20,000 tons per day or more. Sugar consumption in Mexico was 1.9 million tons in 1970 which is expected to rise to 2.38 million tons in 1975 and to 3.06 million tons in 1980. Sugar exports in 1970 were 0.6 million tons and could reach 0.85 million tons by 1980. Total production would, therefore, have to increase from 2.4 million tons in 1970 to 3.9 million tons in 1980. The capital goods requirements for the sugar industry will have to be considered in terms of.

(a) renewal of existing old capacity

(b) renovation and re-structuring of obsolete units

(c) establishment of new capacity

Expansion and modernization programmes are already in progress and fourteen additional plants of an average size of [illegible],400 tons per day would be required to meet the increased demand by [illegible],000. The total cost of machinery and equipment for this programme has been estimated to be about [illegible],000 million pesos.

134.1 At the present time, over 50 per cent of the equipment needed for the sugar industry are being produced inside Mexico, particularly boilers, heat exchangers, disintegrators, crushers, diffusers, tanks, etc. The important items imported are centrifuges, turbines, certain large sizes of extractors and gears. During 1970, for example, the import value of centrifuges was [illegible] million pesos and that of extractors [illegible] million pesos, but separate figures for the turbines for the sugar industry are not available. Suggestions for covering the gap in respect of process-type turbines (including those for the sugar industry), have been made in paragraph [illegible] and for centrifuges in sub-paragraph 121.5, for gears in sub-paragraphs [illegible].3, [illegible].4 and [illegible].5. The existing fabricators of extractors are expected to take up larger sizes gradually. With the local availability of centrifuges, turbines and gears, near complete equipment for the sugar industry should be available domestically.

135. Equipment for food processing industry - The food processing industry in Mexico has a very important place in the economy and it has shown dynamic growth during 1960 - 1970, when its annual growth rate was 6.7 per cent. The industry accounts for a "value addition" of 16,800 million pesos. It has not been possible to make a detailed survey of the existing manufacturing facilities for individual items of a large

variety of equipment used in this industry, but as several items are common to those used in certain other processing industries, it is understood that substantial portions of the demand are being met by local industries.

115.1 Based on an earlier study (by the Unido / Mexico) the requirements of main machinery and equipment for the various types of food processing operations for the period 197[illegible] - 19[illegible] are shown in Table XXVIII, values based on 1978 price levels.

Table XXVIII

Machinery Demand for Food Processing Operations

(1976 - 1990, in total)

		Million Pesos
1.	For processing, packing and canning of meat, vegetables and sea-food	1,140
2.	For processing milk and milk products and soluble coffee	1[illegible]
3.	For biscuits and pastries	145
4.	For flour and flour products, excluding biscuits and pastries	940
5.	For vegetable oil and margarine	390
6.	For feed stuff for animal consumption	400
7.	For beer and beverages	500
8.	For tobacco products	170
	TOTAL	5,575

The above figures include machinery and equipment requirements for new plants, expansions and replacements. Based on the breakdown available in the import statistics, the most important groups of specific equipment, which are included in the above seven types of processing operations, are identified as in Table XIV, along with their values based on 1969 prices. Table XV shows the imports of certain categories of equipment in 1971.

Table XV

Imports of certain food processing equipment

(1970, in total)

		Million pesos (1969 prices)
a.	Bottle washing and filling equipment	510
b.	Packing machines	140
c.	Steam boilers	210
d.	Sterilizers	180
e.	Can making equipment	190
f.	Milk processing plants	40
g.	Milk pasteurizing plants	60
h.	Mixing, processing and moulding machines	119
i.	Ovens and dryers	180
j.	Breakers, mills	250
k.	Tobacco processing and cigarettes	80
l.	Flour products equipment	180
m.	Oil and separator refinery equipment	60
n.	Oil drying and extraction equipment	90
o.	Unclassified equipment	1,135
	TOTAL	3,995

Table XXI

Values of Imports in 1971 for Food Processing Equipment

Equipment Groups	Import Value Million pesos	Main Items of Each Equipment Group	Import Value Million pesos
1. Crusher-Mixer	9.?	Flour mills	4.[illegible]
2. Bakeries	11.4	Mixers, kneaders,	9.3
		Biscuit equipment	6.6
		Paste extruders	10.9
3. Candy chocolate	?.9	Moulders	1.9
		Mixers	1.6
4. Meat, fish, fruit and vegetables	24.0	Slice makers for meat	6.3
		Cutters and scrapers	2.7
		Fruit peelers	1.4
		Vegetable dryers	6.1
		Fruit dryers	2.3
		Sterilisers	2.0
5. Milk and milk products	?.5	Paste mixer for milk	10.6
		Pasteurizer for other items	7.2
		Ice cream makers	2.0
		Sterilisers	6.0
		Total	119.?

19.2 The total imports of 119 million pesos are substantial. If the present trend continues, the imports during 1976 - 1980 could possibly double unless steps are taken to select the high-value items (cf. Table XXI) for domestic manufacture. Technical collaboration from a leading foreign company of food processing equipment would be required for this. The new facilities required for an annual production of, say, 150 million

pesos for workshop machinery, equipment and factory services, but excluding the cost of land, buildings, etc.

135.1 The equipment required for bottling and packaging of milk and other food products have been [illegible] under paragraph [illegible].

V. Equipment for Chemical and Petro-chemical Industry

136. The chemical industry, comprising (a) basic chemicals, (b) petro-chemicals and plastics, and (c) fertilizers, agro-chemicals and pharmaceuticals, holds a leading position in the Mexican economy and is characterised by growth which is expected to continue for a long period. The basic chemicals industry which is mostly in the private sector and has been well established over many years, had an accumulated investment of approximately [illegible] million pesos at the end of [illegible]. The average rate of growth is expected to be maintained at [illegible] per cent in the near future. Several large projects, such as production of hydro-fluoric acid and other basic chemicals, are currently undertaken by a number of companies which are either fully owned or are joint ventures with leading US firms. In addition to meeting the entire Mexican market, substantial exports are taking place which are expected to grow rapidly.

137. In the petro-chemical industry a number of plants are operated by PEMEX, which is a State-owned company. There are also several private companies and joint ventures. A number of new projects have been sanctioned in the last two years and more are in the planning stage. Several plastic resin plants are being brought into production. A high growth rate of 1[illegible] per cent is expected to be maintained for many years for petro-chemicals and plastics.

138. The fertilizer production is chiefly undertaken by Guanomex, a State-owned company. Total production during 1970 was 1,[illegible] million tons. Imports amounted to 77,500 tons and exports to 179,[illegible]00 tons. The principal export item is super triple phosphate. To promote further exports, new projects for phosphate fertilizers are being set up.

The growth rate of production of fertilisers and also agro-chemicals is expected to be around 10 per cent. The pharmaceutical industry has also made some significant progress in the last three or four years and is expected to grow at a rapid pace in the latter part of the seventies. Although precise figures for the cumulative investment in the agro-chemical and pharmaceutic industries are not available, it is roughly estimated around 1,000 million pesos.

119. Having regard to the above rate of growth, an approximate estimate could be made of the requirements of capital goods. As the chemical industry covers a wide range of complex operations, it is not easy to determine precisely the capital goods in the various sub-branches. However, classifying the equipment under certain broad groups which are fairly common to most chemical processes, the equipment requirements for 197[illegible] - 1980 are shown in Table XXI.

Table XXI

Break-up of Heavy Equipment Requirements for the Chemical Industry During the Period 197[illegible] - 1980 (in total) (1[illegible] prices)

Group of Capital Goods	Total Value (Million pesos during 197[illegible] - 1980)	Percentage
Distillation columns	440	6.0
Reactors	80	1.1
Compressors	1,610	20.4
Pumps	960	7.0
Storage tanks	1,792	22.4
Boilers	744	9.3
Containers	912	11.4
Heat exchangers	1,408	17.6
Other equipment	344	4.3
Total	8,000	100.0

Separate projections of imports for the chemical industry have indicated that imports during 1976 - 1980 would be of the order of 4,200 million pesos (at 1968 values). This would mean that the remaining equipment, amounting to 3,700 million pesos, would be manufactured within the country, on an average annual production value of 760 million pesos, by the existing fabricators through normal expansion, and by improvement in production techniques. While import of highly sophisticated and exclusive process equipment would be inescapable, it should be possible to reduce the import level during 1976 - 1980 and beyond by (a) taking steps to remove certain constraints facing the metal transformation and equipment building industry and (b) improving the existing facilities by the installation of modern equipment and adoption of new techniques. These points are discussed in detail in the following paragraphs.

139.1 On the basis of field investigations, it was seen that about a dozen companies are fabricating some or the other of the following equipment.

(1) Process equipment, except distillation columns and reactors
(2) Storage tanks (except very large and special types)
(3) Containers
(4) Heat exchangers
(5) Oil well equipment and oil well platforms (off-shore)
(6) Gas transportation systems for oil wells

In addition, there are four or five firms manufacturing pumps and/or compressors in small and medium ranges and three companies making process type boilers in the requisite types and capacities. All the fabrication of process equipment listed above is undertaken as jobbing work conforming to drawings provided by customers. The Mexican firms are not equipped with process know-how and technology (a) to tender for complete projects giving overall process guarantee

and (b) to design and engineer the various items of equipment with pre-determined performance guarantee. In this situation, the main contracts for complete projects or for major portions of projects are placed with leading foreign firms, who in turn sub-contract the simpler parts of equipment (along with the manufacturing drawings) to metal fabricators in Mexico after retaining for themselves or their associate companies in their own companies the rest of the fabrications. It is only on this basis that the foreign firms are prepared to give process guarantees. Thus, there is a serious technological gap which should be filled gradually and unless this is done, a large import of equipment will be unavoidable over the years even though a good part of it would be within the manufacturing capability of Mexican companies.

139.2 It is understood that PEMEX has a service division for designing certain types of process equipment to assist indigenous suppliers but this know-how, even though limited, is not available to Mexican companies to engineer and tender for complete equipment. One or two metal fabricating companies seem to get some design assistance from structural and civil engineering firms, possibly in respect of simple equipment. In view of the extensive area of know-how covering varied branches of the chemical industry, it would appear that a solution to this problem would be in setting up a design and engineering organisation in Mexico in association with one or more foreign consultancy engineering firms with requisite experience in particular fields in the chemical industry such as basic chemicals, petro-chemicals, plastics, fertilizers, pharmaceuticals, etc. While this institute could progressively establish a number of easier technologies, it could secure on an ad-hoc basis, specialised know-how in respect of new projects as the need arises and gradually absorb more advanced knowledge. The advantage will be that even when new and exclusive technology has to be imported, it could be done on a selective basis limited only to the segments, which are highly sophisticated, filling up the rest with local talent already developed.

139.3 As indigenous capability increases, more and more local fabrication of equipment would become possible under the technological support of the design organisation. It would be worth promoting this project as a co-operative organisation of a number of metal transformation companies in Mexico with the support of Government and major user organisations such as PEMEX.

139.4 It is understood that the approximate indigenous production of equipment for the chemical industry was about 350 million pesos during 1972, while the available capacity is claimed to be much more. However, in the course of this investigation, it has been noticed that there are four or five major firms which are involved in the fabrication of equipment for a number of industries such as, cement, paper, construction, agriculture, chemicals, etc. They take up simpler types of equipment as orders come, on the basis of customer drawings, the machining and other specialised facilities are limited and it is therefore difficult to judge the exact capacity available in real terms and to what extent the firms can meet the large extensive demand of the chemical and other industries. It is also known that most of the companies are not in a position to meet the technical specifications of the American Petroleum Institute and the ASME test codes, for which some kind of certification facilities will have to be established in Mexico. The metal transformation industry will, therefore, have to improve their facilities both in quantity and quality so that they could handle a large share of the market and help in reducing imports.

139.5 As the size of the chemical industry grows, the replacement needs will increase rapidly in view of the fact that the life of the heavy equipment is relatively short, about five to eight years in most of the process items and eight to twelve years in others. As per figures given earlier, the total investment in the chemical industry as at the end of 1971 adds up to 34,000 million pesos and if 60 per cent is assumed to be the value of equipment it would amount to 20,400 million pesos. If the

equipment life is taken to be ten years on a weighted average basis, the annual replacement cost would amount to nearly 2,000 million pesos per year. As a good number of the plants have been installed in the last four or five years, the impact of a heavy replacement programme will manifest itself on an increasing scale in the latter part of this decade and thereafter. This aspect will require a study in depth so that the internal fabricating capacity could be suitably augmented and prepared to deal with this major problems

139.6 In the light of the last two paragraphs, the augmentation and improvement in the facilities to the metal transformation industries could be left to the existing companies, but the position will require careful watching so that if short-falls begin to show up, suitable new projects will be required to be promoted.

O. Textile machinery and equipment

140. Except for the production of detachable cones and spools made of paper, plastic, wood, etc. and also spare parts of a limited range made in small shops, there is at present no manufacture of textile machinery and major equipment in Mexico.

140.1 The average annual market demand in Mexico for all types of textile machines and equipment for the period 1976 - 1980 has been estimated as follows:

Table XXXII

Annual Average Demand for Textile Equipment 1976 - 1980

		Million pesos (1968 prices)
1.	Spinning, extruding and similar machines:	
	a. extruding and similar machines	70
	b. machinery for the preparation of textile material	190
	c. spinning and similar machines	290
	d. winding up machines	100
		650
2.	Weaving, knitting and similar machines:	
	a. looms	230
	b knitting machines	210
	c. similar machines	60
		500
3.	Auxiliary machinery, spare and wear parts to group 1 and 2	220
4.	Machinery for the manufacture of finishing felt	6
5.	Textile finishing machines: bleaching, washing, dressing, coating, printing, etc. (domestic washing machines excluded)	240
	Total	1,616

After 1980 it is anticipated that the country's demand would, on an average, grow at the rate of eight to ten per cent annually.

146.2 In order to meet the above demand, it would be necessary to take up manufacture under a programme, comprising two stages: stage I from 1976/7 to 1982 and stage II from 1983 onwards. Under the stage I programme, it is suggested that approximately 50 per cent of the demand under groups 1, 2 and 3 above should be taken up for manufacture. The items to be selected should be standard products which would enable realization of output in a comparatively short time. Under the stage II programme, in addition to further increase in the products under groups 1, 2 and 3, some of the selected items under groups 4 and 5 above could be included and provision could also be made for exports of more than 20 per cent of total production. On this basis, the total annual output when production reaches planned factory capacities under stage I will amount to 685 million pesos This may necessitate capital investment of approximately 750 million pesos towards machines, equipment and sources such as power, gas and water supply, but excluding the cost of land, buildings, and working capital. The annual production and capital investment values for the stage II programme would depend largely on the extent of products to be covered and the volume of exports. But even on a conservative estimate, the manufacturing facilities to be created under stage II would be of the same magnitude or possibly larger than under stage I. It should be the broad objective that by 1985, over 75 per cent of internal demand should be met by indigenous production, besides meeting export order or well over 20 per cent of production capacity.

146.3 The range of products could broadly be as follows:

1. <u>Spinning, extruding and similar machines</u>:

   a. Staple fibre spinning machinery:

      - opening and blowing machines
      - carding engines
      - drawing frames
      - combers

Alternative I	or	Alternative II
Fly frames Ring spinning frames Twisters		Open end turbine spinning and winding machines

b. Continuous fibre manufacturing machines (polyester, polyamide, polypropylene):

- preparation machinery
- extruders

Alternative I	or	Alternative II
Draw twisters Texturising machines		Draw stretching texturising and winding machines

2. Weaving, knitting and similar machines:

a. Looms:

Alternative I	or	Alternative II
Shuttle looms		Shuttle-less looms

b. Knitting machines:

- circular knitting machines
- flat knitting machines
- raschel machines

c. Similar machines:

- stocking and hosiery machines

3. Auxiliary machines, spare and wear parts for groups 1 and 2:

a. auxiliary machines for group 1a. and b,

- cone winders

b. auxiliary machines to group 2a., b. and c,

- cone winders
- warpers
- slashers
- knotting machines
- draw in machines

c. spare and wear parts to group 1 and 2

140.4 While most raw materials for this industry would be available within the country, the phased integration programme would need to be formulated with great care, so that adequate quality standards can be maintained from the outset to meet domestic and export market requirements. Apart from special components and sub-assemblies, heavy shaft forgings, special bearings, high-alloy steel and sophisticated electrical and suction equipment would need to be imported for some time.

140.5 It is essential that equipment manufacture in this sector is undertaken on the basis of the latest designs and technology, which would have to be acquired. A special training programme would also have to be taken up for Mexican engineers, technicians and workers. It is essential that designs and drawings, material specifications, tools, jigs, fixtures, gauges, patterns etc. should be in the metric system conforming with ISO standards. Adequate provision should be made in the plans for technical services and research and development facilities as are applicable to this line of products. It will also be necessary to carefully investigate and select types and numbers of equipment to be produced, taking into consideration the opinion of the consuming industries, the results of pre-investment studies and trends in world technology in this sub-sector.

P. Agricultural machinery

141. The machinery used in agricultural operations can be classified under the following four groups:

(i) Tractors - small, medium and large

(ii) Sub-soilers, ploughs, harrows and cultivators

(iii) Fertilisers, seeders, etc.

(iv) Harvesting machines, combines, containers, loading and transport equipment, etc.

141.1 Tractors - At present, there are eight companies, most of them with technology-supply arrangements with reputed international firms which are producing tractors in Mexico, mainly in the medium power range of 40 to 135 hp. During 1971, the total production was 5,[illegible] and during 19[illegible] it was 6,[illegible]. It is understood that the actual installed capacity is adequate for the production of over 1,[illegible] medium tractors per year.

Few other firms which are making construction machinery also intend to enter this line. While large land owners have taken to the use of tractors in the past, the medium sized land owners, who are rapidly increasing in number, are creating a need for a smaller size of tractor in the range of [illegible] to [illegible] hp. It is interesting that four out of the eight existing companies are making plans to manufacture "Baby tractors" and others may follow suit.

An organisation known as "work centers" is being promoted to give a lead and assistance to agricultural operations and is expected to introduce large scale reclamation of virgin land and distribute it to small agriculturists. This will necessitate "caterpillar" or "crawler" type tractor in the higher power range of [illegible] to 1,000 hp. Some companies are already planning to enter this line and it is considered feasible in view of the fact that diesel engines up to [illegible] hp are already being produced in Mexico and larger sizes will also become available in the near future as the demand develops. It is therefore felt that adequate capacity and potentiality for growth exists in Mexico for meeting the present and future demand for tractors of all kinds.

141.2 Sub-soilers, ploughs, harrows and cultivators - A number of companies are producing a variety of machines based on the designs and know-how of well-known foreign manufacturers and the level of national integration is around 60 per cent with prospects of increasing progressively in the future. A number of components, mainly forged parts (discs, cutter blades, counter blades, axles, shears, blades, chisels, etc.) are made in a number of existing forging shops and supplied to the main implement manufacturers.

The demand is relatively small in view of the large amount of rural labour available for these operations which use animal-drawn and manual appliances manufactured by local activities. It is considered that the demand, as it increases, will be met by the existing producers.

141.3 __Fertilizers, seeders, etc.__ - For distributing fertilizers, the centrifugal and spreader types of machines are being made by some firms in Mexico and the position is much the same as in paragraph 140.[illegible] above.

141.4 __Harvesting machines, etc.__ - This group of machines which include simple harvesters, more complicated combines, baling presses, loaders, containers, etc. are in demand only from large land owners and the demand, which at present is low, is being met mostly by imports. The existing companies have started making some of the simpler machines and are also expected to go in for the large machines and work them on a co-operative basis for the benefit of the medium and small land owners. The large harvester-combines will require diesel engines in the range of [illegible]00 to 1,[illegible]00 hp and their production in Mexico will give a fillip to the manufacture of large harvesters and other machines.

141.5 Although import projections indicate a likely import of [illegible] thousand million pesos during 197[illegible] - 1980, the rapid growth of this industry in the last four or five years indicates the possibility of near self-sufficiency in the next few years and imports are likely to be limited only to special and sophisticated machines.

Q. __Other equipment for specific industries__

142. This group includes heavy machines and items not included under the various groups, such as printing, type setting and book-binding machines. There may also be several other machinery items which will come up for consideration as new developments take place and the need for special types of equipment arise from time to time in the future.

14.1 In regard to the items for type-making and setting equipment an import of about [illegible] million rupees per year during 1977 - 1980 is anticipated and it should be possible for existing motor fabricating units to cover the same by suitable collaboration with necessary foreign technology to the extent required. In the case of printing machines, the simpler items are being produced at present but the larger ones particularly the automatic newspaper and magazine printing machines are highly sophisticated products and it is advisable that this line of machinery is not taken up at the present time. Book-binding machines are simple to produce and it can be expected that the existing manufacturers would gradually cover the field.

14.2 As for other equipment for different industries, it is not practicable to make any projections at this stage. This will require a continuing review of the capital goods demand and likely imports from time to time.

5. Electrical Equipment

A. Electric Power Generation Machinery

14). Electrical machinery and equipment can be classified under the following broad groups:

(1) Machines and equipment for generation of electrical energy in hydro-electric, thermal (steam) and atomic power plants, comprising such items as water wheels, steam turbines, generators, high pressure boilers, nuclear reactors and auxiliary equipment for the power stations.

(2) Equipment for electric sub-stations and transmission systems, comprising high voltage transformers, circuit breakers, lightning conductors, switches, towers, insulators, A.C.S.R. conductors and auxiliary items.

(1) Equipment for sub-transmission and distribution systems in urban and rural areas, comprising poles, conductors, insulators, switches, distribution transformers, switchgear, fuses, meters, etc.

(A) Machines and equipment for utilisation of power

a. in industry, comprising large and medium size motors for all kinds of drives, rectifiers and thyristor converters, traction generators and motors, control equipment, medium range of transformers and switchgear, etc.

b. in the home, comprising domestic appliances, small motors, farm equipment, etc.

It should be noted that turbines, boilers and nuclear reactors, etc. are included under item (1) above, strictly, these are not "electrical equipment" but as they are essentially intended for use in power plants for generating electricity, these are being included under this chapter.

Items (1), (2), (4) and (A)a. would come under the "Capital Goods" sector. Item (A)b. essentially belongs to the "consumer durables". It is therefore not considered here. However, it can be stated in passing that this field has been well covered in Mexico and market forces would foster the necessary growth in the production and supply of these goods. In regard to item (2) above, there are a number of companies which are producing distribution equipment of requisite quality and quantity and it can be safely expected that future demand would be met by the normal expansion of existing facilities. The present study has been directed, therefore, to items (1), (2) and (A)a. only, which comprise mostly large machines and equipment involving sophisticated technology, both in design and manufacture. It is in this area that a large gap has been identified, as some of these equipments, other than some medium and large size transformers and some motors in the medium horse power range, are at present being manufactured in Mexico. At the same time, no plans of appreciable magnitude, seem to be in progress in any of the existing companies to take up the manufacture of heavy electrical machines and equipment.

Future plans for power development

144. The machines and equipment under items (1), (2) and (3) are almost exclusively used by the country's Federal Electricity Commission (referred to as "CFE" hereafter) which is the public enterprise organization in sole charge of generation, transmission and supply of electricity for the whole country. The equipment under items (4) are used by various large and medium industries. In terms of total value, items (1), (2) and (3) may amount to about [illegible] per cent and item (4) accounts for the rest. In view of this, it is obvious that any plans for the manufacture of heavy electrical equipment should be closely linked to the future programme of power development in the CFE, the salient features of which are given in the following tables.

Table XXIII

Programme for Power Development

Year	Installed generating capacity in mega-watts (mw) - cumulated			% increase over the previous year	Capital** investment during the year (million pesos
	Hydro-electric	Thermal-* electric	Total		
1971	3,185	3,269	6,454		
1972	3,296	3,989	7,285	12.9	5,102
1973	3,534	4,501	8,035	11.6	6,028
1974	4,136	6,070	10,206	26.9	6,269
1975	4,496	6,876	11,372	10.9	6,904
1976	4,496	7,295	11,791	3.7	6,935
1977	4,496	8,928	13,424	13.9	6,769
1978	4,496	10,164	14,660	9.2	8,031
1979	6,196	10,465	16,660	13.6	8,673
1980	6,896	11,157	18,053	8.4	9,162
1981	6,896	12,539	19,435	7.6	9,730

* Includes atomic power plant of 670 mw in 1977 and 670 mw in 1981.

** These investment figures represent the CFE's total outlay for all purposes, namely generation, transmission, distribution, etc.

Note. One US$ = 12.5 Mexican pesos . Source: CFE

It has to be noted that the planned rate of growth of energy generation and of the installed capacity of generating plant is about 10 per cent per annum on the average. This rate of growth is high as compared to most other countries. It is also expected that this rate of growth may be sustained beyond 1991 as well, to supply power to new industries and to far-flung rural areas where electricity has not reached so far. On an approximate projection, the total installed capacity during 1990 may be around 45,000 mw and the energy generation would be about 200,000 million KWH.

Table IV

Electrical Energy Generated

Year	Generation in million KWH	% increase over the previous year
1971	36,424	
1972	41,664	11.4
1973	45,712	12.3
1974	40,279	12.5
1975	45,977	13.9
1976	51,694	12.7
1977	57,489	11.2
1978	63,990	11.3
1979	71,395	11.6
1980	79,742	11.7
1981	89,096	11.7

145. The existing sources of power generation comprise hydro-electric and thermal plants, but as the hydraulic resources would be fully developed by 1990, the plans for the future mainly provide for (a) steam power stations, using residual oils as fuel with conventional high pressure boilers, steam turbines, generators and connected equipment and (b) atomic power plants with nuclear reactors (for raising steam) and

turbine-generators, etc. During the five-year period 1976 - 1981, the CFE will be commissioning as many as 14 sets of 300 mw rating in seven conventional steam power stations. The first atomic power plant in Mexico comprising two units each of 370 mw is now in early stages of construction and the first unit is expected to be put into service by 1977 and the second unit in 1981. Having regard to the high rate of growth of power-generating capacity during 1971 to 1990 (about 1.5 million Kw per year initially, increasing to about 3 million Kw per year towards the end of the period), it is obvious that sets of 300 mw and some sets of a higher rating, possibly 500 mw will be in continuing demand.

146. In the context of the above broad picture of power development it is obvious that the demand for power generating machinery and equipment as well as the transmission and distribution equipment will grow at a corresponding pace. The projected capital investment of CFE on new facilities are given under column 6 of Table 1. For the period 1976 - 1980, the total new investments of CFE for all purposes would amount to about 40,000 million pesos, of which the equipment portion can be taken to be approximately 50 per cent or 20,000 million pesos. Assuming that the imported portion of the equipment would be about 65 per cent, the cost of import will be 13,000 million pesos for the five years. Based on an import projection study, the anticipated imports of power equipment during the same period is estimated at 10,000 million pesos (based on 1969 price levels) and if this is adjusted for probable change in money value over ten years, there is a fair tally between the two figures. Even though the figures are very approximate, they will serve the purpose of quantifying the magnitude of the gap in the heavy power equipment field which will be of the order of 2,600 million pesos per year (average) during 1976 - 1980 and is likely to increase at a rate of 12 per cent annually thereafter, unless efforts are made to set up indigenous capacity of a substantial extent.

Major items of power equipment

147. Prima facie, much of power generation machinery and equipment is highly sophisticated and domestic manufacture will require facilities which are capital intensive and would involve long gestation periods. There are, however, certain items which could be established compartively easily. The following major items or groups of equipment will be individually discussed in the following paragraphs, leading to appropriate recommendations in each case.

Generating plant and equipment.

1. High pressure boilers and auxiliary equipment
2. Steam turbines (300/500 mw)
3. Turbo-generators (300/500 mw)
4. Nuclear reactors and auxiliary equipment

Sub-stations and transmission lines:

5. High voltage power transformers
6. High voltage power circuit breakers
7. High voltage porcelain insulators
8. Transmission line towers, conductors and accessories

Utilisation equipment

9. Electric motors and small and medium generators
10. Motors and generators for railway traction
11. Miscellaneous equipment, such as power rectifiers, capacitors, instruments (electrical, electronic, pneumatic, etc.), electric furnaces, cables and wires, etc.

As already stated, all equipment required for power distribution systems and consumer durables for domestic and commercial needs are being produced in Mexico and as such these items do not find a place in the above-mentioned list. No plans for manufacture of equipment for hydro-electric stations will be required, as practically no new projects are likely to come up due to want of further water resources. However, in line with modern trends, a few pump-storage schemes for meeting system peak loads, would be justified and suitable sites are most likely to be available. This type of project would require very

large turbine-generators of the reversible type, that is, the turbine will have to work as a pump and the generator will have to work as a motor. As the total number of pump-storage schemes will not be large as compared to regular thermal projects and in view of the sophistication and high capital investment, it will not be worth while taking up this line of manufacture in Mexico and the requirements could be met by ad-hoc imports more advantageously.

High pressure boilers and auxiliary equipment

148. At present, there are three companies in Mexico which are manufacturing industrial-type process steam boilers for low and medium pressure, but none of them is equipped to make large size high pressure boilers for power stations. All the three companies are working with the technological support of leading manufacturers in the line. The first one is a wholly-owned subsidiary of a foreign company, the second is a joint foreign-Mexican company and the third is a Mexican company with technology-supply arrangements with a foreign party. In addition to industrial boilers, these enterprises are also fabricating certain auxiliary equipment for industry, essentially of plate work and welded construction. While the standard of production and the skills of workers are satisfactory, their present facilities are totally inadequate to take up a major line of production for high pressure boilers for 300/500 mw thermal units. The CFE has so far been importing complete boilers from other countries, but in recent tenders they have insisted on certain Mexican content for auxiliary items, etc., and it is understood that some of the foreign bids have included about 30 per cent in value of fabrication in Mexico through their associates. For the manufacture of complete boilers of 300/500 mw, totally new facilities of large magnitude will be needed, in respect of high and extensive shop buildings with heavy cranes, special bending rolls, presses, etc. of high capacity, electro-slag and other types of welding machines, stress relieving, shot-blasting, machining and testing facilities.

148.2 During the period 1976 - 1980, the CFT should be ordering on an average two or three boilers of 300 mw rating every year, and this will increase to four to five beyond 1980 with possibility of the next larger size unit being ushered in alongside the 300 mw. This level of demand can be foreseen even after allowing for a limited programme of atomic power generation. Incidentally, a well equipped boiler manufacturing plant could also undertake the fabrication of heat exchangers and a number of other components for nuclear reactors and could take on this additional work load eventually. Furthermore, a number of items of boiler house equipment such as high pressure heaters, etc., as well as certain auxiliaries for the turbine industry could also be included in the programme, as given below:

a. Boilers suitable for burning residual oils and rated for supercritical pressures to supply 300 mw ratings of steam turbines with scope for taking up 500 mw or larger units in the second stage, that is, in about five years after commencement.

b. Additional facilities to the extent required, for the manufacture of high pressure boilers in the medium range of say, 50 to 150 mw ratings for export to Latin American countries and if the foreign markets warrant it, manufacturing facilities should be created for pulverising mills and furnaces, etc. for coal burning.

c. Complete piping, high pressure heaters and as many items of auxiliary equipment as possible for the boiler and turbine manufacture, also condensers to match 300 and 500 mw turbines, although designs for these may have to be evolved with the co-operation of the turbine manufacturers.

d. Subject to a further review, high pressure steam valves in the ranges not being made in Mexico now or in the near future.

e. Process steam boilers in sizes larger than the capability or existing manufacturers.

f. Heat exchangers and reactor components for nuclear power plants in the second stage of the project.

148.3 On the assumption that new manufacturing facilities are installed and ready for commercial operation by 1977 - 1978, it may take about four years to reach an optimum level of production, which can be taken to be 80 per cent of installed capacity. The production value at that stage could be around 300 million pesos and could increase to nearly double this amount in the subsequent five years with some additional factory facilities being added. As a rough estimate, the capital investment on the manufacturing facilities would be of the order of 350 million pesos for stage I, increasing to 450 million pesos in stage II.*

148.4 As the design and manufacture would involve modern and sophisticated technology, there is need for obtaining necessary technology and know-how from a reputed foreign manufacturer. Boilers are individually designed to meet varying needs of different customers or different locations and it is therefore important that a proper design wing, with facilities of computers, etc. be established and the requisite initial training of Mexican engineers and draughtsmen be adequately provided for.

---

* The figures for capital investment and production are based on 1968 values and are given to indicate the order of investments which may be required. Interested investors will no doubt make price estimates of equipment and other items on costs prevailing at the time. The capital investment covers only machinery, equipment and factory services but not land, buildings, etc.

This will be in addition to the training of production engineers and technicians for the shops. The initial set of designs to be selected for the manufacturing programme, should be in conformity with the practice adopted by CFE and also in line with the practice in those Latin American countries from which orders could be expected. Adequate provision should be made for technical services and research and development facilities to enable the plant to maintain high standards of quality and to help in developing new designs for the future.

148.5 In identifying the scope and need for taking up the manufacture of high pressure boilers, the following points have been kept in mind:

(i) The boiler is a high price product, for example, the present price of an imported boiler of 300 mw is about 150 million pesos. Although the manufacturing facilities are capital intensive, it is possible to yield good output within a reasonably short period.

(ii) While designs are sophisticated, the manufacturing techniques and skills could be mastered in a period of say, three to four years as, by and large, the processes are mainly centered around welding technology for structural and plate fabrication. From this point of view, this is not an industry with a long gestation period and satisfactory financial results could be achieved in about four to five years after the commencement of production.

(iii) Mexican workers have shown good proficiency in existing industries engaged in metal work requiring high quality welding and it should be possible to collect and train an adequate work force in a short time. The fabrication work is comparatively labour intensive and would provide a good measure of employment opportunities.

(iv) The continuing programme of [illegible] for thermal power stations would create the need for large quantities of spare parts over the years and supply from an indigenous manufacturer would result in a good deal of import substitution. Besides, standardised boiler and allied equipment from an indigenous supplier will have many advantages in the long run over a large variety imported from several countries.

(v) The installation of certain large sizes of bending rolls, presses, boring mills, welding and testing equipment will provide unique facilities at a national level and certain products like large pressure vessels etc. could be undertaken for other industries to the extent spare capacity is available.

(vi) Due to the locational advantage of Mexico, and in the absence of major boiler making plants in other Latin American countries, there are good prospects for exports to these countries. In view of lower salaries and wages in Mexico, exports of certain components to the USA and Canada could be envisaged.

(vii) Except for certain over-sized plates (both in area and thickness) and certain alloy steels, most of the raw materials are available within the country.

(viii) Very few manufactured components or sub-assemblies will require to be imported and a high level of integration of around 90 per cent could be reached in about three to four years.

Steam Turbines

149. Steam turbines are the most sophisticated of all power generation equipment as it has to run at a high speed (usually 3,000/3,600 revolutions per minute), driven by high pressure steam. It involves

the use of very heavy steel castings, alloy steel forgings, blades of molybdenum vanadium alloys, etc., the weight of a single piece of casting for the casing of a 300 mw turbine is about 100 tons and its shaft forging is about 40 to 50 tons. The weight of a complete turbine would be about 300 tons, and the present-day price of an imported machine is about 3 million pesos. The entire design of a large turbine is the result of very expensive research and development and as such the price for technology and know-how would be high. At present, Mexico has no capacity for large forgings and castings and it may take a long time before it reaches a stage when it can produce these components for large steam turbines. The blades will also be required to be imported as their manufacture is very costly and would be justified only by a large volume of production than the requirements for three or four turbines per year. As a result, over 70 per cent of the components will have to be imported, some fully finished and some semi-finished. The residual work content will comprise only a small extent of machining, fitting, assembly and test, and even these operations will require very high capital investment (probably around 600 million pesos in 1968 values), coupled with a long gestation period. For these reasons, it is recommended that this subject should be considered in all its aspects after 1980 when a fair amount of progress would be achieved in the manufacturing techniques of other types of rotating machines (like large motors, medium sized generators, etc.) and some major foundry-forge facilities would have been established. The CFE's requirements of turbines for the period beyond 1985 would also become clear and the manufacturing programme, size of the machine and the numbers required at that stage.

190. The CFE has in the past installed some gas turbines which are available in varying sizes up to 60 mw, at certain important load centres to deal with seasonal power shortages or peak load requirements. It is possible that a certain number of these machines will be required in future as well, but they are essentially to deal with

emergencies for short period working, as they are very expensive in their working and their cost of energy generation is far higher than that of large central stations. In view of this, it does not appear to be a worthwhile proposition to take up manufacture as there may not be a steady and continuing demand.

151. The turbo-generator is directly coupled to the turbine and in physical size, it is even larger than a turbine, but the essential difference in its construction consists of a mild steel casing of welded construction. It does not involve the high standard of metallurgy as in the case of a turbine. It is fitted with cold rolled sheet steel assembled core and a large number of electrical coils, which no doubt involve high technology similar to that for large electric motors. The rotor is comprised of a heavy forging and it is slotted and fitted with coils of a different type. In the overall, the import content could be limited to about 15 per cent (mainly rotor forging, sheet steel, bearings and certain insulating materials) and almost all the welding machining assembly and testing work could be undertaken locally. The technology is allied to other electrical machines like large motors, but a generator of 100 mw is a very large version and its total weight is 450 tons, and the present duty price of an imported machine is about 40 million pesos. In principle, it can be taken up for manufacture along with other electrical rotating machines, but in the stage II of the "Motor and Generator Project", so that the time schedule for large turbo-generators could be fixed after some progress in establishing the technology is achieved in stage I of the project. However, while planning the stage I of the motor generator project, provision for building space should be made for a large generator shop, and also space, etc. for extending the electrical test plant and for building a rotor over-speed test cell nearby.

Nuclear reactors and auxiliary equipment

[illegible]. The plans for atomic power in Mexico are in a preliminary stage and work on the first project has started only recently. It may take some time before the long term programme of nuclear power generation takes shape. It is only then that the type of reactor, size of turbine generator unit, heat exchangers and auxiliaries would be known and plans could be made for their gradual fabrication within the country. Furthermore, the components of the reactor represent by far the most sophisticated technology and the design and know-how in most cases are of a proprietary nature. The turbine, generator and other equipment are physically much bigger than conventional machines of the same rating, as the former operate with steam of lower pressure and in some cases at less speed. In this context, it is not at this time to attempt or to provide costly expensive facilities for fabricating atomic power plants. However, in the meantime, manufacture of large industrial equipment including some of the conventional power plant and equipment would bring useful facilities, techniques and skills, which in turn may provide the basic capability in the next ten years to prepare the ground for taking up thereafter the more ambitious nuclear equipment fabrication.

3. Transformers, Circuit Breakers and Switchgear

High voltage power transformers

151. There are 10 to 15 companies in Mexico manufacturing distribution-type transformers up to 500 kva of which two or three companies build power transformers in the small ratings from 1,000 to 5,000 kva. There is only one company which has limited manufacturing capacity for large power transformers up to about 100 mva in the 110 and 230 kv class, both single-phase and three-phase. The Comisión Federal de Electricidad (CFE), which are the sole users of large power transformers for the Mexican power system, has been importing most of their requirements, particularly the entire lot of 400 kv transformers and a greater

part of the large capacity [illegible] kv transformers. To the extent that indigenous capacity is available, [illegible] normally purchases power transformers from local manufacturers. In the last few years, the highest voltage of transmission in Mexico has moved to 400 kv and hence the demand for large transformers in this voltage class will continue to increase for a long time along with those of 230 kv and below.

Based on [illegible]'s projections for new generating capacity and substation equipment, it has been estimated that during the period 1976 - 1980 the average annual demand for large power transformers in the 230 and 400 kv classes will be an aggregate of about 35 units totalling to 2,500 mva. During the next five-year period (1981 - 1985) the demand will increase by not less than 50 per cent, that is the annual demand will go up to 4,000 mva with an estimated value of around 160 million pesos. In the subsequent five-year period (1986 - 1990) the demand could increase to over 6,000 mva, amounting to a value of over 240 million pesos. On this basis there is justification for a fully equipped modern factory with manufacturing and testing facilities for large power transformers up to 300 mva and up to 400 kv, with an initial capital investment of about 150 million pesos, increasing to 200 million pesos within five years from starting. As the demand for transformers in the medium range (from 30 mva to 50 mva in the 110-230 kv range) is also expected to increase substantially, the existing factories could be expected to meet this increased load leaving the demand for large units of 230 to 400 kv to be met by the new plant which will be specially equipped for the higher ranges of voltage and capacity.*

---

* All the figures of capital investment and the value of transformer demand are based on 1968 price levels. The capital investment covers only machines, equipment and factory services but not land, buildings, etc.

15 .1 The following product range is suggested for the additional manufacturing facilities referred to above.

(1) Power transformers of 110, 23[illegible] and 400 kv class, single and three-phase, mainly in the range of 50 mva to 400 mva suitable for step-up and step-down duty, including auto-transformers.

(2) Special purpose transformers in the medium range suitable for large electric furnaces, power rectifiers (including rectiformers), etc.

(3) Key auxiliary equipment and components, like on-load tap changers, condenser bushings, etc.

(4) Current and voltage transformers of the 230 kv and 400 kv class, to the extent not being manufactured in Mexico by other companies.

While planning the first stage of the factory, it will be necessary to make provision for the expansion of test and other facilities to cope with a higher voltage, such as 500 or 750 kv in future.

153.2 There is need for making arrangements for obtaining foreign technology and know-how by suitable licensing arrangement which should provide for training Mexican engineers and technicians in design engineering and manufacturing techniques. The designs and drawings should be in the metric system conforming to international standard. The initial set of designs to be selected for manufacture will have to be in conformity with the practice adopted by the CFE and also by the Latin American countries from which export orders could be expected. Adequate provision should be made for the technical services and research and development facilities to enable the plant to maintain high standards of quality and to help in developing new designs for the future.

153. In making this recommendation, the following points have been kept in mind.

a. In comparison with rotating electrical machines, the transformer [illegible] equipment, is comparatively easier to manufacture. However, as it operates at very high voltage, its design for insulation techniques is a critical factor and calls for high standards of quality control.

b. It is well known that in many highly industrialized countries, there is a large volume of production capacity available for transformers. Even so, it has to be noted that the proportion of manual work involved in making the core, coils and tank and in assembling and testing the transformer is very high. The raw materials, namely, copper, silicone sheet steel and mild steel plates and insulating oil are governed by international price levels. Hence it will be possible for a new Mexican plant to produce transformers for the large and continuing internal demand at reasonable prices, although it may find it hard to compete in the export markets for some time until the industry is fully established.

c. Mexican technicians and workers have shown good proficiency in the existing transformer factories and it should be possible to collect and train adequate work forces in a short time.

d. Copper, steel plates and insulating oil are produced in Mexico. Grain-oriented silicone sheet steel, insulating papers, press-boards, gaskets and instruments will require to be imported in the initial stages, but it is expected that most of these will be locally available in due course.

High voltage power circuit breakers

154. There are 8 to 10 companies mostly of small size which produce switchgear of various types but essentially for small industrial purposes. There are only 2 or 3 companies which manufacture power circuit breakers for high voltage up to 15 kv and only one of these companies makes circuit breakers for higher voltages of 34.5 and 69 kv on a very limited scale. The Comisión Federal de Electricidad (CFE) which are the sole buyers of extra high voltage power circuit breakers and allied equipment, have been importing all their requirements of 110, 230 and 400 kv circuit breakers and other special types of switchgear. As the Mexican power system is expected to grow at a rate of about 12 per cent per year (in terms of installed generating capacity) the demand for high voltage switchgear and circuit breakers will continue to increase at a corresponding rate.

154.1 Based on CFE's projections for new generating capacity and sub-station equipment and on the likely demand of large power consuming industries, it has been estimated that during the period 1976 - 1980, the average annual demand for high voltage circuit breakers, switch-gear and allied equipment would be of the order of 300 million pesos which would increase to about 450 million pesos during 1981 - 1985 (based on 1968 values). It can be assumed that about 25 per cent of this could be met by the normal growth of existing manufacturers and another 25 per cent may have to be met by imports of special and sophisticated types of switchgear which might not be taken up for manufacture in Mexico, at any rate in the initial stages of this industry. The balance of 50 per cent would justify the establishment of a new factory with a capital investment of about 150 million pesos initially, increasing to 200 million pesos (based on 1968 values) in about five years after commencement.*

---

* The capital investment covers only machinery, equipment and factory services but not land, buildings, etc.

154.2 The following product range is suggested:

(a) Out-door type circuit breakers for 110, 230 and 400 kv duty with breaking capacity up to 5,000, 15,000 and 30,000 mva respectively. The type of circuit breakers could be of (i) minimum oil, (ii) air blast and/or (iii) sulphur hexafluoride.

(b) Out-door type air-break isolators for 230 and 400 kv duty.

(c) Out-door and in-door type switchgear and circuit breakers for heavy duty and special applications for 15, 34.5 and 69 kv both for power supply and industrial applications.

(d) Heavy duty industrial switchgear for 6.6 kv and special applications.

(e) Sophisticated industrial control equipment including protective relays (static types) and electronic sub-assemblies for mill drives and processes.

154.3 The design and manufacture of high voltage circuit breakers are complicated and are based on costly research and development. It will be necessary to obtain technology and know-how from a reputed foreign manufacturer. Provision should be made to train Mexican engineers and technicians in design engineering and manufacturing techniques. The designs and drawings should be in the metric system conforming to international standards. The initial set of designs and the type of circuit breakers (namely minimum oil, air blast and/or sulphur hexa-fluoride) will have to be in conformity with the practice adopted by the CFE and also by the Latin American countries from which export orders could be expected. Adequate provision should be made on a limited scale, excluding short-circuit testing which may be carried out in testing stations in other countries.

154.4 High voltage switchgear is a static equipment and is relatively easy to make, given the right kind of technological and design support and quality control. The most important components are high voltage porcelain enclosures and supports which should be of adequate electrical and mechanical strength to withstand the rigorous duties. At present, only line insulators up to 69 kv duty are being made in Mexico, but a separate recommendation is being made in the next sub-section of this chapter for the setting up of a high voltage porcelain factory for the manufacture of line insulators as well as bushings and other components for transformers and circuit breakers up to 400 kv. It would be necessary to co-ordinate the time schedule for production of these related product lines and to the extent necessary, porcelain components could be imported initially until such time as these are produced indigenously. Other raw materials such as steel plates for structures and containers, copper sections and some of the contact materials (except special alloys) are available within the country. In view of an increasing and continuing demand for circuit breakers and swithgear from the Mexican power system and the power consuming industries, this is a worthwhile line for self-sufficiency and it is expected that the cost of internal production would be reasonable as compared with imported equipment.

Electric motors and small and medium generators

155. Electric motors play a key role in every industry for providing the motive power for various operations and processes. These are required in a very wide range, starting from a small fraction of a horse power (hp) going up to possibly 10,000 hp and in hundreds of types, speeds and performance characteristics, depending upon the purpose in view. Almost the whole of the fractional horse power motors and a good part of the motors in sizes of 1 to 5 hp are used in domestic durable goods such as air-conditioners, refrigerators, appliances, small pumps, etc. All the rest and the higher rated motors up to the largest sizes form

part of the capital goods industry. As an approximate classification (i) motors from 1 to 20 hp can be grouped as small motors, (ii) those from 21 to 1,000 hp as medium motors and (iii) from 1,001 and above as large motors.

155.1 At present, a high percentage (about 90 per cent) of fractional horse power motors and small motors to the extent required for domestic and commercial purposes are being manufactured in Mexico, imports being limited to special types for sophisticated uses or those forming an integral part of complete equipment. As the volume of demand grows to economic levels, it can be expected that the remaining types will also be taken up for manufacture by existing companies, some of which are associates or licensees of well known foreign firms. In the medium range, there are only two or three firms who are producing motors of the simple squirrel-cage design, meeting only a small part of total requirements. In the range of large motors, only one firm has recently taken up simple types of motors of ratings up to 2,000 hp and has recently completed the first 750 hp motor. It can be expected that this firm may gradually take up some more types of large motors up to 2,000 hp but the greater part of the medium and large motor market in Mexico will continue to depend upon imports for many years to come, unless adequate manufacturing capacity is set up to cover the whole range of size, variety and sophistication.

155.2 Plant visits were made to four of the more important motor manufacturers, one of them covering the small, medium and partly large motors and the others small and partly medium motors. While the standard of techniques and skills are satisfactory, the factories lacked modern methods of large-scale or batch production which contribute to low unit cost. As demand for small and medium motors increases, special efforts will be required to step up the scale of production in some of the existing factories.

155.3 Based on import projection studies, it is estimated that the average annual imports of electric motors of all sizes during 1976 - 1980 would amount to about 272 million pesos and adding 25 per cent towards indigenous production, the annual demand would be about 340 million pesos. This figure could be roughly cross-checked on the basis of the average annual growth of installed capacity of 1.3 million kv of power generating capacity during the same period. On a reasonable assumption that 2 hp of motor capacity is required for each kilo-watt of generating capacity and that the average ex-factory price of motors is 150 pesos per horse power, the total demand would amount to 390 million pesos per year. Taking the lower of the two figures for the purpose of planning, the manufacturing capacity required to meet the country's demand could be taken as 340 million pesos of which the gap of 272 million pesos will have to be filled to a large extent by the creating of new manufacturing capacity.

155.4 In order to establish the design and production technol... of a high standard and also to ensure economy of scale (with exports in mind) it would be desirable to set up one large factory with modern equipment to cover a good part of the additional demand, leaving the rest to be met by existing plants by marginal expansion. For example, the new factory could be planned for an annual output (on full production) of 170 million pesos leaving an output of 70 million pesos to be met by existing plants and the other 70 million pesos by imports in respect of very large or sophisticated items, the manufacture of which will take a longer period than 1980.

155.5 It is suggested that the new plant could be equipped for the following product mix:

(a) For about 25 per cent of the market for small AC motors up to 20 hp (but excluding fractional horse power) on modern production line methods and also DC motors, flame proof and special purpose machines up to 20 hp.

(b) A wide range of medium motors (21 to 1,000 hp) for AC and DC with a variety of enclosures, speed and voltage for all kinds of industrial applications to cover about 75 per cent of the market, leaving the rest to existing companies in Mexico.

(c) About 75 per cent of the market for large motors (1,001 to 10,000 hp) both AC and DC, leaving the balance of 25 per cent for import in the initial phase.

(d) AC and DC generators up to about 5,000 kva for working with diesel engines and industrial steam turbines, could also be included as the nature of this product is similar to motors.

(e) Starters and control equipment for medium and large motors using mostly components and devices from outside suppliers.

155.6 The DC motors for the Metro (underground) and the special traction type AC generator and DC motor for the diesel-electric locomotive programme would justify the establishment of separate plant or alternatively, it could form a division of the new factory recommended herein. This subject will be dealt with in detail in the next section of this chapter.

155.7 The above product mix for the new plant includes also small motors mainly with a view to introducing modern methods of economic production for meeting a part of the market for popular type motors. The new plant would be in a position to export the small motors with more up-to-date means of production and it would also be enabled to take up small lots of DC motors and special purpose motors in this range and would make the new plant more viable.

155.8 As the plans for the capital goods industry take shape, the demand for large and sophisticated motors will increase continuously. With the technology established in the first phase, the plant could take up the manufacture of rolling mill and other heavy duty machines. It will also be possible to take up at that time larger size of AC generators up to 10,000 mw for coupling to industrial turbines and also still higher ratings of turbo-generators of 300 and 500 mw for thermal power stations. The first stage of the plant is designed for an annual output of 170 million pesos (based on 19[illegible] values) and the second stage (say, five years after the start) may cover an expansion of about 100 per cent, aiming to double the output, that is, about 340 million pesos per year. The capital outlay for the first stage would be of the order of 150 million pesos,* (based on 19[illegible] values) and that for the second stage, an additional 100 million pesos for the larger ranges and for the increased output of the products in stage I plus a further 150 million pesos for the special facilities needed for the large turbo-generators of 300 and 500 mw ratings. These figures should be taken to be illustrative only. Along with the use of large motors in industry, the design and supply of complete drive systems (which includes the motors, control equipment and static power supply DC and AC) will have to be developed and this would constitute an important addition in the second stage.

155.9 In view of the wide variety of products involved, the technology required for design, engineering and production are complicated, partioularly in respect of large motors used for complex industrial drives. The insulation techniques have vastly improved in recent years through the adoption of organic resins and plastic films which have permitted higher temperature rise and consequent reduction in the size of machines

---

* The capital investment covers only machinery, equipment and factory services, but not land, buildings, etc.

for a given horse power rating thereby saving on steel and copper. The introduction of the most modern technology is, therefore, essential both from the point of view of economy in cost as well as competitiveness in export markets. It is therefore recommended that a suitable licensing arrangement should be made with one of the leading firms of the world, for technology and know-how. At the same time, a strong technical group made up of competent Mexican engineers, should be given adequate training in design and technology in the licensor's company and placed in charge of design, research and development in the new plant, so that future improvements could be done indigenously.

155.10 Except for special alloy steels and certain insulating materials and large sizes of ball and roller bearings, all the raw materials are available within Mexico. The small and medium motors use gray iron castings while the larger motors have welded frames made of steel plates. The shaft forgings, except for very large motors are of medium weight and diameter and these are already available or will soon be available. It is, therefore, expected that the proposed new plant could start with an integration of around 70 per cent and increase to over 90 per cent in four or five years.

155.11 Essentially, medium and large motors involve considerable individual designs and engineering and a large amount of manual work in the manufacturing and testing operations. In the case of small motors, batch production techniques would result in economy and efficiency. Given the support of modern technology, with the high level of the skill of Mexican workers and moderate wage levels, Mexico could reach a highly competitive position in the export market, not only in the Latin American countries, but also in the United States and Canada. As it may take about five years to establish a fair level of technology, it is advisable to provide any additional manufacturing capacity for export as such. However, efforts to enter and establish export markets should be made in the first stage, itself diverting

5 to 10 per cent of the available capacity to exports, while mainly relying on the internal market. No doubt, during the initial period, substantial export incentives may be necessary but in the long term, it is most likely that the industry could enlarge its export activity to 20 per cent and more, with marginal assistance. Prima facie, it would appear that the motor and small and medium generator industry could be profitable within four or five years from the commencement of production and function within the present price preference of 25 per cent over the corresponding price levels of imported motors, but it can be expected hopefully that in a reasonable time (say five years) the price levels could come down to global levels. The details of the product mix, capital outlay, production costs, sales prices, profitability and such other points will no doubt require detailed investigations and a pre-investment study is, therefore recommended.

Motors and generators for railway traction

156. The Constructora Nacional de Carros de Ferrocarril of Mexico* (CNCF for short) have recently entered into a technical collaboration agreement with a major US manufacturer for the manufacture of a 3,000 hp six-motor diesel-electric locomotive. The workshop facilities are expected to be completed during the middle of 1975 and the first stage of production of 30 locomotives per year, with national integration of 22 per cent (comprising under-frame, super structure, etc.) would be established towards the end of 1976. As at present, no plans seem to be under consideration for the manufacture of the electrical machines and control equipment, which it is understood, would form a part of the final stage of integration sometime after 1978. For realising this objective, it would be necessary that the matter should receive attention even now, as it would take a minimum of five years to set up the manufactureing capacities and to establish regular production.

---

* National Manufacturer of Railroad Cars.

156.1 The railway's demand for diesel-electric locomotives is expected to increase from 50 to 75 units per year over the next five year period and eventually the CNCF plant will be required to meet the full demand, progressively increasing the indigenous content. As the electrical equipment for each locomotive would cost about 1.5 million pesos (being about 30 per cent of the cost of a complete locomotive), the total value of 75 sets would amount to 112 million pesos per year, based on 1965 price levels. The manufacturing facilities for this line of production may amount to about 120 million pesos (1965 values), based on a rough estimate*.

156.2 Each set of equipment includes the following items.

(a) One AC main generator of about 3,000 kva rating supplying to a rectifier system which in turn supplies "direct current" to traction motors.

(b) Six DC traction motors.

(c) One AC exciter with silicone controlled rectifier.

(d) One auxiliary DC generator.

(e) Electrical control equipment.

156.3 The above items represent sophisticated pieces of electrical equipment and it will require special efforts to promote and establish their manufacture. At present only small and medium ranges of AC motors of simple varieties are being made by two or three companies in Mexico and it is doubtfull if any of them would be in a position to take up this new line with its large investment. However, the proposal already made in the preceding sub-section for the establishment of additional manufacturing facilities for motors and small and medium generators, may include the electrical equipment for the diesel-

---

* The capital investment covers only machinery, equipment and factory services but not land, buildings, etc.

locomotive as a separate division, as the techniques and skills required are essentially the same. Alternatively, the CNCF which is setting up facilities for the manufacture of mechanical components of the locomotive, may consider setting up a separate shop in their own complex for manufacturing the electrical equipment. In either case, it would be necessary to ensure the fullest technological and design co-ordination in respect of such generators, motors and controls with the design and performance characteristics of the diesel engine and of the locomotives as a whole. If the CNCF decides to take up manufacture, it is presumed that the technology-supply arrangements would apply as in the case of mechanical components, but if another company undertakes such manufacture, some special arrangements may become necessary. If CNCF takes up this line, this may enable integrated working with other sections of the locomotive manufacture, while if this is undertaken by another manufacturer there would be economies of production and scale taken together with other types of electrical machines and equipment. It is considered worthwhile to plan for such manufacture as early as possible with a view to speed implementation.

156.4 It is understood that the Metro (underground) transportation system may be extended along many other routes, but no details of any long term plan is available. If this materialises, the motors and control gear (which are similar but smaller in size than the equipment for diesel-electric locomotives), could also be made in the same plant.

T. <u>High voltage porcelain insulators, bushings, etc.</u>

157. At present, there are two electrical porcelain factories in Mexico which manufacture mainly line insulators for transmission lines up to 66 kv and for sub-transmission and distribution systems of lower voltages. The output of these two factories meet only a small fraction of the country's requirements and the Comisión Federal de Electricidad (CFE) who are the exclusive buyers of extra-high voltage line (suspension type) and post insulators for 100, 230 and 400 kv transmission systems,

have been importing all their requirements from various countries. The manufacturers of high voltage power and instrument transformers and of high voltage switchgear also import most of their bushings and other porcelain components. In this context, practically the whole field of extra-high voltage porcelain insulators, bushings and special components remains to be covered and it would justify the establishment of a modern electrical porcelain factory in Mexico.

157.1 On the basis of CFE's plans and programmes for transmission lines and sub-stations and on the basis of import projections, it has been roughly estimated that the average annual demand of electrical porcelain in Mexico during 1976 - 1980 would be around 180 million pesos and the corresponding figure during the period 1981 - 1985 would be 50 per cent higher, that is around 270 million pesos. Allowing for about 25 per cent of the line and post insulators to be met by the existing companies through normal expansion of their capacities and leaving a portion comprising sophisticated items (for example, the more difficult transformer and switchgear components) for imports, the balance which could be considered for internal manufacture would amount to about 125 million pesos per year during 1976 - 1980 and 175 million pesos per year during 1981 - 1985.* However, as a new high voltage porcelain factory would require a long gestation period to build up its output, its contribution during 1976 - 1980 would be rather low and hence for purposes of planning the new project its capacity during 1981 - 1985 could be fixed for an average annual output of 150 million pesos increasing to 200 million pesos thereafter. The corresponding capital investment may possibly amount to about 100 million pesos (US$ 8 million) initially, increasing to 125 million pesos (US$ 10 million) after five years.** These values of production and investment are based on 1968 price levels.

---

* Based on 1968 prices.

** The capital investment covers only machinery, equipment and factory services, but not land, buildings, etc.

157.2 The following product mix is suggested:

(a) Suspension disc insulators suitable for 66, 110, 230 and 400 kv lines for requisite electrical and electrical-mechanical strength.

(b) Post insulators for bus-bar supports as well as for air-break isolators for 66, 110, 230 and 400 kv sub-stations.

(c) Transformer bushings (porcelain enclosures only suitable for condenser type elements to be fitted by transformer manufacturers) and also containers for current and potential transformers for a voltage range of 33 to 400 kv.

(d) Special enclosures for minimum oil, air-blast and or sulphur hexafluoride type of switchgear for a voltage range of 33 to 400 kv.

(e) Enclosures for lightning conductors or if considered feasible, complete lightning conductors (up to 400 kv).

In respect of (a) and (b) above, an alternative for glass insulators instead of porcelain could be considered on technical and economic merits particularly in the context of indigenous availability of raw materials for one or the other process, namely glass vis-a-vis porcelain.

157.3 Modern design and technology will be required to be provided by one of the leading foreign companies in this field with a specific undertaking to train Mexican engineers, technicians and artisans. It is essential that designs and drawings should be in the metric system conforming to international standards. The selection of the initial list of products and their designs will have to be in conformity with the needs and practices of CFE as well as those of the power transformer

and switchgear manufacturing industries in Mexico. The requirements of Latin American countries from which export orders are likely to be received in future should also be catered for. Provision will have to be made in the factory plans for technical services and research and development facilities as are applicable to the high voltage porcelain industry.

157.4 Based on present information, it appears that ball clay and other types of white clay of the requisite quality may not be adequately available in Mexico. The initial planning of this project should, therefore, proceed on the basis of importing these raw materials from the North and South American countries. However, possibilities of locating clay of the right quality in Mexico cannot be excluded and efforts for its exploration would be worth undertaking along side the decision to take up this project. Prima facie, in view of (i) the low cost of the raw materials as compared to the high cost of finished porcelain products, (ii) the labour intensive nature of the processes, and (iii) the growing needs of the electric power system in Mexico, there seems to be good justification for establishing this industry notwithstanding the need to import the basic raw material.

U. Telecommunications equipment

158. There are two major companies (besides three or four small-scale producers) who manufacture a wide range of telephone equipment which are exclusively supplied to Teléfonos de México, which is a State-owned enterprise for telecommunication systems in Mexico, except overseas communications which is handled by Secretaría de Comunicaciones y Transportes. The two major producers which are affiliates of well known foreign companies have strong technological support and are in a position to meet practically all the requirements of the telephone systems, except certain sophisticated equipment for line communications as well as micro-wave and VHF equipment. They have in hand expansion projects to take up progressively the sophisticated line equipment and

also to increase national integration through local production of certain relays and other components now being imported. Although import projections have indicated a likely gap of about 2,000 million pesos during 1970 - 1980 it is felt that the growth of local industries would meet almost the entire requirement and possibly undertake some exports as well. From this point of view, full encouragement to promote the rapid growth of this industry would be justified.

158.1 In regard to the micro-wave and VHF equipment, there is scope for starting local manufacture, initially to take up certain sub-assemblies and simpler components and gradually expand the facilities. This will require foreign collaboration and an investment of about 30 million pesos (on 1968 prices) is suggested provisionally for an annual output value of 40 million pesos (on 1968 prices).

V. Electrical measuring and control instruments

159. A number of small and medium sized companies are manufacturing simpler types of electrical measuring and indicating instruments. The most important, in terms of value, is the single phase energy meters for domestic consumers and this is being produced to meet the demand fully. The three phase meters for industrial consumers is not yet in production but it is understood that two or three companies are making plans to start this manufacture. In regard to control instruments, particularly both electronic and pneumatic types for process control, only a few are in production, as the quantity involved is said to be inadequate to make viable projects. As capital goods industry develops, there will be need for more instruments and it will give impetus to increased volume of production. The position should be carefully watched in the next four or five years and if the imports are not reduced, one or two new projects could be encouraged.

159.1 For electric power systems, the relays and other instruments are connected through instrument transformers which convert the high voltage parameters into proportional low voltage value. These are essentially high voltage equipment and are built in the transformer or allied factories. At present, there is one medium sized company which is producing current and voltage transformers for use up to 230 kv of the requisite quality standards. This company, with suitable additional equipment could take up 400 kv equipment as well. To the extent of any shortfall in existing production capacity, it has been suggested under sub-paragraph 157.1 that this product line could be included in the proposed new facilities for power transformers.

W. Electrical and other tools

160. Except for sophisticated types, most of the motor operated and manually operated tools are being produced in Mexico and are also being exported to a small extent. As the demand increases, it is most likely that local production would grow to the necessary extent. In regard to special types of mechanical tools, such as jigs, fixtures, gauges, etc. creation of new facilities has been suggested under sub-paragraph 127.4. Subject to this, the position is more or less satisfactory and the existing companies could be expected to cover the future demand.

X. Electric furnaces, electric welding and cutting apparatus

161. The existing domestic capacity seems to be adequate for the internal demand except for very large electric furnaces or sophisticated welding and cutting equipment for which the demand would arise only when the capital goods industry gets into stride or if a large scale programme for electric steel melting is authorised. Nevertheless, the nucleus for this industry is well established and it can be reasonably expected that as and when new types are required, the existing companies could meet the demand.

Y. Other electrical equipment

162. One of the important items of interest to the power supply industry and to general industries is copper and aluminium conductors, cables and wires. There are a number of companies in the field, of which two or three are major ones who are producing most of Mexico's requirements and also exporting to a small extent. In respect of steel cored aluminium conductors of extra large sizes for high voltage transmission lines (230/400 kv) there is still some import, but as the quantum of demand increases, these could also be made in Mexico. As copper is produced locally, export of finished cables and wires made of copper should be maximised as it is more advantageous than exporting copper ingots or bars.

162.2 Another item used in the power system and in large industries, is power capacitors. There are two small companies producing capacitors one for both high voltage and low voltage and the other for low voltage only. It is understood that internal demand is being fully met by their production, although on account of the small volume of production, their prices are high and hence the chances for export are poor.

163. Among other items, mention can be made of electronic and X-Ray apparatus, photo-cells, diodes, electro-magnets, accumulators, etc. All these products are, by and large, consumer durables with a certain amount of industrial applications. At present, the types used in the consumer market are all being made in Mexico to meet most of the demand. For example, radios, televisions, batteries, etc. are being produced in large quantities, using mostly indigenous components. The products of industrial electronics are too sophisticated and require circuitry and systems technology based on expensive research. Furthermore, the components should be of very high quality to ensure the requisite reliability standards. Nevertheless, even on the basis of

importing key components, assembly of some of the industrial electronic equipment should be encouraged for control equipment of machinery items. This has been included in the product mix in respect of new facilities suggested for circuit breakers and motor generators.

General conclusions

164. As the Mexican power system grows at the rate of about 12 per cent per annum, heavier and more sophisticated machines and equipment will be in demand for generation and transmission purposes. It is imperative that at least 75 per cent of the needs should be met by international production so that external financing from various sources could be conserved for the import of only the most complex items such as nuclear reactors, turbines, etc., which may not be viable for manufacture in Mexico for technological and economic reasons. In regard to general industry, the ready supply of electrical driving equipment and controls from within the country is an essential pre-requisite for its successfull establishment and growth.

164.1 The present position in Mexico has revealed serious gaps amounting to nearly 90 per cent in value in the heavy electrical equipment field and the steps to remedy this situation is a matter of urgency. However, as sophisticated technology is involved, the production programme will have to be phased out in more than one stage, leaving the difficult items for the second and subsequent stages. For example, the steam turbines of 300/500 mw are not considered suitable for manufacture for several years, in view of certain inherent constraints and the need to import most of the raw materials and components. The large turbo-generators are suggested for inclusion in the second stage of the motor generator project. Besides, the quantum of new manufacturing facilities in most products, is based on a target production of 50 per cent of the market demand leaving 25 per cent for the existing companies to cover by expansion and the other 25 per cent for import. This approach will allow time for technology and skills to be mastered to a large extent in the initial years and prepare the ground for greater effort in the subsequent stages.

164. On the above basis, the first stage investment programme for new manufacturing facilities suggested for electrical machines and equipment would aim to cover a production gap of about 1,000 million pesos per annum by 1980, which is approximately 50 per cent of the projected average imports during the 1976 - 1980 period.

6. Z. Capital goods not specifically identified

165. In the entire field of the capital goods sector, certain items exist outside the groups classified as above and these have been left over as a lump-sum figure in Table XI in paragraph 95. There are many equipments of an ad-hoc nature which may be used for exclusive purposes or in more than one industry. New fields such as nuclear fuel complexes, etc. may bring about special equipment needs in future and these will have to be considered on the merits of each individual case.

166. The sectoral analysis contained in the above paragraphs high lights the extent to which domestic production is taking place in various capital goods branches, apart from identifying the principal production gaps and manufacturing possibilities. An important aspect, however, is that in a number of sub-sectors, domestic capacity is available with a relatively few, large fabrication enterprises who are equipped only to a limited extent with large machining and other special facilities. While many of these units are still not operating at full installed capacity, a major programme of machinery manufacture in the various sub-sectors discussed above may not be able to be undertaken by these units without substantial expansions, as overall manufacturing capacity would fall considerably short. Already some of the larger enterprises are concentrating on a limited number of machinery products and if major overall increase in the sector as a whole is to be achieved, the likely shortfall in overall capacity that is likely to develop mainly in fields of more sophisticated manufacture, it will be

necessary to promote additional growth of manufacturing capacity in the capital goods sector as a whole, apart from seeking to cover the specific production gaps that have been identified.

167. A list of the capital goods groups and items having adequate potential for manufacture in Mexico is enclosed at Schedule V at the end of this chapter. As pointed out earlier, such identification cannot be considered to be exhaustive and only the major gaps and shortfalls that are likely to emerge have been highlighted. Capital goods manufacture has extensive ramifications and production of certain groups of machinery products is bound to lead to growth of new demands in other sub-sectors. A survey of such gaps and shortfalls is essentially a continuing process and the present analysis should be viewed as an initial exercise in programming for this sector. In the identification of manufacturing possibilities, only the more significant items have been highlighted, not so much from an import-substitution angle, but for the creation of an essential base for capital goods development.

168. The first stage development programme outlined in the above paragraphs is intended to gradually achieve integrated growth of the principal capital goods sectors. The programme is complementary in its nature, though the impact of such complementation would be much greater during the second stage of development after 1980 as a result of the outputs derived from stage I. Programming for capital goods development must be viewed as a [illegible] process and during the first stage programme, only the basic ground work can be laid for integrated growth in the future.

169. An essential aspect of programming is to define the order of magnitude of likely resource outlay and investments that may be necessary. At this stage of the study this can only be indicated in very broad terms and it is only when the pre-investment studies are completed during the next phase of the study that fairly reliable figures of projected investment requirements are likely to emerge. Nevertheless, for the

purpose of indicating the broad order of magnitude of the capital outlay that may be required, an attempt has been made to assess the investment requirements, particularly on machinery, equipment and certain essential services (at 1968 prices) in respect of the principal groups and items included in the first stage programme, together with the likely production values (at 1968 prices) by 1980. The capital output ratio by 1980 is lower in some sub-sectors where optimum production levels would not have been achieved by that year. The estimates in table XXXV are broad approximations only and cannot constitute the basis for investment decisions without further detailed pre-investment studies in most cases. The investment projections are also confined to the principal items specifically identified and do not extend to the various capital goods branches where it is considered that expansions by existing enterprises could cover the requirements.

Table XXXV

Investment and Production Projections for Capital Goods Items (on machinery, equipment and essential factory services only) during 1974 - 1980 (in million pesos)

Sub-sector or Item	Projected investment (1974-1980) on machinery, equipment and essential services only	Projected annual production (at the 1968 prices) by 1980
A. Non-electrical equipment (common use)		
1. Steam turbines (industrial)	30	30
2. Heavy diesel engines	250	193
3. Machine tools		
a. Chip removing	413	344
b. Chipless forming	42	30
4. Pumps, centrifuges and compressors		
a. Pumps and centrifuges	72	60
b. Compressors	145	120
5. Lifting, loading and conveying equipment	200	200
6. Machinery parts and components		
a. Gray-iron foundry (for medium and heavy castings)	655	595
b. Gears, reducing equipment and precision forgings	385	275
c. Standard parts	65	50
d. Measuring tools	42	30
	2,299	1,927
B. Non-electrical equipment for special industries		
1. Cement production equipment	100	150
2. Paper and pulp production machinery	200	250
3. Sugar and food processing equipment	150	150
4. Textile production equipment	750	685
	1,200	1,235
C. Electrical equipment		
1. High pressure boilers	350	300
2. High voltage transformers	150	160
3. High voltage circuit breakers	150	150
4. Motors, AC and DC (incl. traction)	250	270
5. High voltage insulators and bushings	100	150
6. Telecomm. equipment (micro-wave and VHF)	30	40
	1,030	1,070
Total	4,529	4,232

170. Since the above projections only relate to machinery, equipment and essential services, it will be necessary to add a further provision to cover costs of land, buildings and other fixed-asset requirements. Assuming this to be 40 per cent of the former, a further sum of 1,812 million pesos would be necessary. The order of magnitude of total capital outlay for fixed-assets would, therefore, be about 6,300 million pesos for this programme while annual production would be of the order of 4,200 million pesos by 1980. An investment programme of this magnitude would necessarily require considerable initiative and promotional effort on the part of both the private sector and governmental and institutional agencies in Mexico.

7. Required Pre-investment Studies

171. It needs to be reiterated that the above projections of capital outlay, together with the economic and technological feasibility of the various manufacturing programmes suggested constitute broad approximations only and it will be essential to have fairly detailed pre-investment studies prepared before investment decisions can be arrived at. As pointed out earlier, such pre-investment decisions can take one of two forms, viz. by the interested manufacturers themselves or by independent consultants or experts. In view of the fairly large number of products and projects identified, it is considered that both the alternatives would have to be used. If there is adequate response from suitable foreign manufacturers, whose technology and manufacturing capability is considered appropriate for particular sub-sectors or projects, pre-investment studies could be undertaken by such parties, in collaboration with Nacional Financiera and domestic consultancy agencies in Mexico. The initial cost in such cases would be largely borne by the interested manufacturing groups. The extent of response would very much depend on the promotional efforts that are made. In Phase II of the study, provision has been made for contacts

with reputed manufacturers from industrially advanced countries together with bringing such foreign groups in close touch with suitable Mexican enterprises and entrepreneurs. This is an extremely important aspect of the follow-up phase of this report. In the course of meetings with such manufacturers, the question of pre-investment studies in each case will need to be discussed and determined. It is nevertheless considered that, for a number of products and projects that have been identified, pre-investment studies would need to be undertaken by independent consultants, both in order to generate adequate investment interest and to enable cross-checking of opinions and estimates of interested manufacturers as to the techno-economic feasibility of particular projects. The specific products and projects for which pre-investment studies through independent consultants are considered desirable are as follows:

1. Heavy diesel engines in the output range of 1,000 to 6,000 hp for generation, pumping and marine use.

2. Machine tools:

   (a) For chip removing, except parallel lathes, milling machines, turret lathes, surface grinders and single spindle automatics.

   (b) For chipless forming, such as hydraulic presses, spark erosion machines, ingot, billet and slab shears and bending rolls.

3. (a) Heavy duty pumps for water supply, sewage, boiler feed, mining and petroleum industries and for general industrial user.

   (b) Centrifuges mainly for sugar and chemical industries.

   (c) Heavy duty compressors for mining, petroleum and general industrial use.

4. Gray-iron foundry for medium (100 kg. to 3,000 kg.) castings and also heavy castings (3 to 15 mt.).

5. Production of gears, speed reducers and precision forgings with a range of maximum diameter of 630 mm. (in solid blanks).

6. Manufacture of standard parts for utilisation in tools, jigs, dies, fixtures, moulds, gauges, patterns, etc.

7. Manufacture of paper making machinery including winders suitable for paper mills of 200 to 500 tons per day capacity.

8. Textile machinery and equipment such as:

   (a) Spinning extruding.

   (b) Continuous fibre making.

   (c) Weaving, knitting or suitable alternative machines

   (d) Auxiliary machines and spare parts.

9. Manufacture of high pressure boilers for use in large electric power stations to match steam turbines of 300/500 mw and auxiliary equipment for the boilers and turbines such as condensers, high pressure heaters, etc.

10. Motors and generators for AC and DC, up to 10,000 kw (including generators and motors for traction) in the first stage of production with provision for large turbo-generators (300/500 mw) in the second stage.

11. High voltage porcelain insulators suitable for 110, 230 and 400 kv transmission lines and bushings and other components for circuit breakers and transformers of 110, 230 and 400 kv.

171.1 The proposed scope for the pre-investment studies should be as follows:

(i) Detailed market survey of internal as well as possible export markets in terms of different types and ratings of equipment and the corresponding quantities and values.

(ii) Selection of product mix, their quantities and values and drawing up a phased programme of production.

(iii) Approximate cost estimates for land, buildings, machinery, equipment, factory services, inventories and working capital etc.

(iv) Estimates of approximate cost of production and sales value.

(v) Cash flow statement and profitability.

TABLE 1

Production Programme of Company No. 2

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Piston	1	125	1	600	air	50/60	1.1	Electric*	1/3	85
"	1	125	1	600	"	50/60	1.1	Electric*	1/3	85
"	1	150	1	968	"	50/60	1.7	Electric*	1/2	85
"	1	150	2	968	"	-	1.7	Petrol* IEM	3.5	85
"	1	125	1	995	"	50/60	1.7	Electric IEM	1/2	85
"	1	125	1	995	"	50/60	1.7	Electric IEM	1/2	85
"	2	150	1	530	"	50/60	3.0	Electric*	3/4	85
"	2	150	1	730	"	50/60	4.1	Electric*	1	85
"	2	150	1	730	"	50/60	4.1	Electric	1	85
"	2	150	1	730	"	-	4.1	Petrol*	3.5	85
"	2	250	2	372	"	50/60	4.8	Electric*	1	85
"	2	250	2	519	"	50/60	6.8	Electric*	1.5	85
"	2	250	2	519	"	50/60	6.8	Electric*	1.5	85
"	2	175	2	705	"	-	8.8	Petrol*	2.5	85
"	2	250	2	705	"	50/60	8.8	Electric*	2	85
"	2	250	2	705	"	50/60	8.8	Electric*	2	85
"	2	250	2	525	"	50/60	32.0	Electric*	7.5	85
"	2	250	2	672	"	50/60	40.0	Electric*	10.0	85
"	4	250	2	525	"	50/60	64.0	Electric*	15.0	85
"	4	250	2	672	"	50/60	80.4	Electric*	20.0	85
"	4	125	2	785	"	50/60	110.0	Electric*	25.0	85
"	4	175	2	870	"	50/60	123.0	Electric IEM	30.0	85

* Various makes

Table 2

Production Programme of Company No. 3

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Piston	1	150	1	760	air	50/60	1.3	Electric*	1/2	85
"	1	150	1	760	"	50/60	1.3	Electric* + petrol*	1/2	85
"	2	150	1	575	"	50/60	2.0	Electric*	3/4	85
"	1	125	1	1,050	"	50/60	1.8	Electric*	3/4	85
"	1	125	1	1,050	"	50/60	1.8	Electric* + petrol*	3/4	85
"	2	150	1	760	"	50/60	2.6	Electric*	1	85
"	2	40	1	760	"	50/60	3.4	Electric*	3/4	85
"	2	200	2	400	"	50/60	3.55	Electric* + petrol*	1	85
"	2	125	2	485	"	50/60	4.10	Electric* + petrol*	1	85
"	2	60	1	985	"	50/60	4.20	Electric*	1	85
"	2	250	2	575	"	50/60	5.07	Electric* + petrol*	1.5	85
"	2	250	2	800	"	50/60	5.20	Electric* + petrol*	2	85
"	2	125	2	690	"	50/60	5.80	Electric* + petrol*	1.5	85
"	2	200	2	885	"	50/60	7.19	Electric* + petrol*	2	85
"	2	125	2	960	"	50/60	8.0	Electric* + petrol*	2	85
"	2	250	2	660	"	50/60	10.3	Electric* + petrol*	3	85
"	2	40	1	600	"	50/60	10.7	Electric*	1.5	85
"	2	200	2	720	"	50/60	11.1	Electric* + petrol*	3	85
"	2	125	2	855	"	50/60	13.31	Electric* + petrol*	3	85
"	2	40	1	800	"	50/60	14.30	Electric*	2	85
"	2	250	2	500	"	50/60	15.3	Electric* + petrol*	5	85
"	2	175	2	1,000	"	50/60	15.6	Electric* + petrol*	5	85
"	2	125	2	600	"	50/60	18.3	Electric* + petrol*	5	85
"	2	40	1	600	"	50/60	19.2	Electric*	3	85
"	3	250	2	560	"	50/60	26.5	Electric* + petrol*	7.5	85
"	3	200	2	615	"	50/60	27.9	Electric* + petrol*	7.5	85

* Various makes

* Various makes

Table 2 (continued)

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Piston	2	250	2	680	air	50/60	28.3	Electric* + petrol*	7.5	85
"	2	40	1	500	"	50/60	32.0	Electric*	5	85
"	2	125	2	750	"	50/60	32.0	Electric* + petrol*	7.5	85
"	3	125	2	685	"	50/60	32.4	Electric* + petrol*	7.5	85
"	2	200	2	800	"	50/60	33.3	Electric* + petrol*	10.0	85
"	3	250	2	750	"	50/60	33.0	Electric* + petrol*	10.0	85
"	3	200	2	800	"	50/60	36.0	Electric* + petrol*	10.0	85
"	2	125	2	900	"	50/60	38.8	Electric* + petrol*	10.0	85
"	2	125	2	1,000	"	50/60	42.0	Petrol, Köhler	10.0	85
"	2	60	1	675	"	50/60	42.0	Electric	7.5	85
"	3	125	2	900	"	50/60	42.4	Electric* + petrol*	10.0	85
"	3	250	2	750	"	50/60	49.4	Electric* + petrol*	15.0	85
"	3	200	2	1,150	"	50/60	54	Electric* + petrol*	15.0	85
"	2	40	1	800	"	50/60	54	Electric*	7.5	85
"	2	60	1	900	"	50/60	56	Electric*	10.0	85
"	3	200	2	860	"	50/60	57.8	Electric* + petrol*	15.0	85
"	3	125	2	900	"	50/60	60.6	Electric* + petrol*	15.0	85
"	2	40	1	800	"	50/60	66	Electric*	10.0	85
"	3	250	2	1,040	"	50/60	67	Electric* + petrol*	20.0	85
"	3	125	2	1,000	"	50/60	68.5	Electric* + petrol*	20.0	85
"	3	250	2	1,100	"	50/60	73.5	Electric* + petrol*	20.0	85
"	3	60	1	800	"	50/60	74.0	Electric*	20.0	85
"	3	125	2	1,100	"	50/60	80.5	Electric*	25.0	85
"	3	40	1	800	"	50/60	99.0	Electric*	15.0	85
"	3	125	2	1,140	"	50/60	100.0	Electric*	25.0	85
"	3	60	1	1,100	"	50/60	101.0	Electric*	20.0	85
"	2	125	1	2,100	"	-	150.0	Diesel, Perkins	46	85
Rotary	1	100	2	600	water	50/60	150.0	Electric IEM or SIM	40	90
Piston	1	125	1	450	water	50/60	179.0	Electric	40	85

* Various makes

Table 2 (continued)

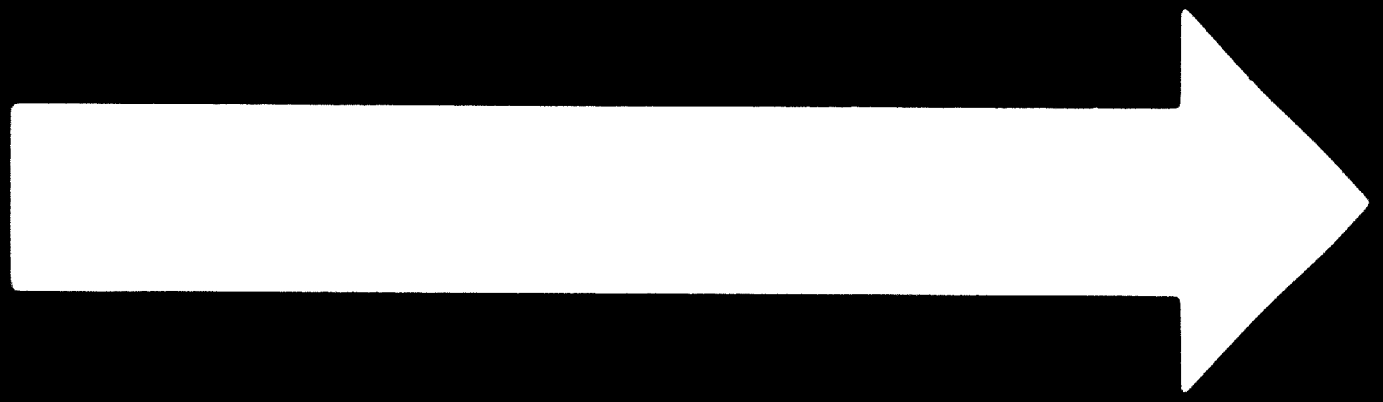
Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Piston	3	125	2	870	air	50/60	175.0	Diesel, Perkins	62	100
"	3	125	2	970	air	50/60	200.0	Electric*	50	85
"	1	125	1	450	water	50/60	218.0	Electric*	50	85
"	1	125	1	450	"	50/60	249.0	Electric*	60.0	85
"	1	100	1	450	"	50/60	340.0	Electric*	75.0	85
"	1	100	1	450	"	50/60	410.0	Electric*	100.0	85
"	2	125	2	750	"	50/60	512.0	Electric*	100.0	85
"	2	125	2	750	"	50/60	635.0	Electric*	125.0	85
"	2	125	2	750	"	50/60	761.0	Electric*	150.0	85
"	2	125	2	750	"	50/60	1,010.0	Electric*	200.0	85

* Various makes

Table 3

Production Programme of Company No. 4

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Piston	1	150	1	840	air	50/60	1.4	Electric Power + G.E.	1/3	97.3
"	1	150	1	1,200	"	50/60	1.91	Electric Power + G.E.	1/2	97.8
"	1	150	1	1,200	"	50/60	1.91	Electric Power + G.E.	1/2	94.3
"	1	150	1	1,200	"	-	2.20	Petrol Brigs + Straton	2	97.9
Diaphragm	2	40	1	1,725	"	60	2.5 - 25	Electric Power + G.E.	1/3	99.9
Piston	2	150	1	723	"	-	2.90	Petrol Wisconsin	3	97.2
"	2	150	1	700	"	50/60	3.25	Electric Power + G.E.	3/4	96.5
"	2	150	1	700	"	50/60	3.25	Electric Power + G.E.	3/4	92.0
"	2	150	1	825	"	50/60	3.86	Electric Power + G.E.	1	96.7
"	2	150	1	825	"	50/60	3.86	Electric Power + G.E.	1	93.1
Diaphragm	2	40	1	1,725	"	60	4.8 to 25	Electric Power + G.E.	1/2	99.9
Piston	2	300	2	460	"	50/60	5.8	Electric Siemens	1.5	93.1
"	2	300	2	460	"	50/60	5.8	Electric Siemens	1.5	89.1
"	2	125	1	723	"	-	6.5	Petrol Wisconsin	5	97.2
"	2	300	2	600	"	50/60	7.58	Electric Siemens	2	93.2
"	2	300	2	600	"	50/60	7.58	Electric Siemens	2	89.2
"	2	300	2	768	"	50/60	8.85	Electric Siemens	3	93.6
"	2	300	2	768	"	50/60	8.85	Electric Siemens	3	87.1
Piston V	4	300	2	465	"	50/60	12.0	Electric Siemens	3	91.0
"	4	300	2	465	"	50/60	12.0	Electric Siemens	3	87.2
"	4	300	2	705	"	50/60	18.1	Electric Siemens	5	91.2
"	4	300	2	705	"	50/60	18.1	Electric Siemens	5	88.1
"	4	175	2	705	"	-	18.1	Petrol Wisconsin	12	97.2
"	4	300	2	890	"	50/60	24.5	Electric Siemens	7.5	91.9
"	4	300	2	890	"	50/60	24.5	Electric Siemens	7.5	88.9



76. 04. 28

4 OF 4

05967

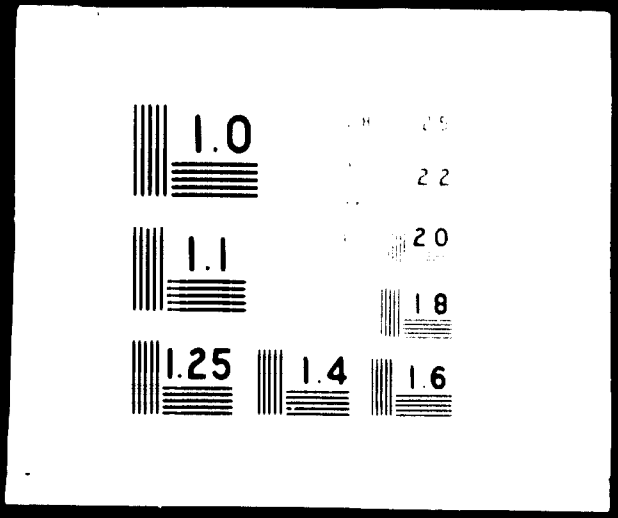


Table 3 (continued)

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Piston V	4	300	2	500	air	50/60	29.3	Electric Siemens	7.5	92.5
"	4	300	2	500	"	50/60	29.3	Electric Siemens	7.5	88.9
"	4	300	2	650	"	50/60	37.6	Electric Siemens	10	92.8
"	4	300	2	650	"	50/60	37.6	Electric Siemens	10	89.6
"	4	300	2	900	"	50/60	49.4	Electric Siemens	15.0	93.1
"	4	300	2	900	"	50/60	49.4	Electric Siemens	15.0	89.9
"	4	125	2	900	"	50/60	50.0	Petrol Wisconsin	25.0	98.5
"	8	300	2	655	"	50/60	75.6	Electric Siemens or SIM	20.0	94.5
"	8	300	2	800	"	50/60	90.0	Electric EMI or US	25.0	95.0

Table 4

Production Programme of Company No. 5

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Screw	-	125	Multiple	3,450	oil	50/60	26.0	Electric, IEM or SIM	7.5	70.0
"	-	125	"	3,450	oil	50/60	36.1	Electric, IEM or SIM	10.0	70.0
"	-	125	"	3,450	oil	50/60	55.5	Electric, IEM or SIM	15.0	70.0
"	-	125	"	1,750	oil	50/60	77.4	Electric* + petrol	20.0	70.0
"	-	125	"	1,750	oil	50/60	95.2	Electric IEM or SIM	25.0	70.0
Piston	1	125	1	600	water	50/60	150.0	Electric IEM or SIM	40.0	90.0
"	1	125	1	600	water	50/60	150.0	Electric IEM or SIM	40.0	90.0
"	1	110	1	560	water	50/60	185.0	Electric IEM or SIM	50.0	90.0
"	1	110	1	560	water	50/60	185.0	Electric IEM or SIM	50.0	90.0
"	1	100	1	600	water	50/60	300.0	Electric IEM or US	75.0	90.0
"	1	100	1	600	water	50/60	300.0	Electric IEM or US	75.0	90.0
"	2	125	2	600	water	50/60	300.0	Electric IEM or SIM	100.0	80.0
"	2	125	2	600	water	50/60	300.0	Electric IEM or SIM	100.0	80.0
"	2	125	2	750	water	50/60	729.0	Electric IEM or SIM	150.0	80.0
"	2	125	2	750	water	50/60	729.0	Electric IEM or SIM	150.0	80.0
"	2	125	2	731	water	50/60	831.5	Electric IEM or SIM	150.0	80.0
"	2	125	2	750	water	50/60	1,072.7	Electric IEM or SIM	200.0	80.0
"	2	125	2	750	water	50/60	1,072.7	Electric IEM or SIM	200.0	80.0

* Various makes

Table 5

Production Programme of Company No. 6

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	C.F.M. (100 PSIG)	Motor	HP	National integration %
Piston	2	200	2	950	air	50/60	27.9	Electric IEM or ASEA	10.0	75.0
"	2	100	1	600	"	50/60	36.4	Electric IEM or ASEA	7.5	78.2
"	2	100	1	750	"	50/60	36.4	Electric IEM or ASEA	10.0	78.2
"	2	100	1	950	"	50/60	46.0	Petrol Köhler	14.0	59.4
"	2	200	2	1,460	"	50/60	90.0	Electric IEM or US	30.0	75.0
"	2	100	2	1,460	"	50/60	105.0	Electric IEM or US	30.0	77.4
"	2	200	2	1,460	"	50/60	124.0	Electric US	40.0	75.0
"	1	100	2	450	water	50/60	137.0	Electric US	40.0	85.0
"	4	125	2	1,460	air	50/60	212.0	Electric IEM or US	50.0	77.2
"		125	2	-	-	-	-	-	-	-
"	4	125	2	1,750	air	-	250.0	Diesel Perkins	77.0	83.3
"	2	50	1	1,450	"	50/60	254.0	Electric IEM or US	50.0	75.0
"	4	125	2	1,460	"	50/60	262.0	Electric IEM or US	75.0	78.7
"		200	2	-	-	-	-	-	-	-
"	4	50	1	1,460	air	50/60	515.0	Electric IEM or US	100.0	75.0
"	2	125	2	970	"	50/60	565.0	Electric IEM or US	113.0	86.4
"	2	125	2	970	water	50/60	575.0	Electric IEM or US	111.0	85.0

Table 6

Production Programme of Company No. 7

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Recipro-cating	2	125	2	960	air	50/60	68.3	Electric, US	20.0	-
"	2	125	2	960	air	50/60	68.3	Electric, US	20.0	-
"	2	125	2	960	water	50/60	68.9	Electric, US	20.0	-
"	2	125	2	960	water	50/60	68.9	Electric, US	20.0	-
"	2	125	2	1,155	air	50/60	81.2	Electric, US	25.0	-
"	2	125	2	1,155	air	50/60	81.2	Electric, US	25.0	-
"	2	125	2	1,155	water	50/60	81.8	Electric, US	25.0	-
"	2	125	2	1,155	water	50/60	81.9	Electric, Siemens	25.0	-
"	2	125	2	960	air	50/60	95.1	Electric, US	25.0	-
"	2	125	2	960	air	50/60	95.1	Electric, US	25.0	-
"	2	125	2	1,450	air	50/60	101.3	Electric, US	30.0	-
"	2	125	2	1,450	air	50/60	101.8	Electric, US	30.0	-
"	2	125	2	1,450	air	50.60	102.4	Electric, US	30.0	-
"	2	125	2	1,450	air	50/60	102.4	Electric, US	30.0	95.0
"	2	125	2	1,155	air	50/60	111.5	Electric, US	30.0	95.0
"	2	125	2	1,155	air	50/60	111.5	Electric, US	30.0	95.0
"	2	125	2	1,155	water	50/60	113.6	Electric, US	30.0	95.0
"	2	125	2	1,155	water	50/60	113.6	Electric, US	30.0	95.0
"	2	125	2	960	air	50/60	127.1	Electric, IEM or US	40.0	95.0
"	3	125	2	960	air	50/60	127.1	Electric, US	40.0	95.0
"	2	125	2	960	water	50/60	131.1	Electric, US	40.0	95.0
"	2	125	2	960	water	50/60	131.1	Electric, US	40.0	95.0
"	2	125	2	1,450	air	50/60	136.3	Electric, US	40.0	95.0
"	2	125	2	1,450	air	50/60	136.3	Electric, US	40.0	95.0
"	2	125	2	1,450	water	50/60	140.7	Electric, US	40.0	95.0
"	2	125	2	1,450	water	50/60	140.7	Electric, US	40.0	95.0

Table 6 (continued)

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Recipro-cating	3	125	2	1,155	air	50/60	153.2	Electric, US	40.0	95.0
"	3	125	2	1,155	air	50/60	153.2	Electric, US	40.0	95.0
"	3	125	2	1,155	water	50/60	159.6	Electric, US	40.0	95.0
"	3	125	2	1,155	water	50/60	159.6	Electric, US	40.0	95.0
"	3	125	2	960	air	50/60	180.4	Electric, US	50.0	95.0
"	3	125	2	960	air	50/60	180.4	Electric, US	50.0	95.0
"	3	125	2	960	water	50/60	183.9	Electric, US	50.0	95.0
"	3	125	2	1,450	air	50/60	192.5	Electric, US	60.0	95.0
"	3	125	2	1,450	air	50/60	192.5	Electric, US	60.0	95.0
"	3	125	2	960	water	50/60	183.9	Electric, US	50.0	95.0
"	3	125	2	1,450	water	50/60	201.9	Electric, US	60.0	95.0
"	3	125	2	1,450	water	50/60	201.9	Electric, US	60.0	95.0
"	3	125	2	1,155	air	50/60	216.8	Electric, US	60.0	95.0
"	3	125	2	1,155	air	50/60	216.8	Electric, US	60.0	95.0
"	3	125	2	1,155	water	50/60	219.0	Electric, US	60.0	95.0
"	3	125	2	1,155	water	50/60	219.0	Electric, US	60.0	95.0
"	3	125	2	1,450	air	50/60	271.2	Electric, US	75.0	95.0
"	3	125	2	1,450	air	50/60	271.9	Electric, US	75.0	95.0
"	3	125	2	1,450	water	50/60	276.0	Electric, US	75.0	95.0
"	3	125	2	1,450	water	50/60	276.0	Electric, US	75.0	95.0

Table 7

Production Programme of Company No. 8

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration
Rotary	1	100	1	1,450	air	50	115.0	Electric, US	30.0	[illegible]
Rotary	1	100	1	1,450	air	50	115.0	Electric, US	30.0	[illegible]
Non-lubricated	2	35	1	1,000	water	50/60	1,210.0	Electric, US	150.0	67.0
Lubricated	2	35	1	1,000	water	50/60	1,200.0	Electric, US	150.0	67.1
Non-lubricated	1	135	1	360	water	50/60	132.1	Electric, US	30.0	-
Lubricated	1	135	1	360	water	50/60	139.0	Electric, US	30.0	-
Rotary	1	100	1	1,750	air	60	140.0	Electric, US	30.0	[illegible]
Rotary	1	100	1	1,750	air	60	140.0	Electric, US	30.0	[illegible]
Non-lubricated	2	27.5	1	1,000	water	50/60	1,600.0	Electric, US	150.0	[illegible]
Rotary	1	100	1	2,200	air	-	160.0	Diesel, Perkins	73.0	[illegible]
Lubricated	2	72.5	1	1,000	water	50/60	1,600.0	Electric*	175.0	[illegible]
Non-lubricated	1	110	1	360	water	50/60	163.0	Electric*	40.0	-
Lubricated	1	110	1	360	water	50/60	171.0	Electric*	40.0	-
Rotary	1	100	1	1,450	air	50	200.0	Electric, US	50.0	[illegible]
Rotary	1	100	1	1,450	air	50	200.0	Electric, US	50.0	[illegible]
Non-lubricated	1	125	1	327	water	50/60	231.4	Electric*	50.0	-
Rotary	1	100	1	1,750	air	60	240.0	Electric, US	50.0	[illegible]
Rotary	1	100	1	1,750	air	60	240.0	Electric, US	50.0	[illegible]
Lubricated	1	125	1	327	water	50/60	243.0	Electric*	50.0	-
Mobile	1	100	1	1,800	air	-	250.0	Diesel Perkins	80.5	[illegible]
Mobile rotary	1	100	1	1,800	air	-	365.0	Diesel, C.A.	123.0	52.4
Rotary	1	100	1	1,450	air	50	500.0	Electric, IEC	150.0	[illegible]
Non-lubricated	2	130	1	1,000	water	50/60	533.0	Electric*	125.0	68.4
Lubricated	2	140	2	1,000	water	50/60	570.0	Electric*	125.0	68.4
Mobile Rotary	1	100	1	1,800	air	-	600.0	Diesel Cummins	190.0	[illegible]
Rotary	1	100	1	1,750	air	60	600.0	Electric IEC	150.0	[illegible]

* Various makes

Table 7 (continued)

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Non-lubricated	2	125	2	1,000	water	50/60	640.0	Electric*	125.0	67.1
Lubricated	2	125	2	1,000	water	50/60	684.0	Electric*	125.0	67.1
Non-lubricated	2	125	2	1,000	water	50/60	805.0	Electric*	175.0	66.2
Lubricated	2	125	2	1,000	water	50/60	835.0	Electric*	175.0	66.2
Non-lubricated	2	50	1	1,000	water	50/60	889.0	Electric*	150.0	68.4
Lubricated	2	50	1	1,000	water	50/60	965.0	Electric*	150.0	68.4

* Various makes

Table 8

Production Programme of Company No. 11

Type	Nos.	Max. working pressure PSIG	Stages	rpm	Cooling system	Frequency Hz	CFM (100 PSIG)	Motor	HP	National integration %
Stationary	2 - 4	variable	variable	600	water	50/60	variable	Gas or Electric Cooper	1,125	75.0
"	2 - 6	"	"	600	water	50/60	"	Gas or Electric Cooper	1,125	75.0
"	2 - 8	"	"	514	water	50/60	"	Gas or Electric Cooper	2,125	75.0
"	2 - 10	"	"	360	water	50/60	"	Gas or Electric Cooper	4,500	75.0
"	2 - 10	"	"	360	water	50/60	"	Gas or Electric Cooper	6,500	75.0
"	2 - 12	"	"	360	water	50/60	"	Gas or Electric Cooper	14,500	75.0
"	4 - 8	"	"	450	water	50/60	"	Gas or Electric Cooper	1,000	75.0
"	4 - 12	"	"	300	water	50/60	"	Gas or Electric Cooper	1,550	75.0
"	4 - 12	"	"	330	water	50/60	"	Gas or Electric Cooper	24,000	75.0
"	4 - 12	"	"	360	water	50/60	"	Gas or Electric Cooper	2,400	75.0

SCHEDULE IV

Questionnair for Plant Visits

Date of visit .....

Person contacted .....

1. General:

a. Name of plant (or plants) and location .....

b. Year of commencement of production .....

c. Total value of capital assets: (present book value in thousands of pesos .....

(i) Machinery and equipment .....

(ii) Buildings, etc. .....

d. Total number of employees .....

(i) Managerial ..... (i) employees .....

(ii) Skilled and semi-skilled .... (ii) Workers .....

(iii) Unskilled .....

e. Total equity paid up capital at present:

(i) Foreign .....

(ii) Mexican, private ..... Governmental .....

f. Total loan liability.

(i) Long-term loans, if any, or debentures .....

(ii) Short-term working capital loans (less than one year) .....

g. Does the unit have a foreign technology agreement? If so, which are the periods of such agreements, principal features and payments made in 1970 - 1971 to licensor? .....

h. What is the profitability of the plant? .....

Indicate average dividends over the last five years and immediate future prospects .....

2. Manufacturing operations

(a) Principal items being manufactured at present, indicating number of units/tonnage manufactured and approximate value of production and sales during 1970 - 1971 and 1971 - 1972.

(b) Approximate extent of share of market in Mexico for principal products.

(c) Which are the main competitors?

(d) What is the import content for present volume of production in terms of intermediate products and components (in percentage and in cost of final product)?

(e) Utilisation of machinery and equipment:

(i) In number of shifts
(ii) Against total installed capacity

(f) If plant is not being fully utilised, indicate main reasons for such under-utilisation.

What are the remedial measures necessary?

(i) At plant level and
(ii) At governmental policy level

(g) Does the undertaking have any programme for expansion in the next three years?

If so, indicate extent of total capital expansion proposed and the:

(i) Increased production of existing products envisaged
(ii) New products proposed to be taken up, and
(iii) Anticipated import substitution of expansion programme
(iv) Anticipated exports (in value)

(h) What would be the broad financing pattern for proposed expansion?

Is any additional foreign investment or technology agreement envisaged?

(i) Which would be the requirements of capital goods imports (in value and in broad groups) for the expansion programme and for replacement?

3. Export possibilities and production efficiency

(a) What is the extent of exports that the company has been able to achieve to date? And to which countries?

(b) What are the main difficulties being experienced in developing exports?

(c) How do the manufacturing costs or prices of principal products compare with international pricing of such products?

If local costs are appreciably higher, indicate reasons why.

What are the remedial measures possible?

(d) What are the principal incentives from government agencies that the undertaking has received in the form of:

(i) Tax concessions
(ii) Export subsidies if any, and
(iii) Waiver of import or other duties
(iv) Financial assistance
(v) Other incentives

(e) What further measures of assistance and incentives are considered necessary for the undertaking for optimum growth and efficiency?

(f) Does protection through,

(i) Import control
(ii) Through tariffs extend to the main products manufactured? If so, give details, if not, indicate the extent of imports taking place.

4. Marketing

(a) Which are the channels of distribution of the company's produots?

(b) Does the company maintain after-sales service directly?

(c) Which are the normal terms of payment for company's products? Is credit usually granted by the company?

SCHEDULE V

Capital Goods Items Identified as Having Adequate Growth Potential for Manufacture in Mexico

This list includes capital goods which could be fabricated under the following conditions:

I. Through new facilities

II. Through planned expansion of existing industries

III. Through normal growth of existing enterprises

The symbols I, II and III are noted against each item, as are appropriate.

	Symbol
A. Non-electrical Equipment (Common Use)	
1. Heavy diesel engines (1,000 - 6,000 hp) for generation, pumping and marine use.	I
2. Steam turbines for industrial use (up to 6,000 hp)	
3. Machine tools: I. chip removing.	
a. Turret lathes with bar capacity Ø 40, 50 and 33 mm.	
b. Single spindle bar and chucking automatics with bar capacity Ø 25, 40 and 63 mm.	
c. Universal cylindrical grinding machines with centre height 125 to 150 mm and centre widths of 600, 1,000 and 1,500 mm.	
d. Surface grinding machines with table size 315 to 400 mm. x 1,000 to 1,500 mm.	
e. Universal tool and cutter grinding machines with centre width 500 to 630 mm.	
f. Heavy duty knee-type milling machines, horisontal, universal and vertical, with table size 315 to 500 mm x 1,250 to 2,000 mm.	

Symbol

g. Heavy duty pillar type drilling machines with capacity Ø 30, 40, 50 and 65 mm.

h. Radial drilling machines with capacity 40, 50, 63 and 80 mm.

i. Shaping machines with ram stroke 450, 630 and 900 mm.

j. Hacksawing machines with cutting range Ø 400 mm.

k. Vertical band sawing machines with throat 500 mm.

l. Cold circular sawing machines with saw blade diameters of 400 and 630 mm.

4. Machine tools II Chipless forming.

a. Open gap hydraulic presses with capacity 80 to 250 mt, for straightening, bending, marking, calibrating, deep-drawing, etc.

b. Spark erosion machines with mounting table 190 x 290 mm up to 600 x 1,000 mm, including integrators with taper shank Morse 3

c. Ingot, billet and slab shears (universal iron workers) with shearing strength 150 to 1,250 mt.

d. Asymetric power driven sheet metal bending rolls with capacity 10 to 50 mm plate thickness and working range 1,500 to 6,000 mm.

5. Packaging, spraying and weighing equipment.

a. Packaging equipment II

b. Continuous weighing equipment with automatic indicator or printing mechanism II

c. Spraying equipment III

6. Heating and cooling equipment

a. Ovens and heat exchangers II

		Symbol
7.	Pumps, centrifuges and compressors	
	a. Heavy duty pumps for water supply, sewage, boiler feed, mining and petroleum industries and for general industrial use.	I
	b. Centrifuges mainly for sugar and chemical industries	I
	c. Heavy duty compressors for mining and petroleum industries and for general industrial use.	I
8.	Conveying and loading equipment	I
	a. Parts and components for bridge cranes.	
	b. Port handling equipment.	
	c. Tower cranes for construction industry.	
9.	Gray-iron foundry for medium castings (100 kg. to 3,000 kg.) and also for heavy castings (3 to 15 mt).	I
10.	Production of gears, speed reducers and precision forgings, with a range of maximum diameter of 630 mm. (solid blanks)	I
11.	Production of measuring tools of various types	I
12.	Manufacture of standard parts for utilization in tools, jigs, dies, fixtures, moulds, gauges, patterns, etc.	I
B.	Non-electrical equipment (specific use)	
1.	Mining and construction equipment	II
	a. Mobile drilling machinery	
	b. Industrial tractors (caterpillar type)	
2.	Equipment for cement production	I
3.	Equipment for pulp and paper production	I
	a. Paper making equipment including winders suitable for paper mills of 200 to 500 tons per day capacity	
4.	Food processing equipment	I
5.	Equipment for chemical and petro-chemical industries	II

		Symbol
6.	Textile machinery and equipment	I
	a. Spinning extruding	
	b. Continuous fibre making	
	c. Weaving, knitting or suitable alternatives	
	d. Auxiliary machines and spare parts	
C.	Electrical equipment	
1.	High pressure boilers for power stations	I
2.	High voltage power transformers (220 and 400 kv)	I
3.	High voltage power circuit breakers (110, 220 and 400 kv)	I
4.	Motors and generators for AC and DC up to 10,000 kv	I
5.	High voltage porcelain insulators for transmission lines, bushings, etc. up to 400 kv.	I
6.	Tele-communications equipment, micro-wave and VHF equipment only	I
7.	Electric furnaces (above 1? mt) - arc and other types of welding (and gas cutting) equipment	II

VOLUME IV

Policy Considerations

172. The domestic manufacture of capital goods products, identified as having adequate manufacturing potential in Mexico, must necessarily be viewed in the context of overall governmental policies and programmes. As described in Chapter II, such policies have had major impact on the industrial growth pattern and import substitution in the past. However, the impact of governmental policies on import substitution in the capital goods sector has been relatively limited and much less than in most other manufacturing sectors. This has to a large extent been due to the special nature of producer goods manufacture. Since the costs and quality of basic machinery and equipment have a major determinant effect on the costs and prices of final user products, recourse has to be taken to imports when such domestic manufacture is not adequately competitive. At the same time, rapid domestic integration being considered an important element in the import substitution process, the cost and quality of domestic component items and inputs have a major impact on production costs of the final machinery products, which often largely comprise of assembly or semi-assembly operations. These aspects have to be further viewed in Mexico in the context of fairly liberal facilities for imports of machinery at concessional duties including, in many cases, the transfer of used and second-hand plants and equipment. It is important that a more selective and co-ordinated industrial growth pattern should be evolved for the next stage of industrial expansion for which the country appears poised at present. Such industrial development should take the form of more sophisticated manufacture firstly in fields where Mexico has specific factor advantages and secondly, of products which are essential to cover critical, sectoral gaps in manufacture, such as machinery and industrial equipment. From the policy viewpoint, a more comprehensive approach would need to be adopted which would dovetail the various policy instruments into an integrated industrial policy designed to raise the level, both of sophistication and productive efficiency, of the Mexican manufacturing sector and to cover the major production gaps in key sectors of manufacture.

1. Implications of present policies

173. If existing policies and procedures are continued unchanged, the growth pattern of the capital goods sector will also largely continue as at present. While existing enterprises would gradually expand their activities and new enterprises may be set up in certain machinery sub-sectors, there would continue to be relatively slow growth in the level of sophistication of manufacture and most of the production gaps identified in the previous chapter would continue to persist. The demand for capital goods equipment and products would inevitably increase rapidly with the pace of overall industrial growth, as pointed out earlier, and the requirements would largely have to be covered by increased imports of machinery, components and processed materials. With the facilities for capital goods imports and low tariffs on such items, there would be little inducement for domestic manufacture, except in respect of certain products where cheaper labour costs or raw material availability would outweigh all other considerations. In most such cases, however, production would continue to be geared to domestic market requirements, as exports would be difficult to achieve because of high input costs and low production efficiency in many cases. In the case of the domestic market also, capital goods manufacturers would find it difficult to compete in many sub-sectors, as is taking place at present, because of higher input costs and low volume of production, leading to higher prices for complete equipment. In the case of components, spares, etc., while there would undoubtedly be increase in production and exports, such increase would tend, by and large to be marginal, as has been the pattern hitherto. Apart form factors militating against the achievement of competitive productive efficiency, investible resources, both domestic and foreign, would continue to be diverted towards consumer and intermediate products to a great extent, as at present. While it is difficult to assess the impact of the legislation on foreign investment and technology at this early stage, these may add to the problem of ensuring adequate resource channelisation for capital goods manufacture.

174. Since the present study is confined to the capital goods sector, the implication and repercussions of present economic and industrial policies on this sector will need to be assessed, together with suggestions as to policies and procedures which would ensure effective and co-ordinated growth of this sector. It is obviously not possible to formulate a set of policies designed exclusively for a particular sector, even if it has a very extensive and varied coverage, and any measures which are considered necessary for this basic manufacturing sector must be fitted within the country's broader socio-economic objectives and policies. At the same time, the manufacture of producer goods machinery has special and distinct problems of its own and these need to be recognised and dealt with. Firstly, strong and deliberate efforts would be required to ensure that adequate investible resources are diverted to this sector. This can present difficulties both in terms of domestic resources, which tend to gravitate towards investments yielding higher returns in the short term, and of foreign capital, as foreign manufacturers tend to consider developing countries as natural markets for their machinery exports. An active investment programme is necessary, both to attract suitable capital investment and technology and an important lead has to be given in this regard by governmental and institutional agencies. Secondly, capital goods production must be based on productive efficiency by competitive international standards. High cost producer goods manufacture would further accentuate existing high cost manufacture of various domestic products and could have a very detrimental effect. It is therefore necessary to exercise care and selectivity not only in the choice of machinery products and manufacturing processes and techniques but also to create conditions and provide necessary facilities to ensure competitive, productive efficiency. Thirdly, with a limited domestic market, even in this country's rapidly developing economy, capital goods manufacture must have some degree of export orientation in order to achieve adequate economies of scale. This again presupposes the need

for manufacturing efficiency of a high order. In the subsequent paragraphs, the policies and instruments in practice in Mexico have, therefore, been considered both in general terms in so far as capital goods manufacture is concerned and also in their impact and implications on the above pre-requisites for such manufacture.

2. Investment promotion

175. Because of resource and other constraints, there is need in developing countries for a clear-cut definition of sectoral priorities in industry and for the channeling of resources as far as possible in accordance with such priorities through the exercise of a positive directional role on the part of the Government. In Mexico's present stage of development, the capital goods sector provides a good field for the exercise of such a role, as leaving this sector to the operation of market forces within the framework of existing policies is not likely to lead to effective growth of this sector. Inter-sectoral priorities and resource allocations for capital goods and other production branches must necessarily follow a careful evaluation of trends and likely production and technological gaps in key growth sectors and the structuring of a co-ordinated industrial development programme.

176. The identification of priorities in terms of meeting essential production shortfalls or developing export potential industries must be accompanied by a positive and dynamic approach for channeling investment resources in priority sectors. For the capital goods sector in particular, an active and dynamic investment promotion approach is necessary. Significant production gaps in countries such as Mexico are often likely to occur in manufacturing sectors where heavy capital outlays are required and where returns, at first glance and over a short term, may tend to be less remunerative. In the machinery manufacturing sector, capital outlays required are usually higher and gestation periods normally longer than in most consumer-goods industries.

If left to market forces, there would be a tendency to continue to import large quantities of machinery which, with some efforts, could be manufactured in the country to meet both future domestic demand as also exports. Investment promotion in this sector necessitates the supply of adequate information and data regarding specific manufacturing possibilities in Mexico and an active campaign to interest those companies whose products are considered appropriate for production in this country. The preparation of investment profile sheets in respect of the identified capital goods products is an essential step in this process. This must, however, be followed up by contacting suitable foreign manufacturers in the identified fields and domestic entrepreneurs who may be interested, so that an appropriate pattern of investment of technology can emerge. An essential aspect of promotional activity would also be the preparation of pre-investment studies for many of the identified capital goods items and groups. Whereas this may not be necessary in many instances, some studies would be required, covering engineering, market survey and other aspects done independently through consultants, as a pre-requisite for promotion of investments. It is also necessary for institutional agencies to play a key role in the promotion, formulation and implementation of specific projects. In the case of the capital goods sector in particular, domestic institutional agencies should also be in a position to participate directly and to cover any major domestic investment requirements in particular projects, in close consultation and co-operation with Mexican private sector interests. At the same time, close co-ordination would be necessary with the governmental departments concerned, particularly with the Secretaría de Industria y Comercio, in order that the promotional activities undertaken are in accordance with overall policies and programmes.

177. In determining the scope of promotional activity, particularly in the capital goods sector, it is essential to ensure adequate utilisation of existing capacity, consistently with achievement of adequate productive efficiency. The survey of existing machine building capacity in Mexico dealt with in the last chapter has brought out a number of cases where production gaps in the capital goods sector can be effectively covered by expansion and supplementary manufacturing activities of existing enterprises. Wherever such expansion can be effectively undertaken and higher productive efficiency achieved, this would be preferable to the establishment of new enterprises in the same field, unless such new units are primarily export oriented. There is already over-capacity in relation to domestic demand in certain machinery branches, such as certain ranges of tractors and cranes and the limited domestic market has got parcelled out amongst a number of units, all operating at relatively low levels of capacity utilisation. While this needs to be avoided, it must also be stressed that the use of the regulatory mechanism to control the establishment of additional production capacity in the capital goods sector should not act as a brake against new projects which may be superior in terms of export commitments and technological content. A typical example is in respect of machine tool manufacture, where there is considerable scope for additional production and exports. While the most suitable proposal or proposals at a particular point of time could certainly be selected on the basis of an "invitation" by the Government to submit such proposals, this should not preclude other propositions which may be more attractive in terms of more advanced technology and better export prospects but which may be submitted later in point of time. The technological content and other aspects of new investment proposals needs of course to be examined with care, particularly in fields where there is already considerable production capacity. At the same time, programming of capital goods production must result in the setting up of production

enterprises which operate with the most appropriate level of technology and export orientation in various branches, so that both domestic and export markets can be served as adequately as possible and so that any deficiencies on this account in establishing domestic enterprises do not get perpetuated to the detriment of the economy.

3. Foreign investment and domestic financing

178. For the planned growth of the capital goods sector, the policy towards foreign capital investment is of great importance. Most capital goods enterprises involve large capital outlays and complex technology in the initial stages. They have to provide the domestic market with high quality equipment based on the latest innovations and techniques and this becomes all the more necessary in order to gradually develop export markets for such equipment. While there is need for the exercise of selectivity in respect of the extent and direction of foreign investment, it is equally necessary to adopt a liberal and flexible approach in respect of more sophisticated production branches, such as the capital goods sector. Investments in this sector are usually not only much larger in magnitude but far more difficult to obtain in developing countries. The order of magnitude of capital outlay needs on the stage I programme for the identified sectors comes to 6,300 million pesos. Resource mobilisation of this order will constitute a major problem. The complex nature of machinery manufacture also makes it desirable to obtain a certain degree of capital participation from foreign manufacturers having adequate manufacturing and technological knowledge and expertise in the field concerned. It would, therefore, be appropriate for foreign investment proposals relating to this sector of manufacture to be treated on a flexible and pragmatic basis, so that adequate investments can be attracted from experienced manufacturers. The normal pattern of foreign equity investment in capital goods enterprises should range from 30 per cent to 49 per cent depending on the

nature of the machine building project. This would provide adequate financial interest and incentive for the foreign party to build up the local unit with necessary technological support and would ensure the full transfer of manufacturing know-how and expertise. For the stage I programme in the identified sectors, the volume of foreign investment would, therefore, range from [illegible] to 1,100 million pesos, assuming a dept-equity ratio of 1.1. This investment requirement would be required largely during 1974 - 1[illegible]. In some cases of sophisticated machinery manufacture, exceptions may also need to be made in so far as foreign majority shareholding is concerned, as manufacturing experience may rest with relatively few foreign enterprises and it may not be possible to avail of such experience without granting majority foreign holdings. In such cases, this could be permitted for a stipulated period of time of ten to fifteen years, within which the foreign shareholding would be required to be reduced to 49 per cent or 40 per cent by sale of shares to Mexican parties and institutions, particularly at the stage of expansions of such units. This practice has been applied in the Philippines for pioneer industries and also used in some other developing countries and could be adopted with advantage for the capital goods sector in Mexico.

179. A related aspect would be the need to arrange domestic financing to the extent of 51 to 60 per cent of equity holdings or even more in certain cases. Assuming this to be 60 per cent, domestic financing requirements by way of equity investment alone would come to 1,770 million pesos on a 1.1 dept-equity ratio. Besides, loan capital and working capital needs would have to be provided. This mobilisation of domestic investible resources has already constituted a problem in Mexico in certain instances and would present considerable difficulty in cases where the gestation period is fairly long and the anticipated returns not adequately remunerative as compared to returns from other

sectors. At the same time, the nature of production envisaged may be essential to provide manufacturing infra-structure for the future growth of the economy. Some of the projects and fields identified in the previous chapter fall in this category. In such cases, institutional finance would need to be provided and it would be necessary for Nacional Financiera to provide a major lead in this regard. The financial participation of NAFINSA and other such agencies may have to be up to 40 per cent in some cases, at least for the initial period. In order that institutional funds do not get locked up in a few projects, there could also be a provision for disposal of part of the shareholding to domestic parties as soon as local investor interest can be adequately generated. The possibility of direct governmental participation in certain major capital goods projects should not also be excluded, particularly where governmental agencies are the sole or principal purchasers of the machinery and equipment manufactured. In view of the basic nature of capital goods production, it may also be desirable as a matter of policy for some shareholding to be retained by a governmental agency or institution such as Nacional Financiera. The fact that such an agency would be participating in the enterprise would also provide significant assurance to potential foreign investors that the project would receive necessary governmental support. In order to avoid an undue initial financial burden on NAFINSA and other such agencies, their capital participation in projects requiring large outlays could, in some cases, be suitably staggered in accordance with the phasing of capital requirements so that part of such participation could be provided from the earnings of the projects in question. This is, however, a complex exercise and would need to be suitably adjusted for particular projects.

4. Local partners

180. Apart from institutional participation, the locating of suitable Mexican partners in joint ventures in the identified capital goods fields is of considerable importance. The growth of competent Mexican entrepreneurship has been very rapid in the last two decades and suitable partners are likely to be forthcoming in private industry for most capital goods projects that can be undertaken. In certain sub-sectors, public sector undertakings can also effectively fulfill this role. However, since most capital goods manufacturing projects would take the shape of joint ventures with minority foreign ownership and institutional participation in most cases, and since export orientation would be an important aspect of such projects, it is necessary that the most appropriate local partners should be available for these enterprises. While initiative in this regard must largely rest on enterprises themselves, a significant lead and assistance could be given both by the Secretaría de Industria y Comercio and by Nacional Financiera in locating such domestic partners and entrepreneurs. The field studies conducted during this phase of the study give a fairly clear picture to Nacional Financiera of the available facilities and the working of a large number of domestic enterprises in this sector. The location of appropriate local partners in joint ventures is, however, a wider task and would require considerable co-ordination between the various organisations and the enterprises concerned.

5. Acquisition of foreign technology

181. The considerations which apply to foreign investments in the capital goods sector apply equally and even more so in respect of acquisition of foreign technology, patents and trademarks. Under the recent legislation, all technology-supply arrangements including patents and trademarks, would need to be registered if they are to be legally valid and such registration would be denied if the agreements contain provisions and restrictions which are considered as being against the country's interest.

[illegible]. In so far as technology inflow for the capital goods sector is concerned, it would still be necessary to adopt a fairly liberal and flexible approach. The market for commercial acquisition of technology is very "imperfect" in this sector and the number of foreign parties from whom appropriate technology in various machine building branches can be commercially secured is fairly limited. It would be desirable, as pointed out above, to have a substantial element of minority capital participation in such cases. Even where this is forthcoming from suitable foreign groups, payments for technology would still continue to be necessary. While the magnitude of technology payments could be adjusted to some extent with the level of foreign capital participation, a flexible approach would be essential. Certain specific recommendations which need to be taken into account in the consideration of technology agreements in the capital goods sector are the following.

(i) Cases involving technology licensing to Mexican companies with little or no foreign capital participation may possibly require, in addition to lump sum payments in some cases, royalty payments higher than the 3 per cent provided for under the Law for new and necessary industries and the 20 July Decree for availing of tax concessions and incentives. Such a percentage may not be adequate for the acquisition of appropriate technology in the case of certain sophisticated machinery products and to deny tax concessions and incentives on this account would not be in the interest of development of this sector. While it is necessary to restrict royalties to the minimum, consistently with the availability of appropriate technology, a flat maximum rate of 3 per cent may not be conducive to obtain suitable technology for more sophisticated machinery manufacture. As other developing countries, as also highly

industrialised economies, royalty for technology in this sector ranges up to 5 per cent of net sales and even more in some cases. On the other hand, it is necessary that, in computing royalty the value of components imported from the licensor should be deducted from the net sales figure constituting the base for the royalty calculation. Such a formula has been applied in some countries quite effectively.

(ii) The duration of technology agreements would also need to be longer in the case of capital goods projects, than in other sectors because of the complex manufacturing techniques involved and in order that the Mexican unit can adequately absorb such technology for future modifications and adaptation. While a duration of five to six years may be considered adequate for absorption of know-how in many other manufacturing branches, technology agreements for manufacture of sophisticated machinery products may require a duration of seven to ten years, depending on the period considered necessary for such absorption in particular cases.

(iii) It is important that restrictive provisions regarding export sales rights in various countries are avoided as far as possible, and this aspect has been specifically covered in the recent legislation. At the same time, it may be difficult to obtain licensing agreements in the capital goods sector which would not restrict sales to countries where the licensor has set up similar manufacturing facilities or where he has given exclusive rights for manufacture and sales to some other parties. Efforts should, on the other hand, be made for allocating particular export markets for the Mexican unit as part of licensing agreements.

(iv) It may be necessary, in many cases, to obtain components and intermediate products such as specialised castings and forgings from the licensor until such items are domestically manufactured. This may also be necessary where the machinery manufactured is part of an integrated plant, the designs and supply of which rests with a foreign party. Where such provisions become necessary, the technology agreement should provide that components and intermediate products would be supplied at competitive international prices and if the local licensee is not satisfied on this account, he should have the option of obtaining supplies from other foreign sources. Where components are of exclusive designs and manufactured solely by the licensor, a suitable pattern for price determination of such items should be provided, linking as far as possible with international prices for the final product.

(v) While patents, particularly for process technology may have greater relevance in certain other production sectors, it is nevertheless essential that technology agreements accord full rights to all patents as may be involved and should also reasonably protect the licensee from infringement of third party patent rights through use of the technology secured.

(vi) The question of trade marks is of particular significance in the capital goods sector. Certain trade marks or trade names in machinery manufacture command high reputation both in the Mexican and in potential export markets. It is, therefore, important that the use of the machinery trade mark or trade name is secured specially for the purpose of exports, as part of any technology supply or

licensing agreement. At the same time, the Mexican unit should gradually be able to develop its own manufacturing reputation, so that after expiry of the agreement period, it can sell on its own and without the use of the foreign trade-mark or brand name. For this purpose, a local trade mark could be adopted, with the stipulation that the product is manufactured under licence from the particular foreign licensor, or a joint trade mark may be adopted which includes the foreign brand name and a local name, so that the latter name can be wholly utilised when the agreement period is over.

193. Apart from the criteria to be used in negotiating the details of technology arrangements, the selection of appropriate technology would be a very important factor in the capital goods sector. It is important that the technology secured for various machine building industries is the most suitable in the Mexican context. This should be selected not only in terms of domestic consumer preferences for particular types of equipment and processes but in relation to export possibilities. At the same time, the angle of labour-oriented techniques should also be borne in mind. Obviously, imported technology need not and should not comprise of the most labour saving techniques, except where this is directly linked to much higher productivity. This requires careful search and evaluation on the part of the Mexican parties, including Nacional Financiera, for appropriate machine building technology. There is also considerable scope for assistance in this field by a well-manned technological service unit, which needs to be urgently set up in Mexico to assist prospective Mexican licensees as to availability of alternative technologies in various fields. It is understood that a scheme for setting up a Technological Information Centre is being contemplated. This is considered to be an essential pre-requisite for appropriate acquisition

of foreign technology. While some Mexican enterprises are well equipped to select [illegible] technology supply arrangements, a Technological Information Centre could perform very valuable advisory services for a number of medium-sized Mexican enterprises which may need advanced technological support in future. The Mexican Council for Science and Technology [illegible] could play a useful and dynamic role in assisting domestic entrepreneurs in this field. While this would essentially be a continuing exercise, it is important that, in the present state of knowledge for capital goods development in Mexico, adequate efforts are made to explore alternative possibilities for securing technology, so that the most appropriate technique as can be obtained are, in fact, acquired.

C. Indigenous Research and Development and Technological Services

194. An essential aspect of technological growth is the need for development of indigenous research and development and technological service facilities in Mexico. As has been brought out in earlier chapters, the Mexican capital goods sector continues to be heavily dependant on foreign designs and know-how and there has been little effort towards development of indigenous research and development and local designs and technological service facilities. This would be of great significance in the future growth of this sector. Even in respect of comparatively simple techniques and processes such as moulds, castings, etc., in this sector, apart from a wide range of consumer and intermediate products, considerable and increasing payments are being made annually for technology. While there is need for much greater selectivity in this regard in so far as non-essential technology is concerned, there is also undoubted need for increased development of domestic technology in most industrial sectors. The fact that some excellent examples can be cited in this regard, such as sponge iron manufacture, is an added reason for placing greater stress on indigenous technological development over a much wider range of productive activity.

The role of the proposed Technological Centre, as also that of CONACYT, could also be of considerable significance in pin-pointing the areas and nature of domestic research and development and technical service facilities which need to be concentrated upon. Indigenous research and adaptation can be developed through various means, such as (i) directly through research and development efforts by the licensee enterprises, (ii) through a group of enterprises in a particular sector conducting joint research and development, (iii) through Government sponsored research and development programmes in various institutions or (iv) through domestic consultancy organisations, particularly in respect of detailed engineering services. All the above mechanisms can and need to be used and suitably co-ordinated in the machine building sector because of its very wide coverage. It is also necessary to ensure that adequate testing and research facilities are set up to deal with future problems related to improvement of designs and equipment efficiency, to suit market requirements.

185. For the capital goods sector in particular, the development of technological service facilities for planning, designing and engineering of complete plants, would be of great importance. A significant technological gap which needs to be covered in order is for development of designing and other facilities for integrated plants in fields such as paper and pulp, cement and various metal transformation industries. While fabrication and workshop facilities have already developed considerably and will only need to be expanded to cover new sectors and products, the gap in overall plant designs and engineering facilities continues to exist and will need to be given much greater emphasis. It is, therefore, recommended that in technology agreements for machine building industries, special efforts should be made to obtain design documentation and training of Mexican personnel in plant engineering and designs. It is also recommended that greater emphasis should be laid on acquisition of know-how for design engineering and equipment manufacture for integrated plants

in various fields such as paper, cement and petro-chemicals and various [illegible] other industries [illegible] to [illegible] manufacturing techniques for specific equipment which [illegible] manufactures. [illegible] know-how [illegible] available within the country and provided [illegible] carefully selected, the responsibility for [illegible] should be increasingly [illegible] foreign techno-logical services [illegible] permitted [illegible] extent that such services [illegible] will call for [illegible] imported technological services. [illegible] services is [illegible] covered [illegible] largely [illegible] develop [illegible] close collaboration [illegible] in Mexico. [illegible] foreign [illegible] technical [illegible] parties, [illegible] services [illegible] likely [illegible] would [illegible] importance in [illegible] services have developed [illegible] industries [illegible] manufacture, these [illegible] In certain fields, where [illegible] this stage, it would [illegible] therefore [illegible] establish one or more [illegible] organisations in certain [illegible] production [illegible] for the designing, engineering [illegible] establishment [illegible] complete plants, including in the capital goods [illegible].

198. While some of the essential policy aspects of investment promotion, resource mobilisation and technology inflow for the growth of the capital goods sector have been briefly discussed above, it is necessary to consider the impact of [illegible] some of the major policy

instruments being utilized at present and to highlight [illegible] in aspects of such policies, which [illegible] particularly in so far [illegible] concerned. [illegible] the regulator[y] side, the most significant [illegible] instruments [illegible] of protection and import control [illegible] integration. On the promotional side, there [illegible] fiscal facilities and incentives, [illegible] recent years. [C]ertain [illegible] and governmental purchases [illegible] consideration.

[illegible]. Protection and import control

[illegible]. The [illegible] extensive network of import control [illegible] in Chapter II. [illegible] and [illegible] import substitution [illegible], the continuing effect [illegible] manufactured and intermediate products [illegible] increasing [illegible] of consumer [illegible] machine products. [illegible] domestic prices in many import substitution [illegible] for machinery manufacture [illegible] policy measure [illegible] that domestic prices of manufactured [illegible] competitive levels and [illegible] protective tariffs would substitute the [illegible] speed and pattern. This would [illegible] difficult to achieve.

Industries used to the shelter of controls will find it difficult to face the [illegible] tariff protection. Yet this process must be [illegible]ively introduced and limited import of items [illegible] are important for the economy but where domestic prices are [illegible] take place. On the procedural [illegible] necessary, [illegible] committees, both in terms of the number of [illegible] committee [illegible] manufacturing interests [illegible] considered would [illegible] to have [illegible] committees, [illegible] governmental representatives and [illegible] representation of private industry, rather than of [illegible] from particular sectors.

1[illegible]. [illegible] tariffs, the import control mechanism has also tended [illegible] the capital goods sector. [illegible] imports of components and parts are usually covered by [illegible] controls, the domestic capital goods producer has often to pay [illegible] higher price than [illegible] per cent differential. In some sectors, [illegible], the Government has been able to ensure [illegible] differential is observed, though this often tends to operate [illegible] minimum differential, but in a large number of cases domestic prices are much higher and considerably add to the costs of the final machinery. On the other hand, a generally liberal approach has been [illegible] in the matter of machinery imports. This is partly because a substantial proportion of such imports is for public sector agencies such as [illegible], [illegible] and governmental departments. Machinery imports by the public sector have increased considerably in recent years. While public sector imports are carefully scrutinized both by the agency concerned and by the Secretaria de Patrimonio, as also by separate import committees, the main emphasis of such scrutiny is in that the price paid is the most reasonable. While the import substitution aspect is not ignored, it is given comparatively less

emphasis than it deserves. Many capital goods items which can be domestically produced [illegible] imported on grounds of special specifications, [illegible] period. The latter argument [illegible] sector agencies. Unless greater efforts [illegible] advance planning of machinery requirements, the volume of such imports cannot be substantially reduced. Even with the limitations [illegible] agencies have in respect of [illegible] approval, it should certainly [illegible] planning of machinery needs and [illegible] allocations. The same holds even more [illegible] private sector where such planning can be far more effective. Import committees [illegible] public and private sectors [illegible]. In the case of private sector [illegible] preference for imported equipment [illegible] import permits for machinery are [illegible] for other imported items.

[illegible]. While protectionist policies and controls [illegible] considerable import substitution in most sectors, the impact on domestic manufacture of capital goods has thus tended to be somewhat different. With a limited domestic market, relatively liberal machinery import facilities and strong emphasis [illegible] it is but natural that capital goods manufacture developed only to a limited extent in certain machinery sectors and up to certain ranges. There can be little doubt that if such manufacture is to be effectively developed in Mexico, the domestic market must be reserved for such production, at least for a reasonable period of time. The imposition of import controls for this sector, however, raises the question of costs and quality of domestically produced equipment. If these are not adequately competitive, the imposition of strict import controls on capital goods machinery could lead to even higher manufacturing costs for resultant products. What is

necessary is that a system of controls for this sector must be conditional to such machinery manufacture being undertaken on reasonably competitive terms in Mexico, so that over a period of time, such manufacture is able to compete effectively on its own. This necessitates consideration of the extent of effective protection which this sector requires, consistently with its efficient growth on competitive lines.

190. In so far as value-added is concerned, the level of protection should be constant so that there is no discrimination among the various manufacturing branches. As for inputs, however, both domestic and foreign, these would require to be suitably adjusted in terms of value, so that capital goods products are able to be manufactured on a competitive basis, subject only to an overall price differential. A reasonable level of such differential would be 15 to 25 per cent. Such a percentage must constitute an adequate cushion for domestic capital goods manufacture, as this limit may materially affect the costs of resultant products. This would also enable effective development of exports, as a differential up to this level could also be adequately compensated through export and other incentives.

191. In order to maintain production costs of capital goods items to a maximum differential of about 25 per cent vis-à-vis international costs, it is necessary that a very flexible pattern be adopted in respect of imports of inputs and components. The emphasis on a minimum domestic content or a high level of domestic integration may tend to become misplaced if this results in final machinery production being forced to utilise domestic raw materials and components at very high prices. A policy departure needs to be made in the case of all input items whose local prices exceed the price of comparable imported items by 25 per cent and more. In all such cases, imports of inputs should be permitted to the extent required by the capital goods producer in the form of "Actual User" permits, which should be issued for six-monthly periods to capital goods manufacturers and be related to actual utilisation of

imported materials and inputs during the previous six-monthly period. If domestic input costs are lowered for any item so as to fall within the 25 per cent limit, this can also be taken into consideration in the next six monthly period. The above approach will ensure that production costs of capital goods items are kept within reasonable limits and that genuine efforts are made by producers of inputs and intermediate products to lower their costs and prices. Since such "Actual User" permits would be issued primarily in respect of new capital goods production, it would not affect the existing manufacturers of intermediate products adversely. At the same time, such a pattern could also be selectively introduced in the case of existing capital goods production, provided the cost of the final machinery product does not exceed the 25 per cent differential.

192. The above system would still necessitate import controls in respect of capital goods machinery and equipment for reasonable periods. Till such time as such controls are dismantled in general and replaced by a system of protective tariffs, it would be desirable to retain import controls for capital goods items for varying periods, depending on the nature and sophistication of the machinery. Import controls should, therefore, remain operative for this sector also, with the proviso that machinery imports would be permitted if domestic prices of equipment exceed imported costs by more than 20 to 25 per cent and provided further that domestic capital goods producers would be permitted regular imports of all inputs, whose domestic price exceeds import prices by 25 per cent or more.

193. The scrutiny of capital goods import proposals poses a problem in itself. With wide differences in specifications and performance, it is often difficult for manufacturers of such items to have "the order closed" for such products. It is, therefore, necessary for the domestic mechanism, particularly for the public sector and for import committees to play a more pivotal role in ensuring that such

machinery and equipment as can be domestically produced within the above price differential and of requisite quality should not be imported.

194. The recommendations as to protection policies for the capital goods sector need to take three basic considerations into account. Firstly, with employment generation as a principal policy objective, the level of protection should not constitute an undue stimulus for more capital intensive growth to the detriment of greater labour utilization. Protection policies should in fact lead to more labour-intensive industries and increased labour utilization, both direct and indirect. Secondly, with greatly increased emphasis on achieving international competitiveness in manufacture, the need for ensuring greater production efficiency has a higher priority than that of bringing about a somewhat higher level of domestic integration, particularly when insistence on the latter results in adverse effects on exports. Thirdly, it is necessary to achieve improved sectoral balance and arrangement, an aspect which bears a close relationship to the first two issues.

194.1 In the light of the above considerations, the following recommendations are made regarding protectionist policies vis-a-vis the capital goods sector. (i) The nominal level of protection should not exceed 20 to 25 per cent over the CIF price of comparable imported equipment. In assessing the import value, full account should be taken of subsidy elements, if any, favouring the price of imported items. This recommendation is consistent with the average protection level of 25 per cent which Mexican industry is expected to reach in the next few years and also with the effective nominal protection tariff of 20 per cent for capital goods. Tariffs on intermediate products, components and sub-assemblies should not be higher than for the equipment as a whole. At present, the duty on some components such as castings, valves, industrial fans and other accessories is higher (above 20 per cent) than for overall machinery. In order to make domestic machinery more competitive, the import duty on sophisticated

components and parts may well be less than for the complete machinery, but should not be higher for any item. In the case of spares, however, a higher duty may be justified to encourage domestic production of spares. (ii) An important consequential recommendation would be the discontinuance of the facilities under Regulation 14, at least in so far as finished machinery and equipment is concerned. This facility results in the reduction of the level of protection to only 7 per cent for most capital goods items. Besides constituting a strong indirect dis-incentive for purchase of domestically manufactured machinery, it adds to the hesitation and doubts of prospective domestic entrepreneurs in entering this manufacturing sector. The loss of governmental revenue on this account is considerable and such resources could be better utilised in promotion of production and exports rather than in stimulation of more capital intensive growth. The discontinuance of the subsidy under Regulation 14 is not expected to affect new investments and would undoubtedly stimulate domestic capital goods manufacture. (iv) Import controls for capital goods manufacture will need to be retained as part of the overall import control structure, at least during early growth stages of capital goods manufacture when problems of "teething" and even of quality, together with preference for foreign equipment on the part of domestic purchasers would present difficulties, necessitating a regulatory approach. Such import controls should not be indefinite, as this militates against productive efficiency over a period of time. A period of five to seven years should be quite adequate for the stabilisation of machinery production in the various capital goods sub-sectors. Import control in this sector must, however, be on condition that the CIF price differential against the domestic price of particular equipment does not exceed 20 to 25 per cent. While such price differential may be difficult to determine in certain cases, the adoption of this principle would ensure that the level of protection would in fact be controlled by the Government, within reasonable levels.

(v) The imposition of such a maximum differential would, however, necessitate that when prices of national inputs exceed 25 per cent, domestic producers would be allowed to import such inputs, such imports being allowed for six-monthly periods on the basis of Actual User permits.

195. Certain other aspects of capital goods also need to be taken into account here, though these are not strictly related to protection policies. Firstly, where machinery imports are requested on grounds of earlier delivery, account should be taken whether advance planning was possible and was attempted. While obviously urgent requirements would have to be imported, it is important that domestic purchasers must undertake advance planning as far as possible, so as to give local capital goods manufacturers a fair opportunity. Secondly, since equipment imports by public sector agencies constitute a large percentage of such imports, the same considerations must also apply to public sector purchases. A special unit should be set up in the Secretaría de Patrimonio or in IMCE to examine, in the case of machinery import proposals, whether adequate advance planning was attempted in terms of domestic manufacture, and also to initiate steps with local manufacturers for taking up production of such machinery items as represent a continuing or growing demand. Thirdly, wherever possible, preference should be given in placement of orders to domestic manufacturers even when most of the equipment is not produced domestically. This should also be subject to the overall price differential being limited to 25 per cent over import prices.

9. Import of used equipment

196. An aspect of machinery imports which needs special consideration in the Mexican context is that of used or second hand equipment. As pointed out earlier, this has been a significant feature of existing capital goods production in the country. Much greater care needs to be applied in this regard in future.

The advantages of such imports are of course lower costs and lower initial investments which is of particular significance in rapidly developing countries such as Mexico, where capital is fairly expensive. On the other hand, this often leads to imports of obsolete machinery which cannot be effectively utilised with technological innovations. The effective production capacity of such used plants is also much lower, as also their life. Resultant products are often more costly and non-competitive internationally. The value of such equipment is also very difficult to assess, in terms of either price or investment value. In the long run and particularly at a fairly advanced stage of development such as in Mexico at present, the disadvantages are far greater in most cases. It is recommended that transfer of second hand equipment in terms of complete plants should normally be permitted only when this is accompanied by very high export commitments or where specific items are sought to be exclusively produced in Mexico for the world market. The manufacture in Mexico of certain tele-printer equipment primarily for exports and of a particular brand of motor vehicle for the world market are examples where the transfer of a second hand plant is obviously of advantage. In most other cases, such transfer should not be encouraged as it often militates against growth of productive efficiency to internationally competitive levels. In respect of specific second hand machines also, the same considerations apply, though to a lesser extent. It is possible to obtain at relatively low cost, certain second hand machines in the heavier ranges which still have considerable life. Great care, however, needs to be exercised in the selection and purchase of such machinery.

9. Domestic integration

197. An important policy aspect which needs to be considered is the present emphasis on a high proportion of domestic content. The significant level, by and large is 60 per cent of local content in terms of direct costs, as this qualifies an enterprise to receive various tax benefits, as also export and other incentives. This

proportion is also the minimum level of domestic content for exports in the LAFTA region. The insistence on speedy maximisation of domestic integration is an important policy element in developing countries. The problem, however, arises in the determination and application of this percentage. A flat percentage of 60 per cent may well constitute an unduly low percentage in certain fields of manufacture, while in the case of sophisticated machinery products, such a percentage may reasonably take four to five years to achieve at competitive prices. At the same time, once a particular percentage is known to be applied, there is a tendency to adjust costs and programmes to fit in with such percentage. This can take the form of adjustment of costs of imported components of artificially increasing the cost of local components or obtaining part imports through component suppliers to whom again the 60 per cent limit is applicable. The system is thus open to a considerable degree of abuse. While emphasis on domestic integration is very necessary, it is recommended that in the capital goods sector, instead of the usual 60 per cent figure, the domestic content requirements in each case, after a suitable initial period, should be determined on the merits of each case, and should be subject to the stipulation that if the price of brought-out materials and components exceeds the imported price of such components by 25 per cent or more, imports of such materials and components would be permitted. This would undoubtedly place a heavier administrative burden on the governmental agencies but is essential for the efficient growth of the capital goods sector. Since fairly extensive facilities are available for metal fabrication and processing in Mexico, a level of 60 per cent or more would still continue to be prescribed by way of domestic integration in most cases but the necessary element of flexibility would be ensured by permitting imports where the domestic cost of inputs is unduly high.

198. With the laws on foreign investment and technology coming into effect, the regulatory problem would undoubtedly become very complex. For example, a proposal involving a minority foreign holding would require separate approvals for (a) the foreign investment involved, (b) the technology contract that may be necessary, (c) the manufacturing or integration programme, and (d) the import of any equipment or materials. Each of these approvals would require the filling in of detailed forms and questionnaires and the following of each application separately. Even though the agencies concerned with these approvals are all located in the Secretaría de Industria y Comercio, the obtaining of the various approvals could be a very time-consuming process and could lead to a vicious circle in some cases, unless effective co-ordination is ensured from the beginning. It is, therefore, recommended that for approval of foreign capital investment, technology and the manufacturing programme, one joint questionnaire should be adopted, and that all these three aspects should be dealt with simultaneously. Since foreign investment proposals have to be processed through the Commission under the new law, it would be desirable if the various aspects of the technology agreement and manufacturing programme are fully processed within the period before a case goes to the Commission and that the decision conveyed by the Commission constitutes the final decision on all these aspects. If any clarifications are required on any aspect of the proposals for technology or manufacturing programme, this should be obtained before the case is submitted to the Commission. It must be stressed that unless very close co-ordination is ensured, the various approvals required could lead to considerable bureaucratic and procedural delays. It is, of course, essential in this context that the Commission meets regularly and frequently. In some developing countries where a similar body is functioning, meetings are fixed on a fortnightly basis, so that all cases which have been processed in that period can be disposed of.

199. Since the development of capital goods industries would involve foreign investment and technology in the great majority of cases in Mexico's present stage of development, it is of great importance that governmental procedures for approval of proposals are suitably streamlined and co-ordinated, so that potential foreign investors do not lose interest in Mexican joint venture proposals, because of the time lag in obtaining various approvals within a reasonable period of time, which should not exceed three months for all the approvals referred to above.

200. The increased regulatory functions will necessitate not only greater co-ordination but also considerable administrative and technical support in the governmental agencies concerned. The administrative work relating to the capital goods sector is also likely to increase considerably with the detailed problems of exercising selectivity, following up individual projects, assessing import and other requirements and effecting co-ordination with promotional agencies such as Nacional Financiera, development organizations such as IMCE and technological institutions in the country. For these purposes, it may be desirable to set up a separate branch or directorate for capital goods sectors in the Secretaría de Industria y Comercio, which would be responsible for all these functions and which could take an overall view of all aspects of growth of this sector. The various sub-directorates in the Secretaría which are dealing with one or other capital goods branch could be more effectively co-ordinated by such an overall body.

201. A related aspect of regulatory control would be the need for ensuring that prices charged by domestic manufacturers of machinery items, components and intermediate products are reasonable. While facilities for import of such items where domestic costs are higher than 25 per cent would itself be a salutary factor in most cases, it would also be desirable to consider the establishment of an agency

which would maintain a continuing watch over costs and prices, particularly in respect of basic industrial materials and products. A beginning could be made in respect of costs and prices of materials and inputs for the metal transformation sector. The agency could take the form of a Bureau on Prices for Capital Equipment and Materials in the Secretaría de Industria y Comercio. The functions of this body would (i) be to keep a watch over cost and price trends in this sector in relation to prices of domestic factors and basic materials and (ii) to determine whether the prices charged or quoted by domestic manufacturers are reasonable, consistently with quality and efficiency as compared with international prices of the same products on the one hand and local costs on the other. Cases for examination could be referred to the Bureau either by the import committees or by the Secretaría directly. The Bureau should give an opportunity to manufacturers to explain the reasons for a particular level of prices and would thereafter advise the Secretaría as to their justification. Such an agency could assist considerably in highlighting the actual impact of domestic raw material and other factor costs in the pricing of various machinery products.

10. Production of ancillaries

209. Reference has been made, in chapter I, to the need for creating adequate manufacturing capacity for ancillary and peripheral items, as also for components and intermediate products. The adequate production of such items of good quality and at reasonable prices constitutes an essential pre-requisite for the rapid and efficient growth of the machine building industry. Capital goods manufacture often tends to be a semi-assembly operation and must have necessary manufacturing support in terms of ancillary and intermediate products. This need, which would increase rapidly in coming years, could be effectively combined with a programme for development of small-scale industries through wholly Mexican enterprises. Many input and component requirements

can be manufactured efficiently [illegible] medium and small-scale operations and it may not be necessary or even desirable for large-scale enterprises to take [illegible] vertical integration through such ancillary units would [illegible] the growth of Mexican entrepreneurship for [illegible] range of products in the ancillary sector. Though considerable financial assistance [illegible] has been given to over [illegible] medium and small-scale sector through a fund (Fondo de [illegible] Mediana y Pequeña) for the purpose, the proportion of metal fabrication units assisted was only 10 per cent. This is partly because small-scale units in this sector require considerable technical assistance in many cases, together with facilities other than finance alone. It is recommended that a comprehensive programme be undertaken for the growth of small-scale industry, particularly in the metal fabrication and transformation sector. Such a programme should include (i) the establishment of industrial estates, comprising of factory sheds with all facilities and equipped with common workshop facilities in areas where the machinery industry is expected to concentrate in future, such as in Queretaro, Cuernavaca, Veracruz, etc., (ii) technical and advisory assistance which should be provided either by the Fondo or through another agency to intending small-scale entrepreneurs in the form of technical service institutes in various areas, (iii) facilities for hire-purchase of machinery, which could be undertaken through the Fondo on fairly liberal terms, (iv) assistance in securing scarce raw materials which could be channeled through the service institutes, and (v) assistance in marketing and in securing orders from large manufacturers and governmental purchasing agencies. The credit requirements for the small-scale sector would also need to be tackled on a special footing and by a specialised public institution for the purpose. Together with hire-purchase facilities, more liberal criteria for credit worthiness would need to be established. Comprehensive programmes for the small-scale sector have been effectively undertaken in many developing countries and have achieved excellent results in widening the entrepreneurial base in these countries.

201. Besides providing an essential complement for the growth of large machine building enterprises, and avoiding the manufacture of items by larger enterprises, which can be done as well, if not more efficiently, by ancillary units, the growth of the small-scale and ancillary sector would enable greater employment opportunities apart from expanding Mexican entrepreneurship, which is also a pressing requirement. Such a programme necessitates however a clear policy orientation for the growth of ancillary and small scale industries and a number of institutional and other positive measures in the above lines.

202. In respect of promotional policies, apart from a selective and dynamic investment promotion programme which has been discussed earlier, the facilities and benefits provided by governmental agencies could be considered under three main sub-headings, viz. credit and financing, tax concessions and export incentives and assistance, in so far as the capital goods sector is concerned.

11. Credit and financing

203. It has been mentioned earlier that although institutional credit for industry is adequately available, interest rates are high and medium and short-term credit is fairly expensive in Mexico. The proportion of direct financing of industry by sponsoring entrepreneurs or through re-investment in the case of expansions, also tends to be higher than in many developing countries where greater resources is taken to institutional financial sources. This poses a special problem for the capital goods sector in Mexico, as substantial capital outlays are required in many of the sub-sectors. The problem has to be viewed particularly in the context of equity requirements and long-term loans. With high interest rates, the debt-equity ratio is likely to tilt towards a higher proportion of equity in the case of new machine building enterprises. It would be necessary, however, for additional equity resources to be forthcoming for this sector. The recent establishment of two financing agencies, the Fondo Nacional de Fomento Industrial (FONEI) and the Fondo de Equipamento Industrial (FOMEX)

may meet the problem to some extent if these latter undertake substantial capital participation in various projects. While this may take care of the smaller [illegible] requirements, in the case of the large capital goods projects, it [illegible] necessary for Nacional Financiera to play a dominant promotional role by way of investment participation. In terms of capital participation and subject to economic feasibility of each scheme, capital goods projects may take one of the following forms. (i) The first category would be new projects involving relatively small investments by Mexican enterprises, with foreign technology obtained under license or with a low proportion of foreign investment ([illegible] per cent or less). In such cases, the gap in equity requirements can mostly be met by one of the Fondos or by one or other of the Financieras. (ii) The second category would comprise of projects which involve substantial foreign capital investment (40 to [illegible] per cent). In such cases, it would be desirable for Nacional Financiera to participate in the equity, ranging from 20 to 40 per cent depending on the extent of interest that may be forthcoming from Mexican private industry. (iii) A third category would relate to proposals of substantial expansion by Mexican controlled enterprises in the identified capital goods fields. Here, equity support should be given largely by the Fondos to the extent necessary. (iv) There would also be proposals for substantial expansion in the identified fields by foreign controlled enterprises. In such cases, equity participation by Nacional Financiera or the Fondos should also be utilised for progressive Mexicanisation of the firms in terms of capital ownership. (v) Finally, there are likely to be new projects involving large financial outlays where adequate foreign or domestic private sector investment may not be forthcoming at this stage. This is likely in the case of more sophisticated machinery production, where the domestic market is somewhat uncertain and large investments are involved. Subject to economic feasibility

being reasonably assured, such projects may have to be undertaken in the public sector, with major participation by governmental agencies or National Financiers and minority holdings by foreign groups. The recognition that manufacture of sophisticated machinery constitutes a basic industry requires that if some significant production gaps are not covered by private industry, the lead has to be taken by public sector agencies. The industrial public sector in machine building is already fairly well established in Kenya in ship building, railway equipment and other branches and the implementation of additional machine building projects in the public sector would not constitute any major policy departure. This would ensure, however, that capital goods projects which are considered economically sound and essential from the view point of the economy could be established, even if private sector response is not adequately forthcoming.

206. The long-term loan requirements of the capital goods sector should largely be able to be met by the country's financial institutions. It needs to be considered, however, whether some relief in the interest structure could be given for the heavy machine building branches by one or other of the governmental agencies. This would be difficult, but as in the case of export credits, it may be possible to evolve a system of interest differentials for selected capital goods industries where the burden of interest charges would otherwise be unduly heavy.

12. External and supplier credits

207. An important aspect of machinery imports and growth of domestic capacity is posed by the external finance requirements for various projects. Most developing countries face a similar situation, which is greatly accentuated in some of these countries because of paucity of foreign exchange or overall resources. Some limitations caused by this factor are unavoidable and have to be accepted in the case of major projects financed through external credit sources, particularly

through international organisations. In the case of major public sector organisations such as [illegible] and PEMEX, resource constraints necessitate availing of external credits which have specific provisions and conditions regarding the procedure for equipment purchases. These inevitably have considerable effect on purchase of domestically produced equipment. While this may be necessary on certain major projects, it would be desirable to keep such cases to a minimum. What would be more desirable is to increase the resources of these major agencies so that they are less dependent on external credits. If, for this purpose, existing prices of basic goods and services need to be revised, this would certainly be considered. In respect of general supplier credits by foreign machinery manufacturers, care needs to be exercised, as the long term cost of such credits may prove quite considerable. The volume of supplier credits in the case of Mexico had reached a level of US$ 456 million out of a total external public debt of US$ 3,041 million by the end of December 1970, and continued to increase during 1971 and 1972. The burden of external repayment is, therefore, likely to be considerable during coming years. In order to enable domestic capital goods manufacturers to compete effectively with foreign manufacturers, it would be desirable if similar institutional credit could be available to the former. As in the case of export credits provided by FOMEX, facilities for deferred payment should be available for capital goods items purchased domestically which could be passed on to the purchaser, as in the case of external supplier credit. This facility is provided by FOMEX in certain cases of import substitution but needs to be extended much more widely for plant and equipment manufactured domestically. Such a facility could be provided by one of the Fondos directly to machinery manufacturers on terms similar to those provided by foreign suppliers. The need for such credit facilities exists both in respect of heavy machinery items and relatively light equipment. A typical

example of the latter is in respect of tractors and agricultural machinery. To the extent that the use of such machinery is considered essential for better productivity, credit facilities need to be extensively provided by machinery suppliers who, in turn, must depend on institutional support.

13. Tax concessions and incentives

208. The general pattern of tax concessions and incentives has been described in Chapter II, together with the new pattern set by the Decree of 20 July 1972. While the Decree undoubtedly constitutes an important policy step, particularly for decentralisation of industry, there are certain aspects which could bear further consideration in the light of experience of operating this measure. Firstly, it would be desirable if a more selective approach could be applied in the case of new industries. At present, new industries manufacturing consumer goods items would attract the same benefits as those which are for producer goods manufacture. A general tax concession policy is certainly appropriate for the purpose of achieving regional industrial dispersal, but since the July Decree prescribes the operative pattern of incentives for all industries, a selective approach may prove more difficult to apply unless this is specifically prescribed. At the same time, a degree of selectivity would be necessary and appropriate to channel resources into priority sectors.

209. For the capital goods sector, while substantial tax relief is called for in the initial years, the concessions provided for in the Decree should by and large, prove adequate. The influence of tax relief on investment decisions relating to large capital goods enterprises often tends to be exaggerated. While such concessions are essential as promotional measures, there may not be adequate justification for any special relief for capital goods enterprises in this regard, except for export promotion which is dealt with later. If however, selective differentiation in tax relief is applied in future,

capital goods manufacture should be treated as a priority sector for this purpose and should be extended such further relief by way of tax concessions as is allowed to such sectors.

210. Apart from the tax reliefs discussed above, a further tax rebate of up to 10 per cent is allowed in respect of domestically producted supplies for [illegible], PEMEX, railways and metro, which would otherwise have to be imported. This concession which is a form of import substitution rebate, should be on a par with any rebates or concessions given for exports of various products. At present, there is a differential in this regard, which needs to be removed. It is also recommended that the above rebate, which appears to be confined to supplies for these four agencies, should be extended in respect of other domestic purchases also of similar products.

14. Export policies and incentives

211. The general pattern of export promotion and assistance has been briefly described in Chapter II. The development of exports of machinery and metal transformation products, however, raises additional policy aspects. Export programming has to be viewed as an essential aspect of capital goods development, so that adequate markets can be developed for such manufacture. It is necessary to effectively exploit the geographical and factor advantages of Mexico in this field and special selective assistance, as may be required, needs to be provided. While it is axiomatic that the country should concentrate on exports of those products where it has comparative competitive advantages, the general factor advantages in Mexico are such that concentration on the capital goods and metal transformation sectors could result in considerable increase in exports in these sectors. The argument that developing countries must necessarily go through various transitional stages for development of exports of more sophisticated machinery products would no longer be applicable in Mexico's present stage of development. The experience of certain countries in recent decades

fully bears out the fact that such transition can be achieved very rapidly and this should certainly take place in the case of Mexico. In fact, it must necessarily be so if the country is to keep pace with other rapidly developing countries, particularly Brazil. This calls for a considerable measure of deliberative planning, both to ensure that export surpluses are created in the metal transformation sector and that such surpluses can, in fact, be exported at competitive prices. As discussed earlier, the first aspect calls for substantial resource allocation in the capital goods sector, together with the accelerated growth of more sophisticated production. For the second, it is necessary that adequate production efficiency must be achieved. Although this is a task devolving on enterprises themselves, incentives and governmental assistance can and must undoubtedly play a very significant role in the export sector.

212. In order to determine export potential in this sector, it is necessary not only to institute a continuing survey of export potential industries and to determine pragmatic export targets in each branch, but also to conduct a detailed survey of export potential enterprises, particularly in the metal transformation sector. For this purpose, all enterprises exporting or having exported 15 per cent or more of their annual production in value should be deemed to be export oriented units in this sector. The specific needs of such enterprises should be examined and selective assistance provided against firm export targets over a period of time. A typical illustrative case is of a medium-sized Mexican enterprise in the packaging equipment sector, which had been exporting a substantial proportion of its production, but which had been languishing for two to three years without expansion owing to lack of capital. It is only recently that adequate financial assistance has been approved through one of the Funds. A continuing study in respect of such export potential enterprises could best be conducted by an organisation such as I.M.C.E. which could

thereafter follow up the requirements of these units with various governmental agencies.

213. An enterprise oriented study would highlight another aspect viz. that of import requirements of exporting enterprises. While exporting industries can obtain import permits for items which are not domestically manufactured, this is usually very difficult in the case of materials and components produced locally, though such items may be much more expensive and often of different quality. In view of the need and possibility for developing exports in the metal transformation sector, it needs to be considered whether exporting units in this sector could be given import permits, akin to "bonus vouchers" given in some countries, for the imports of any materials and components up to a percentage of the total value of their exports. This should be over and above the imports of items not domestically produced or where imports are allowed because of the higher price of domestic inputs. Such percentage could range from 15 per cent for exported machinery products with a domestic content of 40 to 60 per cent, to 20 per cent in the case of domestic content of between 60 to 80 per cent and to 25 per cent where the domestic content is over 80 per cent. The principle of such percentage imports has already been applied in the automobile industry in Mexico and could usefully be extended to other machinery sectors on the above pattern. Such a system could be introduced for an initial period of five years. This would enable export potential industries and enterprises to import essential materials and components for export production. Such a measure would also ensure greater efforts on the part of local manufacturers of such products to reduce costs and prices and would have a very salutary effect in this regard. Since such import permits would be related to actual export performance, except possibly in the first year when it could be in the form of advance import entitlement against specific export commitments during the year, there would be no net

reduction of export earnings. Such a linkage between import facilities and export performance should yield very useful results in this sector.

14. While tax credits are adequately available, the rules governing the grant of such cedis have not been clearly set out. There is a considerable element of administrative discretion in this regard which may prevent a potential exporter of machinery from taking the cedi into account in quoting export prices. With uncertainty regarding the availability and quantum of cedi, which may be nullified during the period of a year or more between quotation and a final invoice, machinery exporters often find it difficult to incorporate this facility in their price quotations. The calculation of the cedi being based on direct labour costs also results in other essential costs of equipment design and manufacture being excluded from this benefit. It is recommended, therefore, that (i) a clearly defined set of rules should be prescribed and publicised regarding the grant of cedis, (ii) in the case of specific machinery export quotations, the Secretaría de Hacienda y Crédito Público should be in a position to confirm to firms quoting from Mexico that cedis up to the percentage prescribed at the time would be available for particular export orders, if the defined level of integration was achieved, (iii) while the level of cedi taken together with the recent scheme for additional 4 per cent refund in the case of consortia and service firms is reasonable for most machinery exports with a domestic content of 60 per cent, a differential cedi at a higher rate of 20 per cent should be prescribed in respect of capital goods machinery exports where domestic integration exceeds 80 per cent, (iv) the cedi calculation should include not only direct labour costs but also direct costs of engineering, including designs and drawings by the Mexican unit.

215. It needs to be pointed out that there is some scope for abuse of the cedi system, largely in respect of the cost of Mexican materials or components since these must also have 60 per cent domestic content, it is possible for exporters to channel certain imports through the supplier of materials or components, without affecting their own percentage. If a system of differential cedis is adopted, it would be all the more necessary to guard against possible abuse of the above type. It is also necessary to ensure that the cedi benefit should be available to a machinery exporter within 30 to 45 days at most, from the date of filing of invoice. In some cases, this takes more than six months at present, which detracts considerably from the benefit of this facility.

216. The scheme for additional incentives in the case of exports through consortia and export service firms would prove to be very useful, if it can result in the growth of such agencies. In the capital goods field, the combination of various enterprises having complementary production programmes can be of great advantage for development of exports and the formation of consortia could serve the purpose. The insistence on a fairly high minimum level of increased annual exports may, however, prove to be a difficult condition to fulfil in the metal transformation field. A more selective approach in respect of different sectors may prove to be more effective.

217. Apart from cedis and refund of indirect duties, an important fiscal incentive is that of post-shipment export credits provided through FOMEX. This varies with the destination of exports and from contract to contract but is generally for a period of five to eight years, with an interest rate of 7 per cent. It is necessary that export credit for capital goods exports is provided on competitive terms with other countries. In the case of some countries, such credit is extended at 6 to 6½ per cent interest for a period of up to ten years. The extent of such facilities for various products is generally known

and needs to be taken into account by FOMEX in determining the period and interest rate for such credits, so that these can be incorporated in price bids by local firms.

218. A procedural recommendation which may be considered is that the examination of the domestic element composition in the case of machinery export orders should preferably be done only once, either by FOMEX in respect of export credits or by the Secretaría de Hacienda y Crédito Público for purposes of tariff calculation. Since the assessment of domestic content is based on the same formula in both cases, the acceptance of a particular percentage by one agency should be equally applicable to the other. This would reduce the time in the processing of proposals in the two agencies.

219. Both in respect of post-shipment export credits through FOMEX and pre-shipment credit for investment and working capital through FOMEX or Banco de Comercio Exterior or any other agency, it is necessary that adequate funds are made available. This has not constituted a problem so far but with increased export possibilities in the capital goods sector, fund requirements are likely to increase substantially and need to be available at relatively short notice, both for working capital and post-shipment credits.

220. Apart from fiscal and financial inventives, a freight subsidy is provided which covers up to 50 per cent of the cost of rail transport to the border. This is an useful incentive, but with increased road haulage of manufactured products, such an incentive for road movement of machinery products up to the border would be used to an increasing extent. A major problem stems from the high cost of shipping between Mexican ports and ports in importing countries and the lack of container-movement facilities in Mexico. While this is part of a much larger problem of high port handling costs and inadequate port facilities in Mexico, it has a considerable impact on exports of domestically produced equipment. It is necessary that the

question of port handling costs and facilities is given urgent attention. This has been given more and importance at present but must be effectively tackled. The question of freight rates on machinery items between Mexican and foreign ports also seems to be immediately reviewed. Certain examples given by private parties indicate that shipping freight rates are higher for machinery items sent out of the country than for machinery imports. This aspect needs urgent study and rectification.

Last, an essential aspect of machinery exports is that of effective international marketing. Emphasis on this question has recently been focussed through the I.M.C.E. While foreign subsidiaries and affiliates usually have access to an international distribution organisation, special facilities need to be provided for small and medium Mexican manufacturers. The channeling of exports through export consortia and service firms provides one alternative. It would also be useful to set up a council for the promotion of machinery exports, consisting of principal machinery exporters which could work in close liaison with I.M.C.E. This council should promote export marketing groups of enterprises producing non-competitive but complementary products so that these could combine and join in export efforts.

222. It is also necessary to use the regulatory instrument to a greater extent for the development of exports. While unrealistic export targets cannot obviously be achieved merely through governmental insistence, more concentrated efforts could be made by a number of enterprises if there was greater pressure in this regard. Both at the stage of establishment of new units or when major expansions are undertaken by enterprises which have substantial foreign participation, efforts should be made to prescribe broad export targets over a period of time, wherever such exports are considered feasible. Hitherto, the emphasis was primarily on import substitution. Now that such stress has shifted to development of exports, this aspect should receive emphasis from the stage when such proposals are considered. In cases where foreign

majority holdings are considered, substantial export commitment [illegible] re-[illegible], [illegible] r[illegible], [illegible] ri[illegible]. In cases of transfer [illegible] the export commitment [illegible], [illegible] approach can be [illegible] regarding [illegible] export commitments that can be prescribed [illegible], but this instrument should [illegible] used [illegible], though with [illegible].

[illegible]. Border industries and [illegible]

[illegible]. The sectoral growth [illegible] in respect [illegible] covered by the border industries or "[illegible]" programme [illegible] been described in Chapter II. It would [illegible] if this programme could be given further orientation in [illegible] sophistication of manufacture. [illegible] this programme is quite substantial, [illegible] considerably if, through selective promotion and encouragement, more engineering industries could avail of this programme. There is great scope and potential for a wide range of medium-sized industries under the programme manufacturing components and accessories for heavy mechanical equipment, as has already developed in the [illegible] the electronics industry. Items such as castings and forgings, gears, component parts and spares for process equipment and [illegible] electrical industries have considerable potential for manufacture for the US market. It would be useful to have a special study conducted which would highlight specific items and components having special scope for the US market. An aspect, which would bear some reconsideration, is regarding the extent of exports that would be necessary in such cases. While the recent regulation in respect of the "maquila" programme does not rule out domestic sales altogether, it still expects export-orientation to the extent of 95 per cent and more. It may be considered, whether in the case of capital goods products and components taken up for

manufacture under this programme, the percentage of export commitment [illegible] depending on the extent of domestic production of [illegible] in question.

[illegible]. Regional co-ordination

[illegible] issues and problems of regional [illegible] and economic integration among Latin American countries, [illegible] capital goods sector [illegible] co-ordination and integration [illegible] results. Although such integration has encountered considerable difficulties, the free trade facilities among the [illegible] countries [illegible] considerably enlarged the market [illegible] trade between countries in the [illegible]. For example, imports [illegible] and other machinery items from [illegible] in [illegible] in recent years. Similarly, [illegible] from Mexico to Central American countries [illegible] that regional co-ordination results [illegible] potential market gives at [illegible] for the capital goods sector, where even the [illegible], Argentina or Brazil are not [illegible] themselves to [illegible] comparable economies of scale in [illegible]. The diverse nature of capital goods production could also enable a greater [illegible] of regional specialisation through a process of negotiations and agreements, than in most other production fields. This could, however, [illegible] two broad levels. Firstly, there should [illegible] of "common" capital goods industries, which would include relatively unsophisticated equipment, certain ranges of machine tools, hand tools, measuring and other instruments, small parts and ancillary items. At a later stage of integration, some of these items could be primarily produced only in the smaller countries of the region. The second category would be

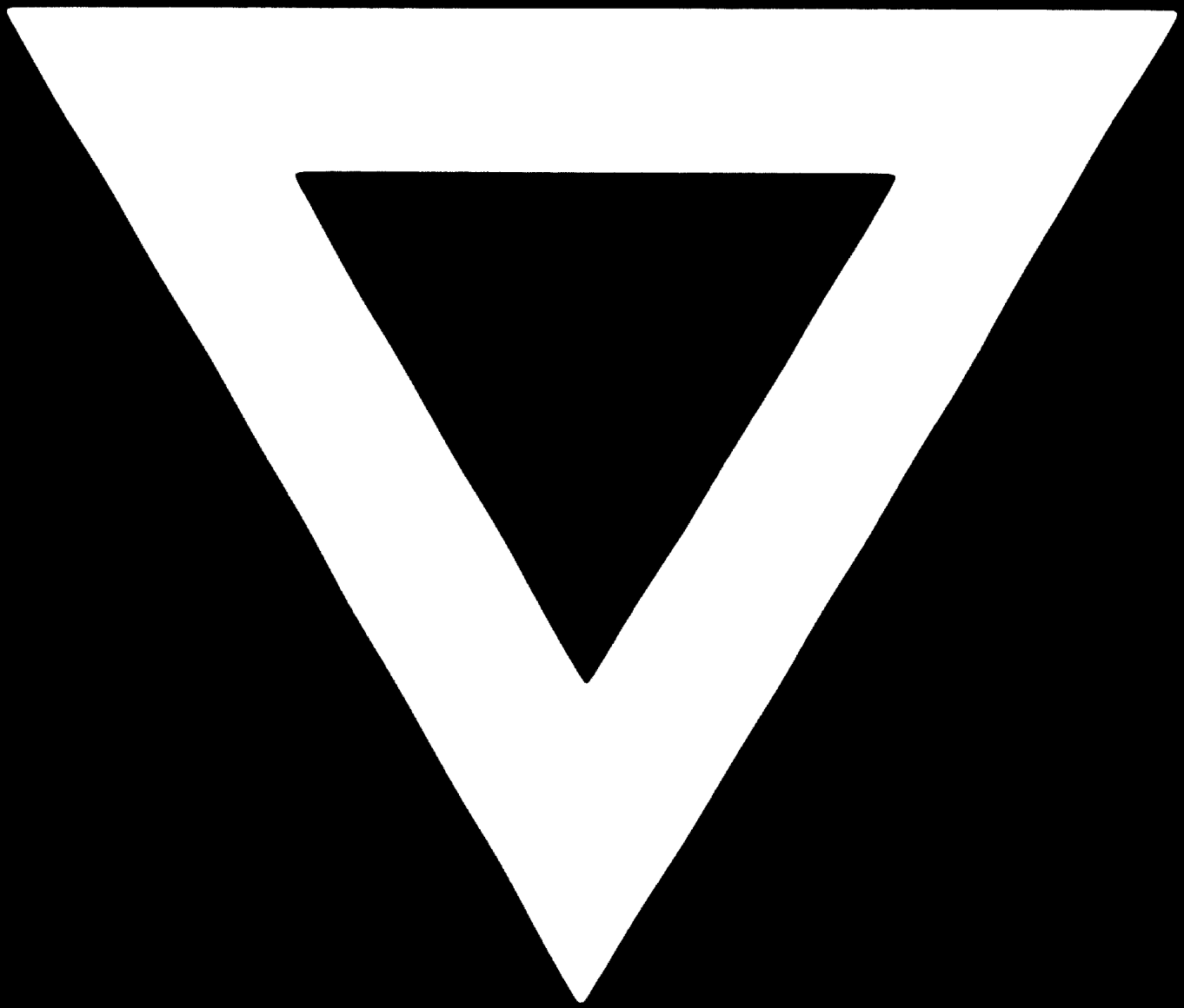
th[illegible] of "special" capital goods, where [illegible] regional pattern of manufacture could be sought [illegible]. [illegible] that production of [illegible] in machinery would [illegible] in [illegible] other country of the region. [illegible], [illegible] capacity is not [illegible] of the [illegible] goods [illegible] market and production [illegible] into consider- tion, so that complementarity [illegible] to be achieved as far as possible. In the limited [illegible] American integration as it exists [illegible] called [illegible]. The essential need [illegible] undoubtedly exists and needs to be [illegible] for [illegible] machinery sectors. The [illegible] many [illegible] countries has already had the effect of bringing about greater [illegible] among manufacturers in the region. In new [illegible] for [illegible] in Mexico, for example, [illegible] will [illegible] competitive with imports from Brazil [illegible] market will no longer be as sheltered [illegible] before. [illegible] co-ordination, both in terms of future planning [illegible], either [illegible] the sub-region [illegible] of regional level, or [illegible] policies and incentives in each country. If such [illegible] can be brought about, there is considerable [illegible] for the development of complementarity in production in this sector. The [illegible] agreement between Mexico and the Andean Group of countries could be the [illegible] production complementarity [illegible] development between [illegible] in the capital goods sector in the first instance. This could [illegible] and extended over a wider regional level. With greater stress on deliberative planning in Latin American countries and increasing awareness of the growth potential of the capital goods sector, the time is opportune for closer contacts so as to assure the development of both larger market for machinery production programmes, and in order to pinpoint the possibilities of such co-ordination.

[illegible]. It would be very useful to initiate a study, possibly under [illegible] [illegible], to [illegible] [illegible] capital goods manufacture in [illegible] to evolve a common set of policies for regional co-ordination [illegible] manufacture. While such a task would [illegible], it [illegible] be attempted for the capital goods sector [illegible] [illegible], as such manufacture is still in a relatively early stage of development in most countries of the region, with the possible exception of [illegible]. On account of the stage of development and because there is greater scope for complementary production over the very wide and diversified range of machinery manufacture, the process of "give and take" which is essential for any programme of economic integration and co-ordination is more capable of achievement in this sector than over a wider parameter.

17. <u>General conclusions</u>

226. Some of the important general policy aspects of capital goods manufacture have been discussed in this chapter. Since the coverage of this sector is extremely wide, most policy measures tend to have a significant impact on one form or another. At the same time, it must be stressed that the impact of specific measures would differ considerably in respect of particular projects for machinery manufacture. The great diversity of production in the machine building sector renders it extremely difficult to prescribe any particular set of policies which could be applied universally to this manufacturing branch and the approach in the matter of investment pattern, technology acquisition, locational decisions and protection and other incentives could vary considerably, both in concept and in detail, in so far as specific projects are concerned. Such policy measures cannot, at the same time, be isolated from the overall socio-economic policies and programmes of the Mexican Government at this point of time and must necessarily be integrated within such a programme. It is in this context that certain suggestions and recommendations have been made in this chapter.

Since a large number of issues were involved, the discussions of these aspects are necessarily brief and not each of these areas is capable of much more detailed analysis, both separately and in their inter-dependant effects on other sectors and for the economy as a whole. Since this study is confined to the capital goods sector, the general aspects of these policies have not been gone into in any detail and only the impact on the capital goods sector has been sought to be emphasised. There is no doubt that the overall policy package in Mexico will play a very determinant and ever increasing role in the country's future industrial development. It is, therefore, essential that priorities and programmes are clearly defined for the next phase of the country's industrial expansion, and that domestic resources and factor-endowments are effectively channeled for the achievement of the country's economic objectives. In this crucial process, the role of the capital goods sector should be pivotal and should undoubtedly receive great significance and emphasis, so that Mexico can occupy its intrinsic position among the advanced and industrialised nations of the world.



76. 04. 28