

INFRASTRUCTURE DEVELOPMENT PLANNING
FOR
THE SOUTHERN CUZCO
THE REPUBLIC OF PERU

PHASE 2

MARCH, 1980

Metal Mining Agency of Japan
Japan International Cooperation Agency
Government of Japan

MPN

80-38

INFRASTRUCTURE DEVELOPMENT PLANNING
FOR
THE SOUTHERN CUZCO
THE REPUBLIC OF PERU

PHASE 2

 LIBRARY



1035199[7]

| | |
|---------------------------------|-------------|
| 国際協力事業団 | |
| 受入 月日 55. 1. 28 84. 9. 27 | 709 |
| 登録No. 09194 | 66.2 MPN |

PREFACE

Upon the request of the Government of the Republic of Peru, the Government of Japan agreed to provide a technical assistance for a survey of infrastructures required in the development of three copper mines in Coroccohuayco, Quechua, and Titaya, all of which are situated in the southern region of Cuzco Department, Peru, during fiscal 1978 and 1979. The task of carrying out this survey was entrusted to the Japan International Cooperation Agency and the Metal Mining Agency of Japan.

This survey project has been divided into two phases: a preliminary survey and a main survey. The preliminary survey mission visited Peru from August 9 to August 26, 1978. The mission examined matters to be surveyed together with related governmental organizations, of Peru, and also examined matters to be surveyed by the main survey mission during the two fiscal years. Since the final survey would cover a wide variety of subjects, and an infrastructure improvement plan would also be utilized for area development in the neighbourhood of the mines, it entrusted the International Development Center of Japan with responsibility for the survey and a mission was dispatched to Peru to the field study. The first survey was conducted between September 27 and October 24, 1978. The second survey was composed of two parts. The first part was a survey of geothermal resources carried out from August 10, to November 9, 1979, and the second part a survey of infrastructures done between September 30, and October 31, 1979.

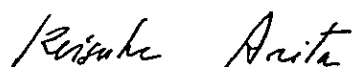
Peru is one of a few countries rich in mineral deposits. These resources include copper, silver, zinc, lead and iron ore. The Export of Peruvian mineral resources represents more than 50% of all exports and plays an extremely important role in the national economy. Among export minerals, copper has represented the largest share since 1973 in terms of export by commodity, taking the place of fish meal, which had been the largest export until that time. Therefore, the Government of Peru has been making great efforts in development planning for mineral resources as the most promising measure for reconstruction of the Peruvian economy, together with petroleum development in the eastern Amazon region. The development plan for the three mines formulated in this report has been taken up with this in mind.

In the formulation of an infrastructure improvement plan, the most important thing to be taken into consideration is an emphasis which ensures that the impact of copper mining development will contribute to development of the economy of the district to the greatest extent possible. Therefore, this survey has been carried out with this point very much in mind. This report includes the findings of basic surveys on power, water resources, railways, port facilities, geothermal energy, and agricultural sectors under these circumstances, while carefully considering the balance between mining and area development in the region. We shall be most happy if this report contributes to the economic development of the Republic of Peru

and area development in the country. We trust that it will also serve for further improvement of the mutual friendship between the Republic of Peru and Japan, which has been very close in the past.

Last but not least, we would like to express our deep appreciation for the sincere cooperation extended to the mission members by concerned individuals in the government organizations of the Republic of Peru as well as the Ministry of Foreign Affairs of Japan, in particular the Japanese Embassy in Peru, the Ministry of International Trade and Industry and other related government offices.

March 1980



Keisuke Arita
President
Japan International Cooperation
Agency



Masayuki Nishiiye
President
Metal Mining Agency of Japan

ACKNOWLEDGEMENT

This report contains the results of findings of the survey carried out by the International Development Center of Japan which was entrusted with carrying out the survey fiscal 1979 by the Ministry of International Trade and Industry through the Japan International Cooperation Agency and the Metal Mining Agency of Japan.

The survey focuses of the development of three copper mines, expected to be developed in the near future, which are situated close to each other in the Andes Mountains in the southern part of Cuzco in the Republic of Peru. The survey, therefore, includes present infrastructure conditions related to development of the mines, formulation of infrastructure improvement plans which may be required, and examination of such plans. We trust that this survey will contribute to area development in the region of the copper mines and to economic development of the Republic of Peru as a whole. We further hope that this survey will aid in strengthening the friendly, cooperative relationship between the Republic of Peru and Japan.

The survey mission conducted a field survey of about three months duration from August 10, 1979 on geothermal energy and of about one month from September 30, 1979 on infrastructures, following the first survey conducted in fiscal 1978. The survey mission was composed of the following members.

| | | |
|-------------------|-----------------------|---|
| Mission Leader | : Keiichiro Hideshima | International Development Center of Japan |
| Electric Power | : Hiroshi Katsukawa | Electric Power Development Co., Ltd. |
| Water resources: | : Tsuneaki Yoshida | International Development Center of Japan |
| Railways | : Masaki Aoyama | Japan Transportation Consultants, Inc. |
| Port and Harbour | : Kenji Fujita | Japan Port Consultants, Ltd. |
| Geothermal Energy | : Naoaki Tomizawa | Mitsui Engineering Service Co., Ltd. |
| - " - | Takashi Aoyama | Mitsui Engineering Service Co., Ltd. |
| - " - | Akira Egawa | Mitsui Engineering Service Co., Ltd. |
| - " - | Kiyotaka Obase | Mitsui Engineering Service Co., Ltd. |
| Agriculture | : Kenroku Hayashi | Professor of Animal Production Grassland Research Laboratory, Tohoku University |
| Adviser | : Kazuhiro Chimura | Japan International Cooperation Agency |
| Adviser | : Hiroshi Okano | Metal Mining Agency of Japan |
| Coordinator | : Takahisa Nakamura | International Development Center of Japan |

I would like to express my sincere thanks for the strong assistance extended by governmental organizations in Peru and the close cooperation of the Japanese Embassy, Peru Japanese joint ventures, commercial firms and various international organizations. I also wish to express my hearty thanks to the Ministry of Foreign Affairs, the Ministry of International Trade and Industry, the Japan International Cooperation Agency, the Metal Mining Agency of Japan and the Embassy of Peru in Tokyo.

March 1980

A handwritten signature in cursive script, reading "Saburo Kawai".

Saburo Kawai
President,
International Development
Center of Japan

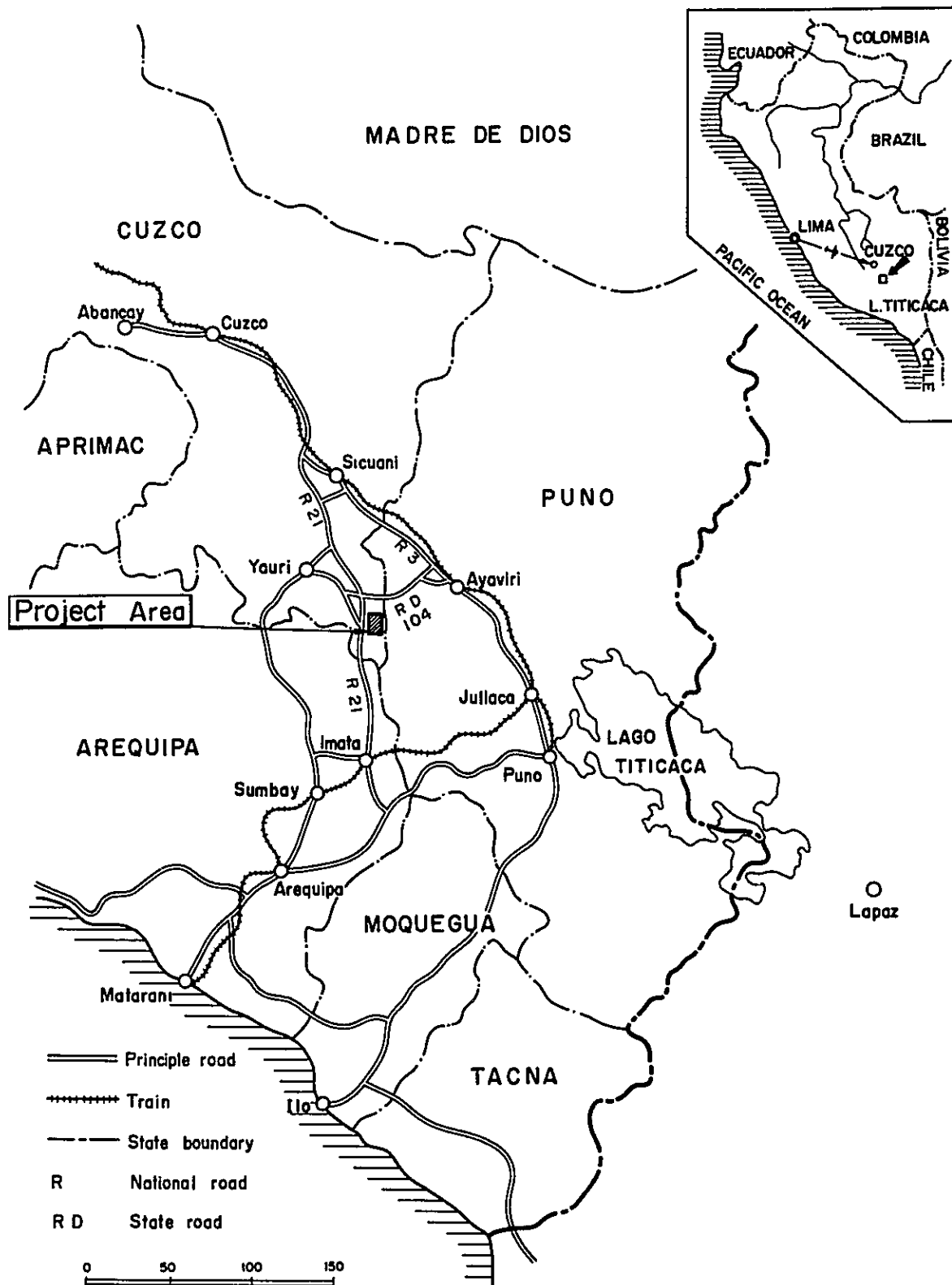


Table of Contents

| | | |
|------------|---|----|
| Chapter 1. | Summary and Recommendations | 1 |
| 1. | Background of Survey | 3 |
| 2. | Purpose of Survey | 4 |
| 3. | Present Conditions and Problem Areas in the Economy of Peru | 4 |
| 3-1 | Present Economic Conditions in Peru | 4 |
| 3-2 | Economic Characteristics of the Project Area .. | 8 |
| 4. | Summary and Recommendations by Sector | 11 |
| 4-1 | Mining Sector | 11 |
| 4-2 | Infrastructure Sector | 11 |
| 4-2-1 | Establishment of Basic Elements for Infrastructure Development Study | 11 |
| 4-2-2 | Power Development | 13 |
| 4-2-3 | Water Resources Development | 15 |
| 4-2-4 | Housing | 16 |
| 4-2-5 | Determination of Transportation Route (Port and Harbor, Road, Railway) | 17 |
| 4-3 | Geothermal Energy Sector | 19 |
| 4-4 | Agriculture and Livestock Sector | 20 |
| 4-4-1 | Selection of Appropriate Place | 20 |
| 4-4-2 | Method for Introduction of Pasture and Selection of Kind of Pastures | 20 |
| 4-4-3 | Irrigation Program | 21 |
| 4-4-4 | Agricultural Use of Geothermal Energy | 21 |
| 5. | Recommendations | 22 |
| 5-1 | Estimated Investment Amounts | 22 |
| 5-1-1 | Infrastructure Sector | 22 |
| 5-1-2 | Agriculture Sector | 23 |
| 5-2 | Evaluation..... | 23 |
| 5-3 | Conclusion | 25 |
| Chapter 2. | Long-Term Trends in the Economy of Peru and Its Future Prospects | 27 |
| 1. | Past Economic Development Pattern | 29 |
| 1-1 | Long-Term Trends | |
| 1-2 | Recent Growth Rate and Trends in the Economy .. | 35 |

| | | |
|---|--|----|
| 2. | Financing of Investment Fund and Savings in Public Sector | 39 |
| 2-1 | Long-Term Trends in Domestic Savings and Investment | 39 |
| 2-2 | The Role of the Public Sector in the Economy of Peru | 41 |
| 2-3 | Public Investment | 45 |
| 2-4 | Public Investment Results and Problems | 49 |
| 2-5 | Financial Source of Public Investment | 53 |
| 2-5-1 | The Central Government as a Source of Domestic Savings | 54 |
| 2-5-2 | Government Enterprises as Sources of Domestic Savings | 56 |
| 2-5-3 | Social Security Funds as a Source of Domestic Savings | 60 |
| 2-5-4 | Local Government Authorities as Sources of Domestic Savings | 60 |
| 3. | Economic Stabilization Policy and Results | 61 |
| 3-1 | Economic Stabilization Policy and Relief Measures Taken by IMF | 61 |
| 3-2 | External Debt Relief Measures | 62 |
| 3-3 | Social Situation after Implementation of Stabilization Measures | 63 |
| 3-4 | Andes Common Market | 63 |
| 3-5 | Desirable Direction of Future Development Policy for the Economy of Peru | 64 |
| Chapter 3. Electric Power Development | | 65 |
| 1. | Electric Power in Peru | 67 |
| 1-1 | Current Power Supply Conditions | 67 |
| 1-1-1 | Power Supply Capacity | 67 |
| 1-1-2 | Main Power Systems | 68 |
| 1-1-3 | The Electric Power Industry in Peru | 71 |
| 1-2 | Current Power Demand | 71 |
| 1-3 | Electricity Rates | 72 |
| 1-4 | Power Development Plan | 73 |
| 1-4-1 | Power Development Policy | 73 |
| 1-4-2 | Electric Power Development Plan | 74 |
| 2. | Power Supply in the Project Area | 75 |
| 2-1 | Current Status of Machu-Picchu-Cuzco System .. | 76 |

| | | |
|-----------|---|-----|
| 2-2 | Expansion Plan for Machu-Picchu Power Plant and Reinforcement of the System | 76 |
| 2-3 | Current Status of the South-Western System ... | 80 |
| 3. | Plan for Supply of Power to the Project Area.. | 80 |
| 3-1 | Power Demand in the Project Area | 80 |
| 3-2 | Supply Demand Balance in the Project Area | 81 |
| 4. | Method of Power Supply to the Project Area ... | 86 |
| 4-1 | Method of Power Supply to the 3 Copper Mines.. | 86 |
| 4-1-1 | Basic Philosophy | 86 |
| 4-1-2 | Method of Power Supply to the Copper Mines .. | 88 |
| 4-1-3 | Expansion of the Machu-Picchu Power Plant and Reinforcement of the Power System.. | 88 |
| 4-1-4 | Reception of Power from the South-Western System | 89 |
| 4-1-5 | Construction of New Diesel Power Plants ... | 102 |
| 4-1-6 | Construction of a New Geothermal Power Plant | 106 |
| 4-1-7 | Construction of New Hydroelectric Power Plant | 106 |
| 4-1-8 | Comparison of Power Supply Methods | 113 |
| 4-2 | Comparison of Power Costs | 113 |
| 4-2-1 | Premises for Comparison..... | 113 |
| 4-2-2 | Power Cost in Case of Purchase from Electro Perú | 116 |
| 4-2-3 | Power Generation Costs in the Case of Diesel Power Plant Usage | 120 |
| 4-2-4 | Results of Comparison of Power Costs | 122 |
| 5. | Recommendations for Further Detailed Studies.. | 123 |
| 5-1 | Start of Operations at the Tintaya Mine | 123 |
| 5-2 | Study of the Southern System Interconnection Plan | 123 |
| 5-3 | Quishuarani Hydroelectric Power Generation Project | 123 |
| Chapter 4 | Development of Water Resources | 125 |
| 1. | Outline of Project Area | 127 |
| 1-1 | Topography and Vegetation..... | 127 |
| 1-2 | Climate | 127 |
| 1-2-1 | Temperature | 127 |
| 1-2-2 | Precipitation | 128 |

| | | |
|-----------|---|-----|
| 2. | Water Resources Endowment | 128 |
| 2-1 | River Runoff..... | 139 |
| 2-1-1 | Runoff Coefficient | 139 |
| 2-1-2 | Flood Discharge | 139 |
| 2-1-3 | River Runoff | 140 |
| 2-1-4 | Water Quality | 143 |
| 2-2 | Underground Water | 146 |
| 3. | Water-Intake Plan for the Mines..... | 146 |
| 3-1 | Water Requirement | 146 |
| 3-2 | Supply Plan | 147 |
| 3-2-1 | Study of Water Sources | 147 |
| 3-2-2 | Comparison of Water-Intake Plans | 147 |
| 3-2-3 | Water Rights | 148 |
| 3-3 | Common Water-Intake Plan | 148 |
| 3-4 | Water-Intake Plan for Each Mine | 150 |
| 3-4-1 | Tintaya Mine | 150 |
| 3-4-2 | Coroccohuayco Mine | 151 |
| 3-4-3 | Quechua Mine | 154 |
| 4. | Irrigation Plan | 159 |
| 4-1 | General Outline | 159 |
| 4-2 | Selection of Suitable Irrigation Area | 159 |
| 4-3 | Availability for Irrigation Water and Irrigation Plan | 160 |
| 4-3-1 | General Outline of Irrigation Plan | 160 |
| 5. | Urban Water Supply | 161 |
| 5-1 | Waterworks in Yauri City | 161 |
| 5-2 | Urban Water Supply in Hector Tejada City | 162 |
| 6. | Summary and Recommendations for Further Detailed Studies | 163 |
| Chapter 5 | Railway Transportation | 165 |
| 1. | Outline of Peruvian Railways | 167 |
| 1-1 | Outline | 167 |
| 1-2 | Railway Network | 167 |
| 1-3 | Lines and Rolling Stock | 169 |
| 1-4 | Organization | 169 |
| 1-5 | Reconstruction and New Line Construction Plans | 173 |

| | | |
|-------|---|-----|
| 1-5-1 | Reconstruction Plan | 173 |
| 1-5-2 | New Line Construction Plans | 173 |
| 2. | Present Condition of Ferrocarril del Sur | 174 |
| 2-1 | Outline | 174 |
| 2-2 | Amounts Transported | 176 |
| 2-2-1 | Freight Transport | 176 |
| 2-2-2 | Passenger Transport | 178 |
| 2-3 | Type of Lines | 178 |
| 2-4 | Rail Construction | 180 |
| 2-5 | Lines and Stations | 180 |
| 2-6 | Operation Safety Equipment | 192 |
| 2-7 | Communications Equipment | 193 |
| 2-8 | Rolling Stock | 193 |
| 2-9 | Charges and Fares | 196 |
| 2-9-1 | Freight Charges | 196 |
| 2-9-2 | Passenger Fares | 199 |
| 3. | Transport Quantities and Routes Related to Mining Development | 201 |
| 3-1 | Amounts Transported | 201 |
| 3-2 | Transport Routes | 202 |
| 3-2-1 | Comparison of Routes | 202 |
| 3-2-2 | Highway Only Routes | 203 |
| 3-2-3 | Highway + Railway Routes | 204 |
| 4. | Transport Plans | 205 |
| 4-1 | Section Between Mines and Ayaviri Station (95 km) | 205 |
| 4-2 | Section Between Ayaviri Station and Matarani Port (542 km) | 205 |
| 4-2-1 | Transport Trains | 205 |
| 4-2-2 | Operating Times | 206 |
| 4-2-3 | Loading Facilities | 207 |
| 4-2-4 | Unloading Facilities | 208 |
| 4-2-5 | Freight Cars Used | 208 |
| 5. | Comparison of Transport Costs | 209 |
| 5-1 | Highway Only Route | 209 |
| 5-2 | Highway + Rail Route | 212 |
| 5-3 | Comparison of Costs | 213 |
| 6. | Railway Development Plans | 214 |

| | | |
|-----------|--|-----|
| 6-1 | Related Items in Plans for Reconstruction and New Line Construction | 214 |
| 6-2 | Items Required for Execution of Project | 214 |
| 6-3 | Rolling Stock and Equipment Costs | 215 |
| 7. | Responsibility for the Transport Facility Costs and Transport Costs | 216 |
| 7-1 | Responsibility for Road Development Costs | 216 |
| 7-2 | Responsibility for Railway Development Costs | 216 |
| 7-3 | Road Transport Vehicle Operating Expenses and Railway Charges | 217 |
| 7-4 | Transport Costs | 217 |
| 8. | Recommendations for Further Detailed Studies .. | 217 |
| 8-1 | Conclusions | 217 |
| 8-2 | Recommendations | 220 |
| 8-2-1 | Roads | 220 |
| 8-2-2 | Railways | 220 |
| Chapter 6 | Port and Harbor Development | 221 |
| 1. | Current Conditions in the Harbors of Southern Peru | 223 |
| 1-1 | Outline of Harbors | 223 |
| 1-1-1 | Matarani Port | 223 |
| 1-1-2 | Ilo Port | 232 |
| 1-2 | Natural Conditions | 239 |
| 1-2-1 | Climate | 239 |
| 1-2-2 | Air Temperature | 239 |
| 1-2-3 | Precipitation | 239 |
| 1-2-4 | Winds | 239 |
| 1-2-5 | Waves | 239 |
| 1-3 | Cargo Handling Costs | 244 |
| 1-3-1 | Matarani Port | 244 |
| 1-3-2 | Ilo Port | 246 |
| 1-4 | Calmness in the Harbors | 248 |
| 1-4-1 | Matarani Port | 248 |
| 1-4-2 | Ilo Port | 249 |
| 1-5 | Littoral Drift | 249 |
| 1-5-1 | Outline of the Southern Coast | 249 |

| | | |
|-----------|--|-----|
| 1-5-2 | Conditions in Matarani Port | 249 |
| 1-5-3 | Ilo Port | 249 |
| 1-6 | Amounts of Cargo Handled | 250 |
| 1-6-1 | Changes in the Amounts of Cargo Handled | 250 |
| 1-6-2 | Shipment of Ore from Matarani Port | 250 |
| 1-7 | Control and Administrative System of Empresa Nacional de Puertos (ENAPU) | 251 |
| 2. | Estimates of Future Cargo Handled at the Ports | 265 |
| 3. | Government Development Plans for the Two Ports. | 265 |
| 3-1 | Matarani Port | 265 |
| 3-2 | Ilo Port | 265 |
| 4. | Increase in Cargo in Conjunction with Mining Development | 265 |
| 5. | Suitability of These Ports for Shipment | 268 |
| 5-1 | Matarani Port | 268 |
| 5-1-1 | Estimates of Future Concentrate Shipments | 268 |
| 5-1-2 | Methods of Transport to the Port | 270 |
| 5-1-3 | Stockyard | 270 |
| 5-1-4 | Belt Conveyor | 270 |
| 5-1-5 | Loading Quaywall | 273 |
| 5-2 | Ilo Port | 273 |
| 5-2-1 | Estimates of Future Concentrate Shipments | 273 |
| 5-2-2 | Transport Route to the Port | 273 |
| 5-2-3 | Stockyard and Belt Conveyor | 273 |
| 5-2-4 | Loading Quaywall | 273 |
| 5-3 | Conclusions | 274 |
| 6. | Recommendations for Further Detailed Studies | 274 |
| Chapter 7 | Geothermal Energy Development | 275 |
| 1. | Introduction | 277 |
| 1-1 | The Project Area | 277 |
| 1-2 | Outline of Survey | 277 |
| 1-3 | Survey Lines for Geophysical Prospecting and Drilling Position | 277 |
| 1-4 | Equipments | 278 |
| 2. | Geology | 278 |
| 2-1 | General Geology | 278 |

| | | |
|-------|---|-----|
| 2-2 | Detailed Description of Geological Features .. | 278 |
| 2-2-1 | Sedimentary Rocks | 281 |
| 2-2-2 | Volcanic Rocks | 281 |
| 2-2-3 | Intrusive Rocks | 282 |
| 2-3 | Geological Structure | 282 |
| 2-4 | Geothermal Showing | 282 |
| 2-4-1 | Rio Jarma Area | 284 |
| 2-4-2 | Macarara Area | 284 |
| 2-4-3 | Quisicollo Area | 284 |
| 2-5 | Core Analysis and the Geological Features of Drill Holes | 284 |
| 2-5-1 | Core Analysis | 284 |
| 2-5-2 | Alteration | 289 |
| 3. | Geophysical Prospecting | 292 |
| 3-1 | Prospecting Method | 292 |
| 3-2 | Analysing Method | 293 |
| 3-3 | Results | 294 |
| 3-3-1 | Trends Observed in the Cross Sections of Apparent Resistivity Distribution | 294 |
| 3-3-2 | Trends Observed in the Apparent Resistivity Plan | 297 |
| 3-3-3 | Trends Observed in the VES Curve | 299 |
| 3-3-4 | Resistivities of Rock and Water | 300 |
| 3-4 | Analysis and Interpretation | 303 |
| 3-4-1 | Analysis | 303 |
| 3-4-2 | The Assumption of Basement Depth | 305 |
| 3-4-3 | Interpretation | 305 |
| 4. | Measurement of Temperatures in Drill Holes ... | 308 |
| 4-1 | Geothermal Survey at the Depth of 20m | 308 |
| 4-1-1 | Measuring Equipment | 308 |
| 4-1-2 | Measuring Method | 309 |
| 4-1-3 | Results | 309 |
| 4-2 | Geothermal Survey at the Depth of 300m | 313 |
| 4-2-1 | Measuring Equipments | 313 |
| 4-2-2 | Measuring Method | 313 |
| 4-2-3 | Results | 313 |
| 4-3 | 300m Depth Temperature Recovery Test | 317 |
| 4-3-1 | Measuring Equipments | 317 |
| 4-3-2 | Measuring Method | 317 |
| 4-3-3 | Results | 317 |

| | | |
|-----------|---|-----|
| 5. | Drilling Work | 320 |
| 5-1 | Outline of Drilling Work | 320 |
| 5-2 | Drilling Work and Rigs Used | 320 |
| 5-3 | Drilling Sites | 325 |
| 5-4 | Preparation for the Work | 325 |
| 5-4-1 | Construction of Roads | 325 |
| 5-4-2 | Transportation of Rigs | 325 |
| 5-4-3 | Construction Work | 331 |
| 5-4-4 | Drilling Water | 331 |
| 5-5 | Drilling Work | 331 |
| 5-6 | Moving and With drawal Work | 334 |
| 6. | Synthetic Analysis | 346 |
| 6-1 | Results of Geological Survey | 346 |
| 6-2 | Results of Geophysical Prospecting | 348 |
| 6-3 | Results of Temperature Within Holes | 350 |
| 6-3-1 | Measurement of Temperatures Within the Drilled Hole (depth 20m) | 350 |
| 6-3-2 | Measurement of Temperatures Within the Drilled Hole (depth 300 m) | 351 |
| 6-3-3 | Results of Recovery Test | 352 |
| 6-4 | Comparison with the Results of Former Survey | 353 |
| 6-5 | Conclusion and Further Work..... | 356 |
| 6-5-1 | Conclusions | 356 |
| 6-5-2 | Prospect for the Future | 357 |
| Chapter 8 | Agricultural Development | 359 |
| 1. | Relation with the Previous Year's Survey | 361 |
| 1-1 | Summary of the Previous Year's Survey | 361 |
| 1-2 | Contents and Methods of this Survey | 362 |
| 2. | Selection of Suitable Areas for Agricultural and Livestock Raising Development | 364 |
| 2-1 | Basic Principles Determining the Project Area. | 364 |
| 2-2 | Outline of the Project Area | 364 |
| 2-3 | Suitable Areas for Agricultural and Livestock Raising Development | 367 |
| 3. | Methods for Introducing Pastures and Selection of Pasture Varieties | 371 |
| 3-1 | Regional Characteristics and Pasture Cultivation | 371 |

| | | |
|-------|--|-----|
| 3-1-1 | Meteorological Conditions | 371 |
| 3-1-2 | Land Conditions | 373 |
| 3-1-3 | Pasture Productivity | 377 |
| 3-2 | Principles and Methods of Pasture Introduction | 381 |
| 3-2-1 | Principles of Pasture Introduction | 381 |
| 3-2-2 | Selection of Pasture Introduction Methods .. | 385 |
| 3-3 | Selection of Varieties for Each Type of Introduction Method | 386 |
| 3-3-1 | Field Irrigation Method | 386 |
| 3-3-2 | Field Method with No Irrigation | 387 |
| 3-3-3 | Grassland Irrigation Method | 389 |
| 3-3-4 | Grassland Method with No Irrigation | 389 |
| 4. | Agricultural Irrigation and Irrigation Development Plan | 389 |
| 4-1 | Regional Characteristics and Irrigation | 389 |
| 4-2 | Irrigation Methods and Cropping Systems..... | 391 |
| 4-3 | Irrigation Techniques and Effects | 392 |
| 4-4 | Irrigation of Grassland | 396 |
| 4-5 | Field Irrigation Plan | 398 |
| 5. | Agricultural Utilization of Terrestrial Heat .. | 404 |
| 5-1 | Regional Development and Geothermal Utilization | 404 |
| 5-2 | Current Conditions of Vegetable and Fruit Distribution..... | 405 |
| 5-2-1 | Interregional Distribution of Vegetables and Fruit | 405 |
| 5-2-2 | Government Guidance Concerning Vegetable Distribution | 407 |
| 5-3 | Comparisons of Vegetable Prices in Each Region | 410 |
| 5-4 | Economical Efficiency of Introduction of Hothouse Farming | 410 |
| 5-4-1 | Procedures and Methods of Economic Investigations | 410 |
| 5-4-2 | Hothouse Cultivation of Vegetables and Cost of Facilities | 412 |
| 5-4-3 | Factors Affecting Economy | 413 |
| 5-4-4 | Comparative Benefits with Bringing Vegetables | 414 |
| 5-5 | Policies Concerning the Introduction of Hothouse Farming | 415 |
| 6. | Recommendations for Further Detailed Studies.. | 416 |

| | | |
|-----|---|-----|
| 6-1 | Actual Understanding of the Management and Economics of Regional Agriculture | 416 |
| 6-2 | Government Assistance and Guidance in Agricultural Development | 416 |
| 6-3 | Trial Cultivation to Select Suitable Varieties of Grazing Grass | 416 |

LIST OF TABLES

| | | |
|-----------|--|----|
| Table 2-1 | The Rate of Economic Growth in Peru (constant price: Base years 1963) | 29 |
| 2-2 | Trend of Long-Term Macro-Economic Indicators (Constant price: Base Year 1973, Rate of change as compared with the previous year) | 30 |
| 2-3 | The Rate of Economic Growth and Related Major Indicators in Most Recent Six Years (Rate of Increase) | 36 |
| 2-4 | The Scale of Government Finance as Compared with G D P | 42 |
| 2-5 | International Comparison of the Scale of the Central Government Finance (The Ratio of current Expenditure Against GDP) | 43 |
| 2-6 | Structure and Growth of Public Investment 1960 - 76 | 46 |
| 2-7 | Public Investment by Project Authorities and Sectors: the Ratio of Composition and the Rate of Growth (1960 - 76) | 48 |
| 2-8 | Ratios of Public Sector Revenue and Expenditure Against GDP 1968-76)..... | 48 |
| Table 3-1 | Evolution of Total Installed Capacity | 67 |
| 3-2 | Annual Power Consumption Classified by Demand Sector (1976) | 71 |
| 3-3 | Examples of Electricity Rates | 72 |
| 3-4 | Electric Power Development Projects (1978 - 84) | 75 |
| 3-5 | Electric Power Development Projects (1985 - 95) | 75 |
| 3-6 | Outline of the 3 Mines | 81 |
| 3-7 | Evolution of Electrical Energy and Maximum Power by Demand Class in the Machu-Picchu System | 82 |
| 3-8 | Supply and Demand in the Macnu-Picchu System ... | 83 |
| 3-9 | Supply and Demand Balance in the Machu-Picchu System | 85 |
| 3-10 | Supply and Demand Balance of the Southern System | 94 |
| 3-11 | Fuel Consumption for Power Generation (for Public Use) (1976) | 99 |

| | | |
|------------|--|-----|
| Table 3-12 | Fuel Consumption for Power Generation (for Private Use) (1976) | 100 |
| 3-13 | Fuel Consumption for Power Generation (Total) (1976) | 101 |
| 3-14 | Average Monthly Discharge and Accumulated Discharge (Salcca River, Vilcanota: c.a.=2,650km ²) | 108 |
| 3-15 | Cost for Expansion of the Machu-Picchu Power Station and Related Facilites | 116 |
| 3-16 | Cost in Case of Purchase of Power (Financial Cost) | 118 |
| 3-17 | Power Cost in Case of Purchase of Power (Economic Cost) | 119 |
| 3-18 | Prices of Fuel and Lubricants | 120 |
| 3-19 | Power Generation Costs in the Case of Diesel Power Generation | 121 |
| 3-20 | Power Cost at Tintaya Mine | 122 |
| 3-21 | Required Construction Costs | 122 |
| | | |
| Table 4-1 | Meteorological Records: Yauri Meteorological Station | 132 |
| 4-2 | Calculation of Runoff Coefficient at Pisac, Vircanota River | 141 |
| 4-3 | Base-Flow Discharge and Runoff Coefficient at Pisac | 140 |
| 4-4 | Measured Runoffs | 143 |
| 4-5 | Drought Water Discharge of a 10-Year Return Period | 145 |
| 4-6 | River Water Quality | 145 |
| 4-7 | Water Requirement for the Proposed Mines | 146 |
| 4-8 | Dimensions on Industrial and Domestic Water- Intake Structures for Coroccohuayco Mine and Construction Costs (as of Oct. 1979) | 152 |
| 4-9 | Dimensions on Industrial Water-Intake Structures for Quechua Mine and Construction Costs (as of Oct. 1979) | 158 |
| 4-10 | Dimensions of Irrigation Structures and Construction Costs | 161 |

| | | |
|-----------|---|-----|
| Table 5-1 | Gauge and Length of Each Line | 169 |
| 5-2 | Lines and Rolling Stock (Dec. 21, 1977) | 170 |
| 5-3 | Reconstruction Plan Materials | 173 |
| 5-4 | Survey of New Line Construction | 174 |
| 5-5 | Tractive Tonnage for Each Type of Locomotive ... | 176 |
| 5-6 | Changes in Freight Transport | 177 |
| 5-7 | Changes in Freight Shipped | 178 |
| 5-8 | Freight Shipped (1977) | 179 |
| 5-9 | Passenger and Baggage Statistics | 179 |
| 5-10 | Line Standards | 180 |
| 5-11 | Rail Standards | 180 |
| 5-12 | Distances Between and Altitudes of Stations Between Matarani and Cuzco | 189 |
| 5-13 | Number of Each Type of Locomotive and Freight Car (as of Oct. 1979) | 194 |
| 5-14 | Number of Kilometers Between Stations..... | 196 |
| 5-15 | Type 2 Railway Freight Charges Between Matarani and Cuzco (per ton)..... | 197 |
| 5-16 | Type 4 Railway Freight Charges Between Matarani and Cuzco (per ton) | 198 |
| 5-17 | International Freight Charges and Rates..... | 199 |
| 5-18 | Passenger Fares Between Matarani and Cuzco | 200 |
| 5-19 | Transport Related Specifications | 201 |
| 5-20 | Annual Changes in Concentrate Transport | 202 |
| 5-21 | Time Required for Transport Between Matarani and Cuzco | 206 |
| 5-22 | Method for Loading Concentrate at Sicuani Station | 207 |
| 5-23 | Number of Freight Cars Required | 209 |
| 5-24 | Truck Operating Costs | 212 |
| 5-25 | Comparison of Highway Construction Costs | 213 |
| 5-26 | Rolling Stock and Equipment Costs in Various Years | 216 |

| | | |
|------------|---|-----|
| Table 5-27 | Road Transport Costs and Railway Freight Charges | 218 |
| 5-28 | Transport Costs (1979 Price) | 219 |
| Table 6-1 | Maximum Air Temperatures | 240 |
| 6-2 | Minimum Air Temperatures | 241 |
| 6-3 | Precipitation | 242 |
| 6-4 | Maximum Wind Velocity | 243 |
| 6-5 | Cargo Handling Costs (Matarani Port) | 244 |
| 6-6 | Cargo Handling Costs (Ilo Port) | 246 |
| 6-7 | Amount of Goods Handled at Matarani Port (Peruvian Goods) | 252 |
| 6-8 | Amount of Goods Handled at Matarani Port (Bolivian Goods) | 253 |
| 6-9 | Amount of Goods Handled at Ilo Port (ENAPU) | 254 |
| 6-10 | Amount of Goods Handled at Ilo Port (Southern Peru Copper Corporation) | 254 |
| 6-11 | Amount Loaded by Belt Conveyor (1975) | 255 |
| 6-12 | Amount Loaded by Belt Conveyor (1976) | 256 |
| 6-13 | Amount Loaded by Belt Conveyor (1977) | 257 |
| 6-14 | Amount Loaded by Belt Conveyor (1978) | 258 |
| 6-15 | Amount Loaded by Belt Conveyor (1979) | 259 |
| 6-16 | Number of Waiting Ships and Simultaneous Arrivals | 260 |
| 6-17 | Increases in Goods | 267 |
| 6-18 | Mining Product Shipments | 268 |
| 6-19 | Estimated Values of Concentrate Shipments | 271 |
| Table 7-1 | Measurement Equipments | 279 |
| 7-2 | Microscopic Observation of This Sections | 291 |
| 7-3 | X-ray Analysis of Clay Minerals | 292 |
| 7-4 | Schlumberger Electrode Configuration | 293 |

| | | |
|-----------|---|-----|
| Table 7-5 | Analysis Flow Chart | 295 |
| 7-6 | List of VES Curve Type | 299 |
| 7-7 | Resistivity of Surface Water | 302 |
| 7-3 | Results and Conditions of Temperature Measurement (IQ-1~IQ-10) | 311 |
| 7-9 | Conditions of Temperature Measurement (IQ-11) .. | 313 |
| 7-10 | Results of Temperature Measurement (IQ-11) | 314 |
| 7-11 | Bottom-hole Temperature in Drilling Work | 316 |
| 7-12 | Conditions of Temperature Recovery Test (IQ-11) | 318 |
| 7-13 | Results of Temperature Recovery Test (IQ-11) ... | 319 |
| 7-14 | Average Temperature Grandient (IQ-11) | 319 |
| 7-15 | Inferred Equilibrium Temperature vs Depth (IQ-11) | 321 |
| 7-16 | Data used for Temperature Recovery Calculation . | 323 |
| 7-17 | Summary Data of Drilling | 324 |
| 7-18 | Machines and Materials for Drilling: L-44 | 326 |
| 7-19 | Consumption Goods for Drilling | 327 |
| 7-20 | Preparation and Moving for Drilling | 329 |
| 7-21 | Time Distribution in Drilling | 334 |
| 7-22 | Respective Data of Drill Hole | 335 |
| 7-23 | Outline of Survey in 1976 | 355 |
| 7-24 | Outline of Survey in 1978 | 356 |
| . | | |
| Table 8-1 | State of Farming Operations by Comunida..... | 368 |
| 8-2 | Agricultural Income of a Medium Size Farmer | 370 |
| 8-3 | Area Comparison Table of Meteorological Conditions..... | 372 |
| 8-4 | Soil Analytical Data | 375 |
| 8-5 | Possible Quantity of Grass Growth Viewed from Temperature and Sunlight Hours | 379 |
| 8-6 | Grazing Days of Milk Cow and Milk Production Per Head in Huancayo | 380 |

| | | |
|-----------|---|-----|
| Table 8-7 | General Description of La Raya Experimental Station | 382 |
| 8-8 | Actual Grass Production by Altitude | 382 |
| 8-9 | Regional Condition and Grass Introduction Methods | 385 |
| 8-10 | Sowing Quantities of Fertilization Quantities of Rye | 387 |
| 8-11 | Irrigation Effect on Natural Grassland under Combination of the Burning and the Fertilization | 397 |
| 8-12 | Vegetation Change of Natural Grassland by Irrigation under Combination of the Burning and the Fertilization | 397 |
| 8-13 | Supply and Demand Plan of Garlic and Onions (1979) | 406 |
| 8-14 | Per Person Consumption of Main Vegetables | 406 |
| 8-15 | An Example of a Price List Designated by the Price Adjustment Committee | 409 |
| 8-16 | Comparison of Vegetables Retail Prices by Area | 411 |

LIST OF FIGURES

| | | |
|------------|--|-----|
| Figure 2-1 | Trend in Investment and Savings (1950-75) | 40 |
| Figure 3-1 | Power Generation by Department (1976) | 60 |
| 3-2 | Plan of Power Generation Facilities in Peru (Including existing facilities) | 69 |
| 3-3 | Power System of Southern Region (existing) ... | 77 |
| 3-4 | Machu-Picchu (Cuzco) Power System | 78 |
| 3-5 | Construction Schedule | 79 |
| 3-6 | Supply and Demand Balance of Machu-Picchu System | 84 |
| 3-7 | Machu-Picchu System kW Balance Estimation Curve | 87 |
| 3-8 | Southern System Interconnection Plan | 90 |
| 3-9 | Interconnection Diagram of the Southern Power System of Peru | 91 |
| 3-10 | Supply and Demand Balance in the South- Western Interconnected Power System | 95 |
| 3-11 | Supply and Demand Balance of the Southern System | 96 |
| 3-12 | Layout of Tintaya Diesel Plant | 103 |
| 3-13 | Hydroenergy Potential of the Southern Region of the Republic of Peru | 107 |
| 3-14 | Runoff Duration Curve of Salcca River | 109 |
| 3-15 | Storage Capacity Curve | 109 |
| 3-16 | Location Map of the Quishuarani Power Station | 111 |
| 3-17 | Mine and Power Development Schedule | 114 |
| 3-18 | Power System Diagram for the Tintaya Mine Area | 117 |
| Figure 4-1 | River System, Discharge Gauging and Water Sampling Points in Project Area | 129 |
| 4-2 | Temperature in Project Area | 131 |

| | | |
|------------|--|-----|
| Figure 4-3 | Precipitation in Project Area | 137 |
| 4-4 | Max. Annual Daily Rainfall | 138 |
| 4-5 | Annual Precipitation Probability | 144 |
| 4-6 | Relative Positions of Mines and Rivers | 149 |
| 4-7 | Rough Water-Intake Plan for Coroccohuayco Mine | 153 |
| 4-8 | Proposed Water-Intake Plan for Quechua Mine | 155 |
| | | |
| Figure 5-1 | Peruvian Railway Network | 168 |
| 5-2 | Organization of the Empresa Nacional de Ferrocarriles | 171 |
| 5-3 | Plans for New Railway Lines | 175 |
| 5-4 | Line Profile | 181 |
| 5-5 | Locomotive Axial Loads and Wheelbases | 183 |
| 5-6 | Rail Structure Standards | 184 |
| 5-7 | Line Plan | 185 |
| 5-8 | Maximum Values of Load Cross Section | 195 |
| 5-9 | Current Transport Routes | 203 |
| 5-10 | Road Conditions a - 3 Route | 210 |
| 5-11 | Road Conditions b - 2 Route | 211 |
| | | |
| Figure 6-1 | Location of Ports in Peru | 223 |
| 6-2 | Location of Matarani Port | 226 |
| 6-3 | Plan of Matarani Port | 227 |
| 6-4 | Cross-section of Matarani Harbor Breakwater | 230 |
| 6-5 | Standard Cross-section of Matarani Port Quaywall (Steel Sheet Pile Cell Type) | 231 |
| 6-6 | Standard Cross-section of Matarani Port Quaywall (Piled Pier Type) | 232 |
| 6-7 | Location of Ilo Port | 233 |
| 6-8 | Plan of Ilo Port | 235 |

| | | |
|------------|--|-----|
| Figure 6-9 | Standard Cross-section of Ilo Port Wharf | 238 |
| 6-10 | Organization Chart of M.T.C. (Central)..... | 260 |
| 6-11 | Organization of ENAPU | 261 |
| 6-12 | Organization of Matarani Port Office | 263 |
| 6-13 | Organization of Ilo Port Office | 264 |
| 6-14 | Changes in Amounts of Cargo Handled | 266 |
| 6-15 | Forecast of Concentrate Shipments Based on Previous Data | 269 |
| | | |
| Figure 7-1 | Location Map of Survey Line and Drilling Holes (Appendix) 1/25,000 | |
| 7-2 | Regional Geological Map of Sicuani-Yauri Area . | 280 |
| 7-3 | Geological Map and Section of Quisicollo Area (Appendix) 1/25,000 | |
| 7-4 | Geothermal Showing in Project Area | 283 |
| 7-5 | Schlumberger Electrode Configuration | 292 |
| 7-6 | Profile on Line A (Appendix) 1/25,000 | |
| 7-7 | Profile on Line B (Appendix) 1/25,000 | |
| 7-8 | Profile on Line C (Appendix) 1/25,000 | |
| 7-9 | AR Map of $\overline{AB}/2 = 250\text{m}$ Level (Appendix) 1/25,000 | |
| 7-10 | AR Map of $\overline{AB}/2 = 500\text{m}$ Level (Appendix) 1/25,000 | |
| 7-11 | Analytical Map in Resistivity (Appendix) 1/25,000 | |
| 7-12 | Equipments of Temperature Measurement | 310 |
| 7-13 | Results of Temperature Measurement | 316 |
| 7-14 | Temperature Gradient Curve (IQ-11) | 316 |
| 7-15 | Bottom-Hole Temperature in Drilling Work..... | 317 |
| 7-16 | Temperature Recovery Test (IQ-11) | 321 |

| | | |
|-------------|--|-----|
| Figure 7-17 | Temperature Recovery Curve (IQ-11) | 322 |
| 7-18 | Panel Diagram (Appendix) 1/25,000 | |
| 7-19 | Integrated Interpretation Map (Appendix) 1/25,000 | |
| Figure 8-1 | Agricultural Development Survey Area | 365 |
| 8-2 | Maximum and Minimum Temperature in Yauri | 384 |
| 8-3 | Transition of Soil Moisture Content During Irrigation Period to Crop Field (Pattern Figure) | 393 |
| 8-4 | Irrigation Water Quantity, and Yield and Quality of Potatoes | 395 |
| 8-5 | Effect on the Yield of Natural Grassland Affected by Duty of Irrigation Water with Annual Nitrogen Fertilization Quantity..... | 399 |
| 8-6 | Showing Water Intake to Irrigation Planned Area. | 401 |
| 8-7 | Cross-Section of Waterway and End Facility | 403 |
| 8-8 | Distribution Channel of Vegetables | 408 |

LIST OF PHOTOS

| | | | |
|-------|-----|--|-----|
| Photo | 3-1 | Condorama Pass, where the transmission line from the South-Western system would cross the mountain range | 102 |
| | 3-2 | Area a long Route 21, Where the transmission line would cross. | 105 |
| | 3-3 | Pampa in the neighbourhood of Imata | 105 |
| | 3-4 | Neighbourhood of Chachani | 105 |
| | | | |
| Photo | 4-1 | Bottleneck at Proposed Salado River Water-Intake Point (Viewed from upstream) | 151 |
| | 4-2 | Confluence of Salado and Ocoruro Rivers | 151 |
| | 4-3 | Prospective Water-Intake Point on Cañipia River (Viewed from upstream) | 157 |
| | 4-4 | Top Soil Layer in Irrigation Site | 160 |
| | | | |
| Photo | 5-1 | Freight Train Stopped at An Intermediate Station | 176 |
| | 5-2 | Signal (Stop Indication) | 192 |
| | 5-3 | Ore Transport Wagon | 195 |
| | 5-4 | Proposed Site of Freight Station (96.5 km Nearer to the Juliaca Starting Point). | 207 |
| | 5-5 | Ore Handling Line at Matarani Station | 208 |
| | | | |
| Photo | 6-1 | Matarani Port | 229 |
| | 6-2 | Ilo Port | 237 |
| | 6-3 | Belt Conveyor at Matarani Port | 272 |
| | | | |
| Photo | 8-1 | Soil Cross Section | 374 |
| | 8-2 | Mixture Sowing Pasture of Alfalfa and Orchard Grass | 388 |
| | 8-3 | Grass Cultivation by Separate Furrow Belt Method | 392 |

| | | | |
|-------|-----|---|-----|
| Photo | 8-4 | Grass Growing along the Waterside near Coroccohuayco | 398 |
| | 8-5 | Greengrocery at Market (Arequipa)..... | 412 |

CHAPTER 1

SUMMARY AND RECOMMENDATIONS

CHAPTER 1 SUMMARY AND RECOMMENDATIONS

1. Background of Survey

In the area of Yauri in Espinar Province, Republic of Peru, the Atalaya copper mine has been in operation since 1970. In addition, several other copper ore deposits have been located which are expected to be developed in future. These include the Tintaya ore deposits (proven ore deposits of 40 million tons, quality 1.76%) owned by Minero Perú, and Coroccohuayco ore deposits (estimated deposits of 7.7 million tons, quality 3.2%). Joint development of these deposits is now being planned by Minero Perú and the Overseas Mineral Resources Development Company of Japan (OMRD). Also found in the area is the Quechua ores deposit (estimated ore deposits of 80 million tons - 100 million tons, quality 0.8%, currently being explored by the Mitsui Mining and Smelting Co., Ltd. of Japan). It should be noted that these ore deposits are all situated within 6-8 km of each other.

The coroccohuayco ore deposits were discovered by the cooperative mineral exploration project provided by the Government of Japan carried out in 1971 and 1973, while the Quechua ore deposits were surveyed during the Japanese Government's overseas geological survey project conducted between 1970 and 1979. With regard to the Tintaya ore deposits, H.A. Simons (International) Ltd. of Canada has already submitted a feasibility study. The Government of Peru intends to establish a mining company by joint contribution of Minero Perú, foreign capital and private enterprises in Peru, and to promote the development of Tintaya at the earliest opportunity.

In this area also, the Geothermal Energy Research and Development Co., Ltd. of Japan carried out a basic survey in 1976 to determine the possibilities for geothermal power generation. The survey, subsidized by the Ministry of International Trade and Industry, found a promising location as a candidate for development.

Against this background, Minero Peru requested Japanese representatives at a conference of the Japan-Peru Joint Committee for the development of Coroccohuayco held in April, 1978 in Lima to formulate an integrated regional development program for the project area, with a view also to development of the Coroccohuayco mine. The Government of the Republic of Peru submitted an official request on this matter to the Government of Japan in July, 1978. In response, the Japanese Government agreed to carry out an integrated regional development survey during fiscal 1978 and 1979.

2. Purpose of Survey

This survey is intended to contribute to improvement of the welfare of residents of this area by setting forth an area development plan including, firstly, the reasonable development of copper ore deposits and geothermal resources in the area and, secondly, the improvement of infrastructures related to the above-mentioned development of mineral and geothermal resources, in compliance with the request of the Government of Peru. Specific objectives of this survey are as follows:

- (i) Survey of present infrastructure conditions related to water resources, transportation, power, telecommunications, and housing which are required for the development of the mining, with a view towards possible development of these infrastructures.
- (ii) Examination, primarily by physical investigation and boring tests, of geothermal power generation development possibilities and development of agriculture and livestock as forms of multi-purpose utilization of geothermal power.
- (iii) Comparative examination of means to improve infrastructures and develop agriculture in such a way as to meet the requirements of a mining development plan.
- (iv) Estimate investment costs required for improvement of infrastructures and development of agriculture.
- (v) Make recommendations for detailed surveys and define items which require further examination.

3. Present Conditions and Problem Areas in the Economy of Peru

3-1 Present Economic Conditions in Peru

At a conference of creditor countries held in Paris at the request of the Government of Peru in November, 1978, rescheduling of foreign debts over a period of three years was approved. The main reason why the Peruvian economy has fallen into difficulty is that Government deficit spending has grown year by year. In 1977, the deficit reached 10% of the GDP. This huge deficit was covered primarily by increasing the supply of money by the central bank. As a result, inflation for 1979 stood at an annual rate of 70% for the second year in a row and import demand was significantly affected. The government came to depend on short-term borrowings of foreign capital, and this caused difficulties

in repayment of foreign debts. On top of this, the economic situation worsened with the deterioration in the trade balance caused by a drop in the price of primary commodities following the oil-crisis in 1973. In particular, non-ferrous metals and fish meal, which were the main export commodities of Peru, were seriously affected. As a result, in fiscal 1978, while the amount of exports was about US\$2 billion, payment of foreign debt principal and interest amounted to an estimated US\$1 billion - debt/service ratio of 50% - and repayment became extremely difficult.

In order to weather these difficulties, the Peruvian Government requested the concerned countries and groups of banks to reschedule the debts. It is also introduced a total demand management policy in May, 1978. Contents of the total demand management policy are as follows:

- (i) A reduction of government expenditure. Especially, the abolition of subsidies on foodstuffs and petroleum products, the improvement of financial positions in public companies and public corporations, and the deferment of public investment plans.
- (ii) An increase in government revenues by revision of the tax system.
- (iii) Restrictions on bank lending and an increase in the reserve requirement ratio of deposits.
- (iv) Gradual devaluation of the exchange rate.

As a result of this policy, the ratio of government deficit against GDP was reduced to the order of about 5% by the end of 1978. At the same time, the trade balance in 1978 recorded a surplus of about US\$400 million, due to recovery of the prices of primary products, the fact that Peru had become a net exporter of petroleum, and a remarkable increase in the export of non-traditional commodities. This favorable balance has continued through 1979, and against this background, the Government of Peru formally decided not to request any further rescheduling of debts from 1980.

As discussed above, circumstances vis-a-vis foreign countries have improved significantly. However, as far as domestic conditions are concerned, consumer prices are rising as a result of the abolishment of subsidies on the necessities of life. In consequence, the level of real wages in 1979, which did not keep pace with increasing consumer prices, have been reduced to about 60% of 1970 levels, and social dissatisfaction of the people is gradually increasing. This is of great concern to the Government and to monetary authorities and, therefore, it is considered that the total demand management policy will be continued in order to control inflation.

Problem areas in the Peruvian economy are as follows: present government authorities have little interest in carrying out long-term planning since it is expected that power will be shifted to a civil administration in August, 1980; there are numerous small political parties and it is difficult to foresee which party will be in control following the shift to civil administration; none of the major political parties have yet clarified their economic policies; in spite of the abolishment of intra-regional custom duties and the fact that introduction of a common duty on products from outside the region is soon to be initiated in accordance with the Andes Common Market Agreement, no positive policies have so far been adopted to foster domestic industry, in particular small- and medium-scale industries, and as a result, due to rapid liberalization, there will exist a high risk of bankruptcy for many domestic enterprises which are now protected by high custom duty, and unemployment will also increase.

Problem areas in the present development policies of the Government of Peru are as follows:

- (i) Development emphasis has been placed on a small number of large public enterprises and investment has been concentrated on these enterprises - during the period from 1968, when the military administration began, to 1976, when financial positions of the Government became aggravated, more than two thirds of the real increase in public investment was concentrated on twelve large enterprises.
- (ii) Out of these twelve, two existed before the start of the military administration, and the remaining ten are directly concerned with production. However, it does not appear that these enterprises were set up on the basis of adequate surveys of economic viability. The majority of them are not operating successfully, in spite of the fact that they have been given investment priorities (a good example is the Majes Irrigation Project which was discussed in last year's report).
- (iii) As examples of success, we may refer to three cases: the modernization of copper refining factories and the rationalization of iron and steel factories and shipyards. However, the majority of large enterprises, including these three cases, are strongly characterized by capital intensive structures and at present cannot be expected to contribute to alleviation of the employment problem which the economy of Peru is now experiencing.
- (iv) Since investment in the production sector has been given too much importance, the weight of investment for improvement of infrastructures

was reduced. Between 1974 and 1976, investment in infrastructure sector was only 15% of total public investment.

- (v) Extremely complicated red tapes at the various levels of planning, budget allocation, execution of projects and control, as well as decision making procedures tend to cause delays. In addition, political considerations receive first priority in many cases, making the complicated appraisal procedures meaningless, and execution and budget control quite difficult.

One of the measures which the Peruvian Government has been carrying out to solve these problems is establishment of eight Regional Development Organizations to develop regions of the country. Special characteristics of these Regional Development Organizations are, firstly, decisive transfer of authority to each Regional Development Organization in order to correct the unfavorable results resulting from excessive centralization of authority in the past. Secondly, since planning organizations and execution organizations were separate and independent and much time was wasted for coordinating planning and execution, and the two stages were not consistent, regional offices of all public enterprises have been consolidated in each Regional Development Organization. Among the measures taken up recently, some seem to have been overdone, e.g., consolidation of utilities enterprises such as power in the Regional Development Organizations. However, each Organization is making an effort to increase agricultural productivity in the remote regions by improvement of basic requirements such as small-scale irrigation and small-scale hydro-power generation, and to encourage the development of agriculture by upgrading the processing industry for livestock products.

Organismo Regional de Desarrollo del Sur Oriente (ORDESO), referred to in last year's report, is one such Regional Development Organization, and responsible for the area covered by this survey. This Organization started operations in 1979 with its own budget and is now preparing a two-year investment plan for 1980 and 1981. Judging from what we have heard from this Organization, the two-year plan is nothing but a list of investment projects. This Organization has jurisdiction over three provinces: Cuzco, Apurimac, and Madre de Dios, with a total area of 180,000 km² or about half the total land area of Japan. The area includes a jungle region on the upper Amazon River drainage and a plateau region in the Andes Range. What we wish for in the future planning of this Organization is the best utilization use of the special characteristics of the regions within its jurisdiction, each of which has quite different characteristics, and a combination of these characteristics in mutually complementary ways. At the same time, we also hope that this Organization will formulate an integrated regional development plan which has a close

functional relationship with the national economy of Peru. We would be more than happy if this report served as one measure in this direction.

3-2 Economic Characteristics of the Project Area

The survey conducted last year covered the entire Espinar Province wherein are located copper ore deposits and a prospective site for geothermal development. Since this Province has a total area of 4,418 km², this year's survey was limited to the valley which encompassed all prospective mining and geothermal development. The survey covered the up-stream regions of the Salado River to a point where the Apurimac River meets Salado River, about 10 km north of Yauri City.

Within this area of approx. 2,000 km², representing a little more than half of Espinar Province, are the five towns and villages of Yauri, Tocroyo, Ocoruro, Condorama and Pichigua. All three prospective mining development sites, the Atalaya copper mine and the prospective site for geothermal development at Quisicollo are in the area. The only modern industry in operation at present is the Atalaya mine and more than three-fourths of the population, including side-work farmers, is supported by the agriculture and livestock industries, which are still under-developed. Apart from these industries, there exist some traditional manufacturing, a transportation industry, and some service industries such as commerce.

As to the climatic conditions of the area, the annual average temperature is about 8°C while the lowest temperature of the year is around minus 10°C and, therefore, agriculture is difficult. The main agricultural products cultivated here are an original species of potatoes (Papa Amarga), such cereals as Cañihua and Quinoa and Onions, which can be cultivated at low temperatures. These agricultural products are grown during a short rainy season and are mainly for domestic consumption. The main cash source for farmers is the sale of llama, alpaca, and such livestock products as meat and wool. Livestock is done by way of pasturing and is dependent on natural grasses only. Land as well as labor productivity in livestock are both extremely low.

The project area is located so as to make utilization of such main transportation means as the trunkroad connecting Cuzco, Sicuani, Juliaca, Puno, Arequipa and Matarani and the railways difficult. Since the area is located at an altitude of about 4,000 m, improvement of roads has been retarded and, particularly during the rainy season, transportation is almost completely cut off. Therefore, transportation costs are generally high and the fresh food-stuffs and gasoline brought into this area from Cuzco, Arequipa and Puno are generally expensive. Gasoline, which costs 200 soles per gallon in Cuzco for example, costs 230, soles per gallon in Yauri.

As far as power supply is concerned, there are diesel and small-scale hydro-power generation facilities in Yauri where the provincial office is located, and the majority of residents in the area are not supplied with electricity. For illumination, candles and petroleum lamps are normally used, while for heating and cooking, kerosene and dried animal dung are used.

During our field surveys, a household survey was carried out. The typical regional middle-class individual seems to be a middle-class farmer who cultivates an average of 4 ha of land and breeds 5 cows, 50 sheep and 15 llamas. (refer to Chapter 8, 2-3, "Appropriate Site for Agricultural and Stockbreeding Development" and Table 8-2 of the same chapter, "Agricultural Income of Middle-Class Farmers").

As shown in the following table, the balance of household accounts for this year of this farmer indicates a deficit of about 80,000 soles. However, this deficit was due to the purchase of a motorized-bicycle. If the expenditure for this durable consumer product were excluded, the household account would have shown a surplus of about 90,000 soles. The amount of this surplus is nearly equal to "Other revenue". This other revenue was derived from work as a caretaker at the Coroccohuayco mining camp. However, there are very few opportunities for the average farmer to obtain such cash revenue in the project area, and therefore, in determining the economic conditions of the average farmer, we may just take up agricultural income. This income is nearly equal to the total expenditure minus the cost of purchasing consumer durable goods, i.e., a little more than 290,000 soles. This means that if there is no "other revenue", we can see very clearly that the ratio of expenditures for food to total expenditures, the Engel Coefficient, is quite high. This ratio is over 72% and is higher than the national average for India in fiscal 1960 (70%). According to the results of a household survey conducted in Peru in 1971 and 1972, the national average Engel Coefficient was 48.2%, while the average in the agricultural zone of Northern Sierra, where the standard of living is particularly low, was 67%. Therefore, it is obvious that the present economic standard of the residents in the project area is lower than the average standard in the agricultural area of Northern Sierra was in 1971 and 1972. For reference, we would like to show the results of household survey conducted in 1967 and 1968 in Sudan. The Engel coefficient of more than 72% shown in the household survey in the Sudan corresponds closely to the lowest income group in Peru's urban area and the lower-middle income group in the rural area.

Secondly, out of expenditures for foodstuffs, the domestically produced portion represents 51.5% of the total, showing that more than half of all food is produced at home. As regards agricultural income, nearly 90% is obtained as livestock revenue. Agricultural revenue, the remaining portion, represents a little more than 10%, out of which more than 90% is consumed at home.

Survey of Household Accounts of Middle-Class Farmer in the Project Area

| A. Annual Revenue | | B. Annual Expenditure | |
|-------------------|---|-----------------------|----------------|
| (Unit: Soles) | | | |
| 1. | Agricultural Income | 296,400 | |
| | (1) Agricultural Revenue | 34,400 | |
| | Out of which (Sales Proceeds) | (2,400) | |
| | (Domestic Consumption) | (32,000) | |
| | (2) Livestock Revenue (Note) | 262,000 | |
| | Out of which (Sales Proceeds) | (181,000) | |
| | (Domestic Consumption) (Note) | (81,000) | |
| 2. | Other Revenue | 88,200 | |
| | <u>Total</u> | <u>384,600</u> | |
| | <u>(Revenue) - (Expenditure)</u> | <u>-78,700</u> | |
| | | | |
| | 1. Food | | 211,600 |
| | Out of which (Domestic Production) | | 109,000 |
| | (Purchase from Market) | | 102,600 |
| | 2. Agricultural Expenditure | | 5,400 |
| | 3. Clothing | | 20,000 |
| | 4. Lighting & Fuel | | 21,600 |
| | 5. Repairs to House | | 900 |
| | 6. Purchase of Consumer durable Goods (Motorized-bicycle) | | 170,000 |
| | 7. Transportation Cost | | 3,000 |
| | 8. Educational Cost | | 2,700 |
| | 9. Culture and Pleasure | | 1,500 |
| | 10. Medical Cost | | 1,500 |
| | 11. Sundries | | 21,100 |
| | 12. Social Expenses (Note) | | 4,900 |
| | <u>Total</u> | | <u>463,300</u> |

(Note) The difference between this table and Table 8-2 is due to the addition of the cost of one sheep (4,000 soles) which was spent as a social expense (a wedding gift) into livestock revenue.

From the above findings, we can conclude that the standard of living of residents in the project area is extremely poor. The per capita annual production, including the domestically produced portion, converted by the price level as of the middle of October, 1979 was around 60,000 soles (a little less than US\$250).

Many of the younger residents of the project area move to urban areas in order to earn cash revenue, while some leave the area as temporary seasonal laborers. The number of these people reaches about 10 to 20% of the population. As indicated in the above household survey, agricultural income can only support the lowest subsistence level, and no surplus remains for savings. Therefore, residents must earn extra-agricultural revenue if they wish to purchase such consumer goods as bicycles, motorcycles, transistor radios, etc.

We also conducted a survey on procurement of required commodities for everyday life of the laborers at the Katanga mine in Arequipa. We should mention here that the survey showed that there were almost no commodities which could be procured except meat in this area.

In developing the mines, it is desirable to improve infrastructures which would directly contribute to the welfare of residents of the project area, irrespective of the convenience to the mines themselves. Study of mine developments in the past indicates that a large difference in income levels is created between people directly involved to the mining industry and those who are not. In order to correct this imbalance in income levels, it is necessary to increase the

productivity of livestock and agriculture industries upon which the residents of the project area depend. This Mission wishes to propose a integrated regional development program which combines mine development, improvement of infrastructures, and improvement of productivity in livestock and agriculture.

4. Summary and Recommendations by Sector

4-1 Mining Sector

As mentioned in the "Background of Survey" above, Minero Peru intends to put first priority on development of the Tintaya copper ore deposits, which are at present in the most advanced stage of preparations. However, this Mission Proposes a general development program which allows for development of three mines simultaneously, instead of development of the Tintaya mine alone first, for the following reasons:

- (i) The quantity of ore deposits have not been ascertained as had first been anticipated.
- (ii) The Coroccohuayco and Quechua ores deposits are quite near to the Tintaya deposits, the three being 6 to 8 km from each other.
- (iii) The quantity and quality of these three ore deposits are complementary.

It should also be added that improvement of infrastructures related to the development of the mines can be carried out far more economically if done for common use by the three mines rather than developing independent infrastructures for each individual mine. For the same reason, we also propose, as was proposed in last year's report, the concentration of ore of the same quality in a common ore dressing plant and operation of workshops and repair shops for common use by the three mines.

4-2 Infrastructure Sector

4-2-1 Establishment of Basic Elements for Infrastructure Development Study

Basic Elements for Study

For the three mines mentioned above, there are numerous elements of uncertainty concerning the start-up times and the scale of operations for each mine, since plans are still in a preliminary stage. Under the circumstances, the Mission, after close consultation with Minero Peru and other related enterprises, decided on basic elements for formulation of the scale of the infrastructure program and such items as the scale of operations, the quantity of refined ore, materials, fuels, etc. to be transported, annual power and water requirements, number of employees, and the life of mines. These items are shown in the following table.

FUNDAMENTALS FOR THE INFRASTRUCTURE DEVELOPMENT

| | <u>1</u> Atalaya | <u>2</u> Tintaya | <u>3</u> Corocchohuayco | <u>4</u> Quechua | Note |
|--|---------------------|--|----------------------------|---------------------|-------------------------------|
| <u>Mining Method</u> | Pit Mining | Combination of Open-pit Mining and Pit Mining | Pit Mining | Open-pit Mining | |
| <u>Scale of Operations</u> (ton/day) | 450 | 8,000 | 1,000 | 8,000 | |
| <u>Transportation Quantity</u> (ton/year) | 12,200 | 212,000 | 28,500 | 141,000 | |
| Refined Ore (ton/year) | 9,600 | 152,000 | 20,000 | 92,000 | |
| Materials (ton/year) | 1,000 | 15,000 | 2,500 | 15,000 | |
| Fuels (ton/year) | 1,600 | 45,000 | 6,000 | 34,000 | |
| <u>Machinery and Tools for Construction</u> (ton) | - | 50,000 | 5,000 | 30,000 | Max. unit ø3m, 20 t. |
| <u>Power Generation</u> (kW) | 1,675 | 15,000 | 5,200 | 15,000 | Constant use ≅ x 0.75 |
| <u>Power Required Annually</u> (MWh) | 6,000 | 90,000 | 20,000 | 68,000 | |
| <u>Water Required</u> (ton/day) | 1,500 | 8,800 | 3,000 | 12,500 | Includes only New Water |
| For Industry (ton/day) | 1,000 | 7,000 | 2,000 | 11,300 | |
| For Human Life (ton/day) | 500 | 1,800 | 1,000 | 1,200 | |
| <u>Employment</u> (men) | 262 | 900 | 600 | 650 | |
| <u>Life of Mine</u> (years) | 8 | 15 | 15 | 15 | |

Mines Operations Program

The start-up time for operations at each mine has yet to be decided. However, the Mission, after close consultation with those involved with mining, decided upon an annual operations program as indicated below.

(Unit: 1,000 tons)

| | 1979 | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 |
|---------------------|------|-----|-----|---------|-----|--------|-----|---------|--------|---------|-----|--------|-----|
| Tintaya | | | | <-----> | 152 | | | | | | | | |
| (New) Coroccohuayco | | | | | | | | <-----> | 20 | | | | |
| Quechua | | | | | | | | | | <-----> | 92 | | |
| (Existing) Atalaya | 9.60 | | | | | | | | | | | | |
| Total: | 9.60 | | | | | 161.60 | | | 181.60 | | | 273.60 | |

(Note) <----> Construction Period
----- Operation Period

In addition, in the implementation stages of mine development, it is necessary to formulate annual infrastructure construction schedules so that the necessary infrastructure can be in place by the start-up date for mine operations at each site, after taking into consideration the relationships between the undertaking of work at the mines themselves and the construction of infrastructures proposed in both the reports for the last and this fiscal year.

4-2-2 Power Development

As far as power supply in the project area is concerned, at present Atalaya mine has its own diesel generation facilities and plans call for Tintaya mine to also have its own diesel generators. However, assuming that Coroccohuayco mine and Quechua mine will be developed in the near future, it would be more economical to establish a single source of power for common use by the four mines.

The following five methods can be considered for this purpose:

- (i) Increase power generation capacity (69.9 MW) at the Machu-Picchu Power Station planned by the Ministerio de Energia y Minas and extend transmission lines (138 kV, 308 km) to Tintaya mine.
- (ii) In the southern part of Arequipa Department, phase I construction of a large-scale regional development program focusing primarily on agricultural development (the Majes Project) is in progress. In the Majes Project construction, two power stations, Lluta Power Generation Station (274 MW) and Lluclla Power Generation Station (382 MW), are planned. Power can be supplied to the mines by building transmission lines (150 km - 170 km) from either of these two power stations.

- (iii) A diesel power generator with a capacity of 5,350 kW can be set up at Tintaya mine, as this mine is expected to begin operations earliest. This generator could supply power by transmission lines (66 kV) to each of the other mines.
- (iv) The Rio Jaruma and Macalala areas where geothermal surveys were carried out are, together with Quisicollo, which was surveyed previously, potential locations for geothermal power generation on a scale of more than 30 MW. If the existence of high temperature geothermal fluids can be ascertained, construction of a geothermal power generation station and supply of power by means of 66 kV transmission lines to each mine is possible.
- (v) Construction of a hydroelectric generation station for power supply to the mines. Two alternative plans can be implemented: (a) construction of a dam at the exit of Langui y Layo Lake, 15 km south of Sicuani, a power generation station down-stream of the dam and transmission lines (138 kV, 70 km) to each mine; or (b) construction of a multi-purpose dam for power generation, irrigation and drinking water supply in the valley about 2 km north of Yauri, at the confluence of the Apurimac and Salado Rivers, both of which flow near the mines.

This year the Mission carried out a comparative examination of the five alternatives as a follow-up to the study carried out last year. Conclusions are as follows:

- (i) Based on the cumulative results of two years of geothermal survey, it is concluded, quite regrettably, that the economic viability of geothermal power generation is extremely low.
- (ii) Based on this conclusion, the Mission this year carried out a comparative examination of two other possibilities, namely the purchase of necessary power from the Machu-Picchu power system, and the construction of diesel power generation facilities for Tintaya mine.

Evaluation of power supply to the copper mines was based on economic calculations as well as financial costs necessary for supplying the required quantity of power for mining operations. It was found that economic as well as financial costs are lowest if power is purchased from the Machu-Picchu power system. Therefore, as a method for supply of power to the mines, use of Machu-Picchu power is the more advantageous. However, construction of additional power generation facilities cannot be completed by the time the Tintaya mine goes into operation at the beginning of 1983. Tintaya mine must, therefore, establish its own diesel power generation facilities for supply of power for the two years

up to the end of 1984, when the additional power generation capacity will be available. Therefore, higher mine operating costs are unavoidable.

4-2-3 Water Resources Development

Generally speaking, the project area is abundant in water resources, and there exist adequate resource to meet water demand for the development of mining both from technical as well as economic points of view.

(1) Industrial Water

Almost all industrial water demand of copper mines is for ores dressing. This estimated water demand for the three mines is 20,300 m³/day. The river which can meet the demand for this quantity of water is the Salado River, of which drought discharge over a ten-year return period is 40,000 m³/day. When the common ore dressing facility is established, it will be desirable to draw water from the Salado River. However, if an unexpected accident occurs with the joint water supply facilities for the three mines, the effects would bear on all three mines at the same time. Therefore we would like to recommend establishment of a fixed weir strong enough to withstand even abnormal flooding and installation of more than one pump and water pipe.

(2) Drinking Water

If a mining town is established jointly for the two mines in the hilly area on the left bank of the Salado River and situated about between Tintaya and Coroccohuayco Mines as proposed, the water quality of the Salado River is not sufficient for drinking. It would be more appropriate to draw water from the Ocoruro River, which shows better water quality.

As for the third mine, Quechua Mine, it is appropriate to draw water from the Allahualla River which flows along side the mine and which is quite pure. The basic flow of water, however, can only meet about half of the water requirements for drinking and, therefore, the remaining half must be supplied by wells in the neighborhood of the mine's residential area.

(3) Irrigation Water

The water remaining after being used for concentration can normally be used for irrigation purposes. The results of examination of quality and quantity of the water, however, show that only Ocoruro River water can be used for irrigation. Land where such irrigation is possible is found in the Pampa Canlli area on the left bank of Salado River, where it is possible to carry out open-channel gravity water feed from the Ocoruro River. The area consists of about 500 ha

and at present cultivation is done with rain water. As for the point for drawing the irrigation water, the left bank immediately up-stream of the confluence of the Ocoruro and Salado Rivers is appropriate. A part from the Pampa Canlli area, the Pallpatamayo River area and the Apurimac River area also presents possibilities and further survey at these two places should be carried out.

(4) Water Rights

We proposed in the above to draw water from the Salado River for joint industrial use by the three mines. The required water demand of the three mines is only about 50% of the basic flow of the river. Moreover, in an area of about 40 km around where the Salado and Apurimac Rivers meet, there is no place where water from the Salado River is used for irrigation, due to its quality. Therefore, no water rights problem should arise with residents in the down-stream area.

4-2-4 Housing

At present, plans call for establishment of individual mining towns for each mine. However, since the four mines are located so close together, development of a single common mining town is more economical. We therefore wish to propose a method for development of a common mining town. However, transportation between Tintaya and Quechua and between Coroccohuayco and Quechua is rather inconvenient due to the steepness of the intervening mountains, about 4,700 m above sea level. On the other hand, Tintaya and Coroccohuayco can be connected rather easily via Ruta Departmental 104. Therefore, it is desirable that at least the development of residences for Tintaya and Coroccohuayco mine employees be unified.

As a suitable site for construction of a common mining town for Tintaya and Coroccohuayco mines we propose a hilly area on the left bank of the Salado River located approximately halfway between the two mines. The location is gently sloping and the ground is suitable for construction of residences. Drinking water is convenient. If this site is chosen, the distance to each mine would be approximately 12 km.

When the joint mining town for the two mines is completely developed, the scale would be as follows: total population of approx. 3,100, including mine employees, their families and those working in service industries; number of residential houses supplied totalling be 1,350, capable of accommodating 5,400 people; total town area of approx. 100 ha. The development of this mining town would result in creation of a population center nearly double that of Yauri, the province seat.

4-2-5 Determination of Transportation Route
(Port and Habor, Road, Railway)

To begin construction and operation of the mines, it will become necessary to transport large quantities of construction material as well as refined ore, fuels, materials, machinery and tools. Atalaya mine, which is operating at present, makes use of road transportation between the mine and Sicuani (length of road: 128 km) for transportation of ore concentrate and railway transportation from Sicuani to Matarani. The Mission studies various combinations of transportation means last year from the standpoint of developing the three mines consecutively. At the same time, the Mission also examined the question of whether use of Matarani Port, presently in use, is appropriate for export of concentrate. What we have taken into consideration in this examination is that the transportation route should be not only most appropriate for mining industries, but at the same time should have maximum effect on area development by construction of a road.

After taking into consideration all these factors, the Mission recommends the following;

(1) Port of Export for Concentrate

The Mission considers Matarani Port, now being used as an export port, to be more appropriate than Ilo Port, examined by the Mission as an alternative. Reasons are as follows:

Inland transportation costs are cheaper for Matarani Port since it is nearer to the mine than Ilo Port. In addition, the existing facilities at Matarani Port, e.g., stockyard, belt conveyor, wharves, etc., meet requirements for future increases in handling, both in terms of quantity and duration.

On the other hand, at the Empresa Nacional de Puertos pier at Ilo Port, they have no experience in handling mineral products, and there are no facilities for bulk loading of concentrate. Substantial investment would be required, therefore, to prepare facilities for this purpose.

Judging from present conditions at these two ports, we consider Matarani Port to be the best port for export of concentrate produced by the three mines. Ilo Port can be considered as an alternative in case something unexpected should occur at Matarani Port in future.

(2) Road Transportation

The road (128 km in length) from Atalaya mine to Sicuani which is presently used for transportation of concentrate passes through extended mountainous areas and therefore must skirt many geographical barriers. In addition, some road widening work will be required, as we feel that the

present road is not adequate for transportation of larger quantities. We carried out comparative examination of several other candidate routes for a new road taking into consideration such factors as construction costs, operating costs for trucks, technological problems for road improvement, future maintenance and control problems, impact on area development along the route, etc. As a result of the examination, the Mission concluded that two routes are most appropriate for development as future transport routes and we wish to propose their development.

- (a) If only road transport is used: Mines - Sibayo - Arequipa - Matarani Port (283 km)
- (b) If road and rail transport are combined: Mines - Ayaviri (95 km, thereafter, rail transport)

Let us compare the merits and demerits of the above two means of transportation. Route (a) has the following merits: (i) time required for transportation between the project area and the sea-coast will be considerably shortened; (ii) along this route, the large-scale Majes agricultural development Project is now in progress and many villages and mines are also located in the area. There are, therefore, numerous benefits which would be derived from the easier communication with the area. On the other hand, there are many difficult construction points, and the development cost for transportation route (a) would be more than three times the cost for route (b). Therefore, although we propose construction of route (b), namely a combination of road and railway transportation, we believe it will become necessary to gradually develop route (a), since it will become necessary to have another transportation route to fall back on in case of accident, heavy snowfall or other unexpected incident.

(3) Railway Transportation

From the viewpoint of railway transportation, we consider utilization of the Ayaviri route more beneficial than use of the existing Sicuani route. The reasons are firstly, that there is a very steep 4.9% grade on the route between Sicuani and Ayaviri and secondly, because the Ayaviri route displays an advantage in length of approx. 15% in comparison with the Sicuani route. Problem areas remaining for future consideration are as follows: Ferrocarril del Sur is now examining a railway rehabilitation program, including replacement of old rolling stock and facilities, to meet expected demand in 1990. However, transportation of copper ore and heavy oil for power generation is not included in this program. We believe that the volume of transportation resulting from copper mine development will reach approx. 50% of the total quantity of transportation now being planned by Ferrocarril del Sur. Therefore, it will be necessary to secure the required amount of rolling stock (at maximum period, 66 cars will be required), locomotives (4 will be required) and tank cars (7 will be required), as well as construct a

short-cut line at the entrance of Juliaca Station and a new station especially for freight at Ayaviri, since there is no room for expansion at the present station there. Therefore, complete liaison and consultation is required between Minero Perú and Ferrocarril del Sur on these points.

4-3 Geothermal Energy Sector

Geothermal showing at this area is genetically related to the N-S fault especially the meeting point with the E-W fault and ascending from the depth through faults. Its geothermal source is due to the newest volcanic activity at this area along the N-S fault and seems to originate in its igneous activity at the depth.

In the geophysical survey, though the low resistivity zone is distributed near the land surface, such a low resistivity where the existence of large-scale geothermal reservoir can be assumed is not detected.

On the other, around the measurement stations 16 - 18 on the A survey line a narrow low resistivity structure ranging from the intermediate part of high resistivity structure up to its depth is assumed.

The position of this low resistivity showing corresponds to the part of N-S fault closely connected with the geothermal showing at this area.

According to the geological survey, as the N-S fault is affected by the argillization corresponding to peripheral portion of alteration, it is assumable that it approaches the central portion of alteration with depth.

When this low resistivity is brought about from the markedly thermally altered part, formed along the N-S fault, it is assumable that the more highly altered zone and the geothermal activity exist at the depth.

Its potentiality may be compared with the heat radiation 66×10^7 Cal/min, assumed from the former survey, namely heat energy index of class V.

From the geological and geophysical surveys, however, this geothermal showing are judged to come from considerably deep part and such geothermal resources having been developed in the world are difficult to extract at this area. As above mentioned, the existence of geothermal source and possible reservoir are expected at considerably deep point.

So if the survey of geothermal resources at this area will be carried further on, it is necessary to make clear the nature of low resistivity zones at the lower part of thick high resistivity layer and within the high resistivity zone, ranging from the intermediate to deep parts and then pilot drilling at least at the depth 1000 m and more around the station 18 on the A survey line.

4-4 Agriculture and Livestock Sector

We wish to propose the following plan for improving the extremely low productivity of agriculture and livestock in the project area.

4-4-1 Selection of Appropriate Place

In selection of the best place for development of agriculture and livestock in the project area, priority must be given to minimizing the burden on beneficiary farmers. We therefore wish to propose starting with small-scale pilot farms which have favorable land conditions for successful development. We propose, for the time being, to start the program with a total area of about 1,000 ha, out of which 500 ha are irrigated farm land and 500 ha are grass land which would be improved by the program. As far as the place for the pilot farms is concerned, an area on the left bank of the Salado River downstream from the confluence of the Ocoruro and Salado Rivers for the irrigated farm, and two places on a plateau on the right bank of the Ocoruro River for improved grass land, appear most suitable.

4-4-2 Method for Introduction of Pasture and Selection of Kind of Pastures

In the selection of a place in the project area for introduction of pasture, there are two main factors to be considered: soil conditions and hydro-conditions. At sites where land conditions are suitable, pasture using a farm method can be introduced and at sites where water is readily available, grass can be introduced using an irrigation method. By studying land conditions and water availability, we have worked out the following grass introduction methods.

| | | Water Facilities | |
|--------------------|-------------|------------------------|-------------------------------|
| | | <u>Good</u> | <u>Bad</u> |
| Land Conditions | <u>Good</u> | Irrigated farm method | Non-irrigated farm method |
| | <u>Bad</u> | Irrigated grass method | Non-irrigated grass method |

The type of grass for pasturing should be suitable for cold regions from the viewpoint of climatic characteristics of the project area. There are many species of pasture grass which are suitable for the above-mentioned methods of cultivation. However, results of experiments, research in the project area and consideration of the strength (or weakness) of various grasses against drought, suggest that grasses of the following kinds are particularly suited for cultivation in this area.

(1) Irrigation Farming Method

Mixed planting of rye and clover. As far as rye in concerned, it is desirable to plant mainly perennial rye, partially mixed with Italian rye. As for clover, mainly white clover should be planted, mixed partly with red clover.

(2) Non-irrigated Farming Method

Alfalfa

(3) Irrigated Grass Method

White clover, followed by red clover and alfalfa.

(4) Non-irrigated Grass Method

White clover

4-4-3 Irrigation Program

(1) Irrigation of Grasslands

The number of rainy days in the project area is relatively small even during the rainy season and, therefore, irrigation of grassland in the project area would have considerable effect on growth even during the rainy season. The results of experiments at the La Raya experimental farm showed also that irrigation has a very large effect. For irrigation of grassland, the surface irrigation method must be employed. Irrigation over the entire grass area using a combination of contour line irrigation and obstruction irrigation in addition to natural irrigation is desirable.

(2) Irrigation of Farm Land

Examination of this problem was carried out on the assumption that the initial area to be developed was approximately 500 ha. Water will be taken from the Ocoruro River, and a reservoir constructed at a point just before the confluence with the Salado River. A canal will be constructed along a road leading from the point where water is drawn to Yauri City. The canal will be constructed of concrete using a trapezoidal cross sectional shape.

4-4-4 Agricultural Use of Geothermal Energy

Agricultural development utilizing geothermal energy is not necessarily economical, due to the special circumstances in Peru described below and to the topographical conditions of the project area even when surplus heat from geothermal power generation can be obtained free of cost.

- (i) Since gardening with proper facilities does not at present exist at all in Peru, investment costs for facilities would be comparatively high.
- (ii) In Peru, production of vegetables is possible year round in coastal regions, mountainous areas and in the vicinity of the Amazon, the supply of vegetables from these three regions being mutually complementary.
- (iii) In the project area, almost no vegetable cultivation is carried out at present. However, when irrigation farming has been developed, the possibility of vegetable production may arise.
- (iv) Transportation conditions in the project area are extremely poor at present. However, as the development of roads progresses, it will be possible to reduce transportation costs for vegetables from other areas.

5. Recommendations

5-1 Estimated Investment Amounts^{1/}

5-1-1 Infrastructure Sector

| | | | |
|--------------|----------------------------|--------------|-----------|
| <u>Power</u> | New construction of diesel | | |
| | power generation station | 15,900 | US\$1,000 |
| | Procurement of power from | | |
| | Electro Peru | <u>2,650</u> | " |
| | Sub-total | 18,550 | " |

Water resources^{2/}

| | | | |
|--|--|-----------|-----------|
| | Dam at the Salado River for industrial | | |
| | Use | 115 | US\$1,000 |
| | Dam at the Ocoruro River for everyday | | |
| | Water use | <u>48</u> | " |
| | Sub-total | 163 | " |

Mining city

| | | | |
|--|--|--------|-----------|
| | Construction of common mining city for | | |
| | Tintaya and Coroccohuayco | | |
| | Mines | 18,833 | US\$1,000 |
| | (Including additional | | |

Notes:

1/ In October, 1979 prices.

2/ Excluding costs for water pump and piping because location of common ore dressing place is not yet decided.

construction cost required during the three to four years after the beginning of operations of mines)

Transportation

Port & Harbor No need of investment for development or improvement as long as Matarani Port is used.

| | | |
|------------------------------------|--------|-----------|
| Road A-Mines - Matarani | 16,953 | US\$1,000 |
| B-Mines - Ayaviri | 4,617 | " |
| Sub-total | 21,570 | " |
| Railway Locomotive (4 loco.) | 3,520 | US\$1,000 |
| Tank rolling stock (7 tanks) | 420 | " |
| Uncovered rolling stock (4 wagons) | 3,432 | " |
| Shortcut line | 270 | " |
| Freight station | 600 | " |
| Sub-total | 8,242 | " |
| Grand Total | 67,358 | US\$1,000 |

5-1-2 Agriculture Sector

| | | |
|------------------|-----|-----------|
| Water Intake Dam | 46 | US\$1,000 |
| Channel | 92 | " |
| Total | 138 | " |

5-2 Evaluation

Evaluation for selection of the most appropriate development and improvement plan for each infrastructure has been made in the respective sections of this report. Economic effects which may be brought about by development of the three mines and by improvement of related infrastructures in the project area under this survey are as follows.

(1) Effect on Balance of Payments

When production of concentrate is at the maximum, concentrate exports will be approx. 264,000 tons. Foreign exchange earnings of approximately US\$170 million (at October 1979 prices) annually can be expected.

(2) Effect on Government Revenue

The total amount of sales tax, royalty, corporate tax, mine-lot tax, tax on remittance of interest, and tax on dividends, constitutes about 15% of the sales proceeds. Therefore, by development of the three mines, additional tax revenues of approximately US\$25.5 million annually can be expected.

(3) Effect of Employment

The expected effects on the economy of the region after the three mines in the project area are developed can be summarized as follows:

- (i) With development of the mines, demand for local unskilled labor will increase to some extent. Out of an estimated 2,150 employees required for these mines, local employment is estimated at about 10%, judging from studies of other already-developed mines (refer to Chapter 6 of the Phase 1 report). The scale of local employment will be less than 1% of the estimated population of the project area (about 28,000). It is thus estimated that those employed in these mines will constitute about 3% of the total male labor population of the project area. Therefore, we can say that the effect of direct employment on the project area as a result of mine development will not be very large.
- (ii) On the other hand, if the approx. 7,700 people involved in the development of the mines (mine employees and their families) settle the area from outside of the region, this means that an influx twice as large as the population of Yauri city will flow into the project area. In addition, service industry businesses would be needed to meet demands of the mine-related population, providing further employment. Judging from observation of already-developed mines, the size of the population involved in such service industry work could reach about 30% of the population directly working for the mines. This means that these populations would comprise about 8% of the estimated total population of the project area. It is not clear what portion of the service-related population can be drawn locally as a result of mine development since no information is available in this regard for the developed mines. However, on the basis of an educated guess that about 60% of the service-related population can be supplied locally, indirect employment effects as a result of mine development would be about 5% of the resident population of the project area.

(iii) As mentioned earlier, approx. 10 to 20% (primarily young people) of the estimated population of the project area move to urban areas seeking cash revenue, or leave the area temporarily as seasonal agricultural laborers. If the three mines are developed in the project area, the employment opportunities both directly and indirectly related to the mines would be created and between 30 and 60% of the people who have been leaving the area in search of work could find employment and remain. Thus, the development of three mines would also have a considerable effect in reducing excessive concentration of people in the large cities (Lima City, in particular) which is a growing problem in Peru, and halt the growth of slum areas in these cities.

(4) Transportation costs for the necessities of life, which are higher by 10-20% in the project area than in Cuzco and Arequipa, can be improved through improvement of transportation.

(5) Also, an increase in the productivity of agriculture and livestock in the project area by improvement of pasture and the introduction of irrigation can be expected.

5-3 Conclusion

As mentioned earlier in this report, the standard of living in the project area is extremely low. Since there are three promising ore deposits in the area, special consideration should be given to increasing both the direct and indirect employment effects of the area by development of mining. It is desirable to develop these three mines together, instead of developing them individually. Improvements in mine-related infrastructures which can be used jointly by the three mines should also be carried out so that the cumulative effect of these infrastructures can be increased. Moreover, improvement should be carried out not merely for the convenience of the mines but also in the direction of increased area development effect. Residents of the project area indicated to the Mission that they most strongly desired improvement of roads and bridges, followed by development and improvement of power and water supply systems. At present, the prices of necessary goods for everyday life in the area are from 10 to 20% higher than prices in Cuzco City or Arequipa City due to difficulties in transportation. Through improvement of the transportation infrastructure, the transportation costs for these goods can be reduced.

It is necessary to consider countermeasures for coping with the problem of the large difference in income levels of mine-related people and other residents in the project area which is likely to arise when the mines are developed. In addition, since the life of a mine is 15 years at greatest, the ore deposits will be completely exhausted

by the beginning of the twenty-first century if the development of the mines is carried out as scheduled. We must prepare for this situation. For this purpose, it will be necessary to improve the productivity of livestock and agriculture, presently at an extremely low level, and to establish a foundation for rural industry based primarily on the processing of agricultural and livestock products. A first step in this direction would be the introduction of improved pasture and the development of small-scale irrigation systems.

Finally, we would like to propose to the Government of Peru that a certain percentage of government revenues such as mining tax proceeds, which are expected to increase as a result of development of the mines, and export taxes related to the mining products, be set aside for inclusion in the developmental budget of ORDESO, and spent for improvement of infrastructures in the project area. We consider that it would be to the benefit of the national economy in the long run if the government established a policy of returning a part of the benefits gained from mining to residents of the area since the mineral resources are not unlimited.

CHAPTER 2

LONG-TERM TRENDS IN THE ECONOMY OF PERU AND ITS FUTURE PROSPECTS

CHAPTER 2 LONG-TERM TRENDS IN THE ECONOMY
OF PERU AND ITS FUTURE PROSPECTS

1. Past Economic Development Pattern

1-1 Long-Term Trends

In analyzing the development pattern of the economy of Peru and the special characteristics of its social and economic structures, it is necessary for us to examine long-term trends from as far back as the 1960's. The long-term economic development trends over the past 20 years can be divided into four periods, namely:

The first period: 1960 - 1964

Industrialization for import substitution was at the height of prosperity and the fish meal industry was growing.

The second period: 1965 - 1968

Industrialization for import substitution as well as the export sector were in a slump.

The third period: 1969 - 1973

Structural changes were under way and exports enjoyed prosperity.

The fourth period: 1974 - 1979

Structural changes were readjusted and the export sector underwent a crisis. Measures were taken to overcome this crisis.

In each of these four periods, important changes in policies were observed. Also, changes in the performance of the external sector, in particular the export sector, were witnessed. As can be seen in Table 2-1 and Table 2-2,

TABLE 2-1 THE RATE OF ECONOMIC GROWTH IN PERU
(CONSTANT PRICE: BASE YEAR 1963)

| | (Unit: %) | | |
|-----------------------------------|-----------|-----------|-----------|
| | 1960 - 64 | 1965 - 68 | 1969 - 73 |
| Agriculture | 3.8 | -0.5 | 2.1 |
| Fishery | 17.1 | 1.5 | -16.8 |
| Mining | 2.9 | 2.6 | 1.4 |
| Manufacture | 9.2 | 5.3 | 7.1 |
| Construction | 6.4 | -2.2 | 10.0 |
| Service | 9.2 | 3.8 | 8.9 |
| GNP | 7.6 | 2.9 | 6.3 |
| Gross Fixed Capital Investment | 10.3 | -1.2 | 9.0 |
| Price ¹⁾ | 7.4 | 13.7 | 7.3 |

(Note) 1) GNP deflater

(Source) Fitzgerald E.V.K., The State & Economic Development: Peru Since 1968, 1976.

TABLE 2-2 TREND OF LONG-TERM MACRO-ECONOMIC INDICATORS
(CONSTANT PRICE: BASE YEAR 1973, RATE OF
CHANGE AS COMPARED WITH THE PREVIOUS YEAR)

(Unit: %)

| Year | GDP | Domestic Final Demand | Final Consumption Expenditure | Population | Per-Capita GDP | Per-Capita Domestic Final Demand | Per-Capita Final Consumption Expenditure |
|------|-------|-----------------------|-------------------------------|------------|----------------|----------------------------------|--|
| 1951 | 7.73 | 11.92 | 7.02 | 1.87 | 5.75 | 9.86 | 5.06 |
| 52 | 5.48 | 4.27 | 3.04 | 1.85 | 3.57 | 2.39 | 1.17 |
| 53 | 5.33 | 4.80 | 3.44 | 1.91 | 3.35 | 2.83 | 1.51 |
| 54 | 5.95 | 3.56 | 7.04 | 2.04 | 3.83 | 1.49 | 4.90 |
| 55 | 4.23 | 6.06 | 8.07 | 2.24 | 1.94 | 3.73 | 5.70 |
| 56 | 3.77 | 4.02 | 1.48 | 2.44 | 1.31 | 1.54 | -0.93 |
| 57 | 6.49 | 7.69 | 7.12 | 2.57 | 3.82 | 5.00 | 4.44 |
| 58 | 0.35 | -2.01 | 0.52 | 2.68 | -2.27 | -4.57 | -2.10 |
| 59 | 4.71 | 0.11 | 3.66 | 2.78 | 1.89 | -2.61 | 0.86 |
| 60 | 11.31 | 8.46 | 4.04 | 2.83 | 8.25 | 5.48 | 1.17 |
| 1961 | 6.99 | 5.91 | 7.51 | 2.99 | 3.88 | 2.84 | 4.39 |
| 62 | 8.17 | 9.60 | 10.83 | 2.99 | 5.03 | 6.42 | 7.62 |
| 63 | 4.15 | 7.25 | 10.25 | 2.98 | 1.14 | 4.15 | 7.06 |
| 64 | 7.34 | 7.20 | 6.97 | 2.97 | 4.24 | 4.11 | 3.88 |
| 65 | 5.16 | 7.98 | 6.99 | 2.97 | 2.13 | 4.86 | 3.91 |
| 66 | 6.42 | 9.20 | 6.45 | 2.97 | 3.35 | 6.05 | 3.38 |
| 67 | 3.36 | 4.62 | 6.64 | 2.98 | 0.37 | 1.60 | 3.55 |
| 68 | -0.25 | -4.30 | 2.56 | 2.99 | -3.14 | -7.08 | -0.41 |
| 69 | 3.86 | 4.81 | 5.09 | 3.00 | 0.84 | 1.76 | 2.03 |
| 70 | 5.41 | 6.23 | 8.09 | 3.01 | 2.34 | 3.12 | 4.93 |
| 1971 | 5.03 | 7.05 | 5.71 | 2.85 | 2.12 | 4.08 | 2.79 |
| 72 | 1.66 | 0.01 | 5.42 | 2.85 | -1.15 | -2.76 | 2.50 |
| 73 | 4.27 | 5.25 | 5.34 | 2.84 | 1.38 | 10.29 | 2.42 |
| 74 | 7.48 | 11.08 | 5.16 | 2.84 | 4.51 | 8.01 | 2.26 |
| 75 | 4.54 | 3.06 | 5.16 | 2.83 | 1.66 | 0.22 | 2.26 |
| 76 | 2.02 | 0.55 | 3.76 | 2.83 | -0.79 | -2.22 | 0.91 |
| 77 | -0.04 | -0.65 | 3.58 | 2.83 | -2.79 | -3.38 | 0.73 |
| 78 | -0.66 | -6.72 | -5.05 | 2.82 | -3.39 | -9.28 | -7.66 |

(Source) INP, Cuentas Nacionales del Perú 1950-78, Lima, 1979, p. 55.

there is remarkable difference in the rates of economic growth observed in each of these four periods:

As regards the first period, we must point out two important characteristics. There was a rapid expansion of the import substitution industry. Peru began development of an import substitution industry much later than other major Latin American countries. This reflects the political situation in this country and the relative smallness of the domestic market. As a result, while the height of prosperity of import substitution industries in Brazil, Argentina and Mexico was in the 1950s, the height of such industrialization in Peru was not reached until the 1960s.

The differences between the 1950s which preceded this first period, and the first half of the 1960s can be summarized as follows: Firstly, during the early 1950s, the economic policies of Peru (under the Odría Administration from the end of 1948) were based primarily on mining and petroleum, clearly indicating that Government policy was to promote exports of primary products. During the 1950s reform, a positive attitude towards industrialization began to take form (in the later period of the Odría Administration). Commodities promoted by the new policy were, however, mainly processed export goods and industrial goods for use in the production of export goods, with the exception of construction-related goods such as cement.

On the other hand, from the end of the 1950s through the early 1960s, full scale industrialization began for import substitute goods for the domestic market, including primarily consumer goods (in particular consumer durables), pharmaceutical goods, etc. As representative industrial policies of the period which promoted this change, the Industry Promotion Act, proclaimed in 1959, and also the substantial devaluation in the exchange rate in 1958 are pointed out.

Since this Industry Promotion Act contained extremely favorable conditions for industrial investment and included no discrimination against foreign capital, direct foreign investment in the manufacturing industry was carried out on a large scale in the early 1960s. Overdependence on foreign capital in the manufacturing industry of Peru, which was criticized during the Velasco Administration, began during this period. In Table 2-1 shown above, the average rate of growth of the manufacturing industry during the 1960 - 1964 period maintained a high level of 9.2%. This was achieved against the background of import substitution industry expansion.

Another important characteristic of the first period was the rapid growth of the fish meal industry. As is well known, the fishery industry in Peru depends mainly on catches of Anchovy, which are processed into fish meal and fish oil for export. This industry achieved remarkable development in the early 1960s. This is illustrated by the fact that the growth rate 1960 - 1964 period was reached a high of 17.1%. As indicated above, we can say that the economy of Peru enjoyed a relatively high growth rate during this first period.

Moreover, this first period can be said to have been a balanced growth period. Namely, in the external sector, while imports showed some increase, the export of fish meals also increased, and the international balance of payments was balanced. Besides, along with the expansion of the import substitution industry, fish meal related industries (including the fishing boat construction) and the construction industry also showed progress. On the other hand, the expansion of the agriculture sector was rather slow, but the growth rate was not below the rate of growth of population.

The second period, however, was characterized by a slow-down in the growth rate and imbalances in the economy. The policies of the second period (under the Belaúnde Administration) basically succeeded on policy as the first period, with continued expansion of the import substitution industry. In the export sector, exports of fish meals were maintained at a high level. However, the main difference seen in the second period was that the import substitution industry and the fish meal industry gradually became unable to fill a role as the leading sector of a dynamic economy, as they had in the first period. As regards the import substitution industry, since products were for the domestic market, it could not grow further and slowed down when a certain stage of development was reached, due to the smallness of the market. Particularly when expansion of an import substitution industry is carried out under a high degree of protection by policy (the case in Peru was a typical example), generally speaking it becomes difficult to shift to new industrialization by increasing export of manufactured goods because of inefficiency and high cost. In the case of Peru, it had to go into import substitution on a regional level as an extension of domestic import substitution through formation of the Andes Pact (in 1969) for the above-mentioned reason.

At any rate, limitations of such import substitution became clearly visible as early as the latter part of the 1960s, and the growth rate for the manufacturing industry during the second period dropped to 5.3% from the 9.2% of the first period. In addition, the fish meal industry, which had attained a high level of production, maintained this level, but it gradually became more difficult to achieve further expansion. The characteristics of the second period existed in the fact that the development pattern of the first period began to face its limitations gradually, and this constituted an important factor in the reduction of the growth rate. In addition, agricultural production during this period fell to a very low level. Not only was the growth rate below the rate of population growth, a minus growth rate was encountered. This constituted another factor in the low growth rate of the entire economy and contributed to acceleration of inflation.

During this period, in addition to domestic imbalances such as inflation, deterioration in the balance of payments in the external sector was observed, since the increase in

imports was greater than the increase in exports. In 1967, therefore, Peru was faced with a balance of payments crisis and had to devalue its currency considerably. Thus, the second period is characterized as a time when the development pattern from the later 1950s approached its limits. It was also a period when long-term structural problems began to show themselves through the growth gap between agricultural production and population, imbalanced distribution of wealth, the concentration of population in cities, etc. The population growth rate increased from 2.2% in the 1940s to 2.9% in the 1960s, making the gap between agriculture and population more critical. A rapid change was observed in the concentration of population into cities. The ratio of the urban population to total population was 28% in 1961. Eleven years later, i.e., 1972, this ratio reached 41%. It is nothing but the reflection of such a situation that guerrilla activities in rural areas became quite active in the 1960s and slum areas in the cities expanded.

The shift to the third period was carried out, by the establishment of the Joan Velasco Alvarado Administration in 1968 and was marked by the "Peruvian Revolution"; which was promoted by the Administration. However, internal as well as external imbalances which gradually became clearer during the second period and aggravated structural problems constitute the background of the second period. The Velasco Administration promoted the following policies: a series of structural reforms such as agricultural land reforms, an increase in the weight of the public sector in the economy through expansion of public investment, and the development of resources such as petroleum and copper in the export sector by introduction of very large foreign borrowings.

The various reforms carried out by the Velasco Administration and their evaluation will be covered in more detail later. Since this section serves to outline past trends in economic development, we shall examine the short-term effects of the economic policies during the Velasco Administration. This is because of the fact that structural reforms such as agricultural land reform do not necessarily lead immediately to the expansion of production, and the effects of other reforms such as nationalization of foreign capital enterprises cannot be evaluated from the short-term point of view. The same thing can be said of the effects of redistribution of income, changes in consumption markets, and the increase in the products of particular production sectors.

As regards the mining industry, the Velasco Administration continued to negotiate with foreign enterprises, just as the Belaúnde Administration had done, and requested commencement of development of undeveloped but hopeful ore deposits. The successful conclusion of a contract for development of the Cuajone copper mine in 1969 with the Southern Perú Copper Corporation (SPCC) was an important result growing from this policy.

Except in this case, however, no other mining development with new foreign capital materialized and Minero Peru, which was established by the Government in 1970, was given the task of developing mining from 1971, taking the place of foreign enterprises.

Regarding the economy as a whole, the Government introduced a monetary expansion policy and measures to encourage industrial investment in 1970. At the same time, protection of domestic industry was strengthened by increasing import duties. However, private investment in Peruvian manufacture did not grow significantly in spite of these policies, and the Government, facing with this situation, adopted a policy to promote economic activity itself through expansion of the public sector. As a result, investment in the public sector comprised 39% of the total gross fixed capital investment between 1969 - 1973, and 58% during the 1974 - 1976 period. This is a remarkable change when compared with the 30% figure for the 1965 - 1968 period. The Velasco Administration increased the weight of economic activities of the public sector in the mining industry as well as other economic fields including mainly the manufacturing industry, and changed leadership of the economy from the private sector to the Government. However, as far as industrial policies were concerned, it continued expansion of the import substitute industry, and no fundamental changes were brought in as compared with the second period. It should also be noted that Andes Pact was begun after establishment of the Velasco Administration.

In the beginning of the Velasco Administration, recovery in the manufacturing and construction industries was clearly observed. Recovery of the economy in the thirds period from the slow-down seen during the second period was achieved almost solely by the expansion of production in the manufacturing and construction industries, except for a temporary recovery of mining and fishery which will be described later in this report. How does this phenomenon relate to the economic policies of the Velasco Administration mentioned above? First, the expansion of production in the manufacturing industry was mainly for the purpose of meeting increases in consumption demand. This increase in demand was due to the policy of the Velasco Administration to increase the real income of the people and promote redistribution of income. Therefore, the expansion of manufacturing production in this period was characterized solely by expansion of consumers' goods manufacture, in particular consumer durables. Another characteristic, mentioned above, was that private investment during this period was at a very low level. Expansion of manufacturing industry production was achieved only by increasing of the operating ratio of existing production facilities (idle facilities in particular). Increases in final demand did not encourage productive investment. This reflects a special short-term circumstance of the early Velasco Administration; an uneasiness brought about in the private sector due to the progress of reforms, while demand was created due to the increases in real income levels of the people.

On the other hand, the expansion of the construction industry was due to growth in the construction of residences and infrastructures. This again reflects the increase in public investment of the Velasco Administration. However, in this period private housing construction was also active since policies to encourage housing construction were introduced in 1968. Thus, as shown in Table 2-1, the construction sector increased at a high annual rate of 10% and the manufacturing industry at a rate of 7.1%. In agriculture, slow growth was observed, lower than population growth.

Next we shall look into the export sector. As far as the fish meal industry is concerned, the Anchovy catch reached its highest amount in 1970, but then fell remarkably reduced during the 1972 - 1973 period to less than half of that of the 1960s. This caused a drastic reduction in the amount of exports only in 1973, however. Exports of other commodities such as minerals and agricultural commodities during this period stayed at favorable levels in general, and the trade balance was maintained throughout this period. But in this period, a substantial increase in exports was observed. Moreover, as will be discussed further, favorable exports were due mainly to increases in the price of primary commodities. We can summarize the above discussion of the third period as follows: The Velasco Government carried out a series of important reforms and these brought about short-term effects such as increases in consumption and public investment.

Recovery of productive activities centering around the manufacturing and construction industries was observed, and the economy improved markedly in comparison with the second period. The rate of growth of GNP during this period averaged 6.3%, as against the annual average of 2.9% in the second period. Exports and imports were in close balanced during this period.

During the fourth period which we shall discuss in the following paragraphs, various problems which originated from execution of reforms in the third period materialized. A change in international circumstances was observed due to the oil crisis, and for this reason the external imbalance was aggravated and Peru faced a crisis in its international balance of payments.

1-2 Recent Growth Rate and Trends in the Economy

The fourth period which began following the oil crisis was characterized by a growing imbalance in many economic aspects and low rates of growth. As far as policies were concerned, the government was forced to make adjustments in structural reforms, and to gradually introduce stricter economic policies. Aggravating the economy, the imbalance of the external sector was most significant. The trade balance as well as the overall balance of payments began to show larger deficits quite rapidly during this period. The internal imbalance also expanded. The rate of unemployment increased, inflation was aggravated, and, as a result, real

income was reduced. During this period, the rate of economic growth dropped from 6.2% in 1973 to 3.0% in 1975 and to 3.3% in 1976. In 1977 and 1978, the rate of economic growth recorded minus figures: -1.2% in 1977 and -1.8% in 1978. This shows the degree of deterioration in economic conditions during the period. It is estimated that the rate of growth has recovered to 2% at best in 1979.

In 1974, the rate of growth stood at 6.9%, which was about the same as the level for the second period. On the other hand, drastic deterioration in trade balance (from a deficit of US\$140 million in 1973 to US\$400 million in 1974) and progressive inflation and a reduction in real wages were observed. We can already see the negative indications in these years as with 1975 and later. The year 1974 was transitional in the sense that while the policies of the third period were continued in a basic sense, imbalances had clearly materialized. It goes without saying that the Velasco Administration, which had been carrying out various reforms since 1968, was overthrown in August 1975. The new Morales Bermúdez Administration which came to power at this point carried out the various measures characterizing the fourth period. The circumstances discussed above are clarified by the rate of growth for the last six years and the related major indicators shown in Table 2-3.

Table 2-3 The Rate of Economic Growth and Related Major Indicators in Most Recent Six Years (Rate of Increase)

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|--|-------|-------|--------|--------|-------|-------|
| Domestic GNP | 6.2 | 6.9 | 3.3 | 3.0 | -1.2 | -1.8 |
| Per Capita GNP | 3.3 | 4.0 | 0.5 | 0.2 | -3.9 | -4.5 |
| Consumers' Price | | | | | | |
| Annual Rate of Increase | 13.8 | 19.2 | 24.2 | 44.7 | 32.4 | 73.7 |
| The Rate of Increase at the Middle of Year | 9.5 | 16.9 | 23.6 | 33.5 | 38.1 | 57.8 |
| Real Wages (Laborers) | - | -2.1 | -17.6 | 16.6 | -23.5 | -9.0 |
| The Rate of Unemployment (Non-Agriculture) | 7.1 | 6.7 | 8.1 | 8.4 | 9.4 | 9.8 |
| Trade Balance (In US\$ million) | -139 | -601 | -1,348 | -881 | -552 | 329 |
| Current Account Balance (In US\$ million) | -299 | -751 | -1,573 | -1,233 | -957 | -192 |
| External Debts (In US\$ million) | 1,814 | 2,563 | 3,474 | 4,074 | 4,700 | 4,904 |

(Source) Compiled from INP, Informe Economic y Social 1978, etc.

The causes of the economic crisis during the fourth period are attributable mainly to the problems which were brought about by the various reforms of earlier periods and changes in the international economic situation following the oil crisis in 1973. Among the internal and external imbalances of this period, the most serious problem and that which brought about a economic crisis in Peru was the balance of payments problem. This, however, is closely related to policy decisions during the previous periods.

The causes of the balance of payments crisis were as follows: a slow-down in the production of export commodities; a plunge in international market prices for these export commodities (in particular from 1975); a rapid rise in imports of foodstuffs and intermediate industrial goods; and an increase in the burden of external debt repayment. Firstly, the increase in real wages carried out by the Velasco Administration caused an increase in consumption, but the domestic supply necessary to meet this increase was limited, and dependence on imports, therefore, increased. As regards imports, the expansion of production by utilization of already existing facilities to meet the consumption increase caused an increase in the demand for intermediate industrial goods. Domestic production capacity for supplying these commodities was either lacking or limited, however, and projects intended for the implementation of a domestic production plan were not carried out rapidly, thus serving only to increase the amount of imports. As regards the production of foodstuffs, part of the cotton producing area in the coastal region was converted for food production, resulting in an increase in food production until 1971. However, production slowed down thereafter and per capita food production dropped. This led to an increase in food imports.

We shall examine exports next. The reason why exports during the third period were comparatively favorable was due to the high prices prevailing from 1969 to 1974. As for export quantities, they were either leveling off or decreasing, depending on the commodity. This tendency was further strengthened from 1972, when the reduction in prices began. As a result, the value of exports remained at a low level. The Velasco Administration, which was faced with the problems of a slow-down for fish meal and limitations on the production areas for export commodities (for details refer to the next section), adopted a policy of petroleum, copper mine, etc. development in order to expand exports. However, neither development of petroleum nor copper mining attained the expected results during this period. On the other hand, the public sector gradually grew to depend more and more on foreign borrowings for the expansion of economic activities, namely public investment and resources development. As a result, accumulated debt increased from US\$740 million in 1968 to US\$1,430 million in 1973. Due to this accumulated foreign debt, debt service payments increased, and since 1974, new borrowings began to increase at a rapid pace.

The important thing in this connection is that the Morales Bermúdez Administration, which came to power in

August 1975, gradually began introduction of very stringent policies. The target was to decrease imports by reducing economic activities to improve the balance of payments and to control inflation. This resulted in a shrinkage of economic activity, indicated by the minus-growth rates prevailing in comparison with the previous years of 1977 and 1978. However, the accumulated amount of foreign debt was already too large and, in spite of the fact that these policies achieved considerable effect, Peru was faced with a great balance of payments crisis in the first part of 1978, and finally had to request rescheduling of debts by creditor nations.

We can confidently say that 1978 was the first year of the recovery process for Peru. The nation achieved an increase in foreign exchange reserves in the amount of US\$800 million during the one year period from the middle of 1978 to the middle of 1979. This was made possible by the fact that exports improved considerably due to a rapid increase in petroleum revenues brought about by the rise in oil prices, and the expansion of non-traditional exports. The level of imports on the other hand, was held at a low level through stringent policy measures. It goes without saying that the rate of growth in 1979 is basically at the low level which has continued since 1976. However, it is now estimated that the growth rate will be about 2% in 1979, above the originally expected growth rate of 1%. This will mark the end of the consecutive minus growth rates recorded in 1977 and 1978. Particularly remarkable points are as follows: the production of cement in 1979 should increase by 21.4%, crude steel output by 66.5% and power generation by 6.2% as compared with the previous year. It is considered that these data reflect that domestic economic activities such as manufacturing and construction are now recovering in spite of the stringent Government policy measures.

As mentioned above, the fourth period is an re-adjustment period for the reforms carried out during the previous periods. Although economic growth has remained at a very low level for a long period of time, some symptoms of recovery have been observed recently. With recovery of the balance of payments, we can expect that there will appear a greater opportunity for introducing more positive policies. Just about this time, the Morales Bermúdez Administration will begin shifting to a parliamentary civil administration and we have cause to believe that the period which began in 1974 will end in the very near future. In addition, some noteworthy changes are now being observed in industrial and trade policies and a fair amount of liberalization of trade is being introduced into trade policy, which has, in the past, been particularly characterized by import substitution, and heavily protected from the 1960s on into Velasco period. Along with these changes, a rapid expansion in manufactured goods export is being witnessed. It is, therefore, considered that a new industrialization policy will be maintained, which will encourage export while also promoting import substitution at the regional level.

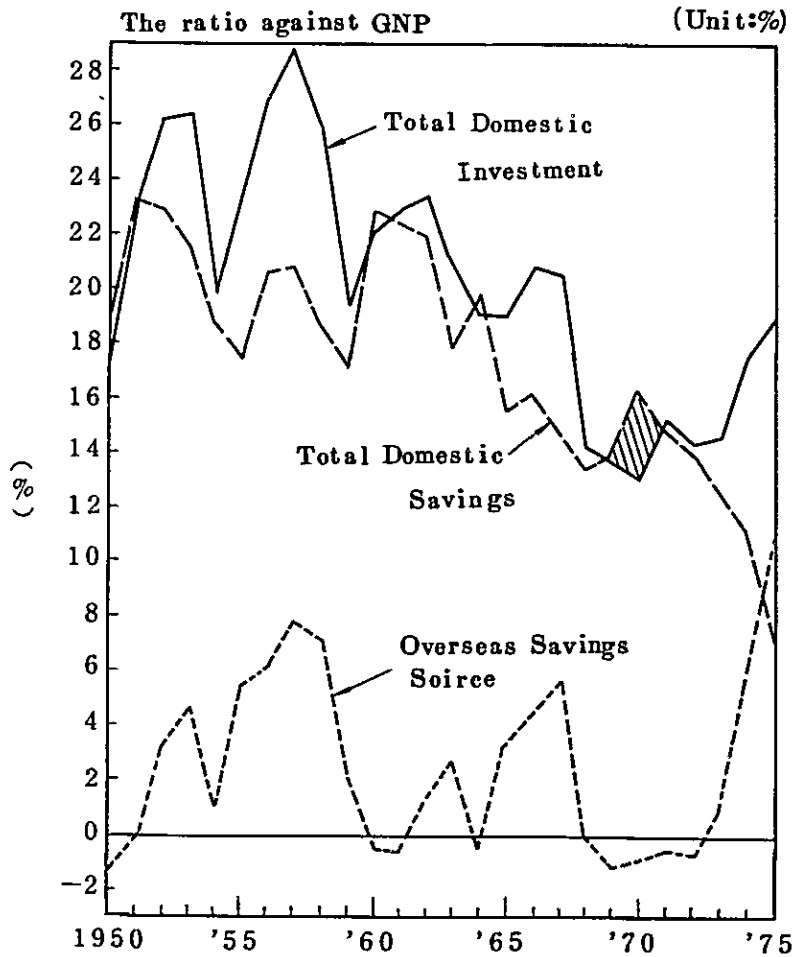
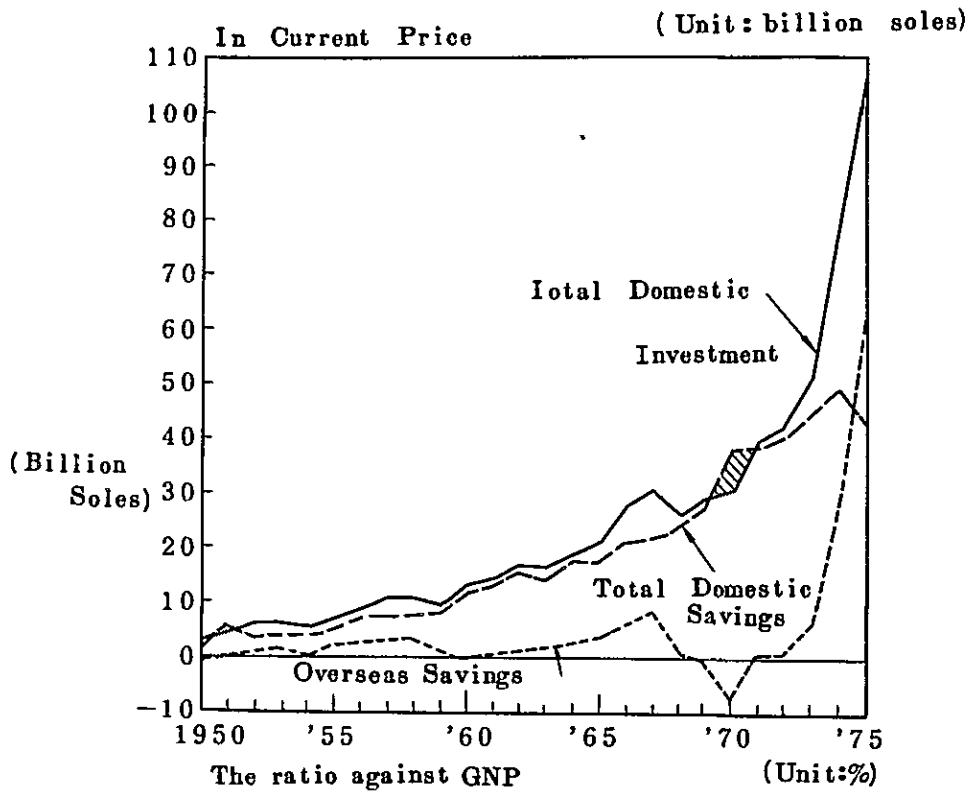
2. Financing of Investment Fund and Savings in Public Sector

2-1 Long-term Trends in Domestic Savings and Investment

In the previous section, we examined the long-term trends of the economy of Peru from the 1960s onward. The main item in this present section is the examination of savings and investment from the institutional as well as monetary points of view. As mentioned in the previous section, the public sector has played a major role in investment since the Velasco Administration came to power in 1968. During the 1974 - 1976 period, not only did public investment comprise more than 50% of total gross fixed capital formation, the importance of the public sector in mobilizing domestic savings for investment funds became much more important. The rate of investment was in the order of 21% in the first half of the 1960s, but dropped drastically during the latter half of the decade, reaching a low of 13% temporarily. Thereafter it stayed around 15 to 17%. Fig. 2-1 shows the long-term trend in savings and investment over the 25 year period from 1950 to 1975 in current prices and the ratio against GNP. As Fig. 2-1 shows, the rate of savings was at a relatively high level of around 18 to 23% until the 1950s and in the first half of the 1960s. A regression analysis of this long-term trend reveals the following facts:

- (i) The change in the rate of savings in the 1950s was a short-term movement and cannot be assessed as a structural change;
- (ii) from 1961, a structural change can be observed;
- (iii) even after 1961, short-term movement of the rate of savings can be observed, but the trend in the rate of savings is downward;
- (iv) the marginal propensity to save against GNP during the 1950 - 1974 period is 0.11;
- (v) along with a reduction in the rate of savings from 1961, the rate of investment also shows a downward trend with some time-lag;
- (vi) the marginal propensity to invest against GNP during the 1956 - 1975 period is calculated at 0.22;
- (vii) an analysis of the correlation of the same time series of the rate of savings and the rate of investment shows that the correlation was in the same direction during the 1950s, while there was no correlation during the 1960s, and contrary correlation during the 1970s;
- (viii) as regards whether expectation of inflation will reduce the rate of savings or not, no significant results were found statistically. The conclusions which can be drawn from the above observations are that:

Fig. 2-1 Trend in Investment and Savings (1950 - 75)



(Source) INP, Cuentas Nacionales del Perú, 1950 - 78

(i) the long-term downward trend in investment was caused by the long-term reduction trend in the domestic rate of savings as a limiting factor; (ii) the increase in total domestic investment could not be met by domestic savings alone, and resulted in a rapid increase in the demand for foreign savings such as investment from abroad and foreign borrowings. The investment boom during 1972 and 76 led by the public sector indicates this trend quite clearly.

When we analyze the trend in domestic savings during the 1950 - 1975 period by classifying savings by public and private sectors, various facts can be revealed. Findings for the 1950s are as follows: (i) household savings, corporate savings and public savings, show the same trends in current prices; (ii) when analyzed as the ratio against GNP, the movement of household savings fluctuates most clearly, and constitutes a major factor in the fluctuation of domestic savings as a whole. The movement of corporate savings is relatively moderate, but some reduction was observed during the 1952 - 1953 period and in 1958. These years were recession periods in the world economy, and the export industry in Peru was strongly hit by this recession. The importance of public sector savings, shown as the ratio against GNP, was not so great, and began to decline from 1955.

During the 1960s, a clear change in the trend was observed. That is the declining trend in the ratios of household savings and public savings against GNP. This can be explained by the fact that while a modern sector was formulated by the development of the export industry during the 1960s, and a new entry to the labor market increased rapidly due to a high rate of growth in population and employment opportunities were created with sufficient abundance to meet the increase in the labor force, unemployment and under-employment increased and social tensions increased. This constituted political pressure, and as a result, Government expenditures for social welfare increased. On the other hand, successive governments were not successful in mobilizing sufficient domestic savings to finance increases in Government expenditures. In particular, public savings during the 1964 - 1967 period recorded minus growth figures. This trend continued up until the latter half of 1970.

2-2 The Role of the Public Sector in the Economy of Peru

The role of the public sector in the economy of Peru began to change from the beginning of the 1960s. In particular, since 1962 when the Belaunde Administration came into power, expenditures of the Central Government increased quite rapidly, mainly for the development of transportation facilities, education, health and other infrastructures as well as for the improvement of social services. Under the Velasco Administration in 1968, various reforms with strong characteristics of socialism were undertaken such as the most radical land reform in South America and nationalization of the International Petroleum Corporation (IPC) and several other influential enterprises.

The strengthening of government intervention into the economic activities naturally resulted in an increase in the power of the Central Government. However, as is shown in Table 2-4, the ratio of the current expenditures of the Government against GDP has shown almost no increase since 1968. This fact is in sharp contrast to the rapid increase of this ratio in the mid-1960s. Further, Table 2-5 shows an international comparison of the scale of government finance in national economies, indicating that the scale of current expenditures of Peru cannot be considered as excessively large. The ratio of the scale of current expenditures of the Peruvian Government against the GDP is around 17 - 18%, which is far smaller than the ratios of such other Latin American countries as Chile, Uruguay, Brazil and Ecuador, and which nearly equal to the average ratios of developing countries.

Table 2-4 The Scale of Government Finance as Compared with GDP (Unit: %)

| | 1960 | 1966 | 1968 | 1970 | 1974 | 1975 | 1976 | 1977 | 1978 |
|---|------------|------------|------------|------------|------------|-------------|-------------|------------|------------|
| <u>Central Government</u> | | | | | | | | | |
| Current Revenue | 15.0 | 17.9 | 18.9 | 19.8 | 15.2 | 16.0 | 14.6 | 14.6 | 15.8 |
| Current Expenditure | 12.3 | 18.3 | 17.5 | 16.3 | 13.9 | 16.5 | 16.0 | 18.2 | 17.4 |
| <u>Development Expenditure of Public Sector</u> | <u>2.2</u> | <u>4.5</u> | <u>3.7</u> | <u>4.0</u> | <u>9.2</u> | <u>10.8</u> | <u>10.1</u> | <u>7.3</u> | <u>5.8</u> |
| Central Government | 1.5 | 3.2 | 2.4 | 2.5 | 4.5 | 5.1 | 4.9 | 3.8 | 3.4 |
| Government Enterprises | 0.7 | 1.3 | 1.3 | 1.5 | 4.7 | 5.7 | 5.2 | 3.5 | 2.4 |

(Source) Central Reserve Bank of Peru

In the case of Peru, the increase in the role of Government finance took the form of an increased number of Government enterprises rather than a continuous increase in the scale of Government finance. At the time of the "Peruvian Revolution", government enterprises numbered less than 20. At present, the number of enterprises for which the Government has paid in all capital is 110. There are also many subsidiary companies of nationalized enterprises and related companies shares of which are held by nationalized enterprises. The number of such companies is not known exactly. For example, Petro Perú is a big shareholder of a company which produces gas stoves, and Hierro Perú succeeded at the time of nationalization, a customs agent which was a subsidiary company of the nationalized enterprise. It is thought that subsidiary and related companies of governmental enterprises number at least 60 - 70. Out of 110 enterprises for which the Government has paid in all capital, 47 enterprises can be regarded as legal public enterprises while the rest are run in the same manner as private enterprises. For example, Centromin Perú, which is a mining company, and three nationalized commercial banks are within this category.

There is very little data related to the importance of nationalized enterprises in the overall economy of Peru. Some indicators are available, however. According to a

survey^{1/} conducted in 1973 by the Instituto Nacional de Planificación (INP), total assets of the nationalized enterprises (excluding financial institutions) were 65 billion soles; much more than the 50 billion soles estimated independently by the Ministerio de Industria y Turismo for manufacturing industry as a whole. We can therefore say that Government is the largest enterprise in Peru.

According to the estimate of Fitzgerald we referred to in Chapter 1^{2/} the Government controls at least one eighth of all production and employs one-tenth of all workers in Peru. When small - and medium-scale industries and cottage industries are excluded, and when we take into account of the modern sector only, the above ratios rise to one third and two-fifths, respectively.

Table 2-5 International Comparison of the Scale
of the Central Government Finance
(The Ratio of Current Expenditure against GDP)

| | (Unit: %) | |
|--|-----------|------|
| | 1960 | 1973 |
| Advanced Industrial Countries (Average) | 25.1 | 30.2 |
| Developing Countries (Average) | 13.3 | 17.4 |
| Latin American Countries (Average) | 11.9 | 16.8 |
| Peru | 12.3 | 17.4 |
| Chile | 22.0 | 37.7 |
| Uruguay | 22.0 | 37.7 |
| Brazil | 15.7 | 25.4 |
| Ecuador | 19.1 | 22.5 |
| Panama | 13.4 | 18.2 |
| Costa-Rica | 12.9 | 17.8 |
| Bolivia | 13.6 | 17.6 |
| Venezuela | 15.3 | 14.6 |
| Argentina | 8.5 | 11.2 |
| Colombia | 7.5 | 10.4 |
| Mexico | 5.1 | 7.2 |

(Source) IBRD : World Tables, 1976

Notes: 1/ INP, Analisis Economico de las Empresas Publicas, 1973

2/ Fitzgerald, E.V.K., The State and Economic Development Since 1968, 1976 Chapters 3 and 4.

A noteworthy point in the increased importance of Government is the functional aspect of greater government intervention in the major sectors of the economy rather than the expansion of scale alone. The first point we should mention is intervention of the Government in the traditional export sector. Firstly, the Government is engaged directly in the refining and sale of petroleum. Secondly, oil exploration, production and contracting with foreign petroleum companies are all carried out by Petro Perú as an agent of the Government. As regards the mining industry, Minero Perú, which is a holding company for nationalized mines, is responsible for the development of new mines either jointly with foreign enterprises or independently. Furthermore, Minero Perú is a shareholder of an iron-producing public corporation and Centromin Perú, the producer of non-ferrous metals. As regards fishing industries, Empresa Pública de Producción de Harina y Aceite de Pescado (PESCA-PERU) has a monopoly in the production of fish meal and fish oil. Moreover, the Government is a shareholder in the three largest companies engaged in refrigeration and canning of fish.

Secondly, intervention of Government in the manufacturing industry is directed towards the basic industrial sector, in particular, the heavy industry sector. At present the Government has a monopoly in production of iron and steel through Empresa Siderúrgica de Perú, (SIDER PERU) fertilizer through Ferti Perú and Cachimayo Co., cement through four factories, and telephone equipment through Fabrica de Equipos Telefonos S.A. (FETSA). Furthermore, Sima Perú, which is run by the Government, is a large-scale ship-building enterprise. Indu Perú, which is a joint venture with a foreign enterprise, runs four companies which engage in the production of tractors, diesel engines, air compressors and industrial machines and tools. As mentioned earlier, the Government became a shareholder in subsidiary companies and the related companies of nationalized enterprises at the time of nationalization. These industries cover gas, manufacture of stoves, tobacco and the processing of coca.

Thirdly, the Government is now entering into the field of foreign trade and domestic sales through national enterprises. Minero Perú Comercial (MINPECO), a subsidiary company of Minero Perú, has a monopoly on the export of mineral products, and Empresa Pública de Comercialización de Harina y Aceite de Pescado (EPCHAP) has a monopoly on the export of fish meals. Empresa Pública de Servicios Agropecuarios (EPSA) has not only a monopoly on the export of coffee but also engages in the export of a major portion of all fresh foodstuffs, and, moreover, is now increasing its

transactions in the domestic sale of agricultural products. Empresa Nacional Comercialización Industrial (ENCI) has control over the import of important industrial and agricultural products, processed foodstuffs and alcoholic beverages. The export of sugar is monopolized by Central de Cooperativas Agrarias de Producción Azucarera del Perú Ltda (CECOAP).

Fourth, the Government holds an overwhelming position in the field of banking, to which we shall refer later.

The fifth field is public utilities. In the power sector, 22 private power companies have been nationalized since 1968 and are now consolidated under Electro Perú. Electro Perú is engaged in the management and operation of generation and transmission of power throughout Peru. The telegraph and telephone business has been consolidated into Empresa Nacional de Comunicación (ENTEL). In the field of transportation, Empresa Nacional de Ferrocarriles (ENAFER) Empresa Nacional de Puertos (ENAPU), and Aero Perú, retain monopolistic or semi-monopolistic positions.

2-3 Public Investment

In contrast to the fact that the scale of current expenditures of the Government in the national economy showed almost no increase in the 1968 - 1976 period, the scale of public investment increased very rapidly, reaching an unprecedented level in the history of nation. The three-year moving average, used in order to even out the large annual fluctuations in the annual growth rate of public investment during this period, was 21%. The ratio of public investment to GDP in this period was 3.7% in 1968 and 10.1% in 1976, showing close to a three-fold increase. The ratio of 10% of public investment against GDP is high even by international standards. The ratio in other Latin American countries in 1976 were as follows: Mexico, Ecuador, and Dominica, 8 - 9%, Costa Rica, approximately 7%.

The rate of increase in public investment itself is important. More important is the increase in the contribution of public investment to gross fixed capital formation. The ratio of public investment in total fixed capital formation averaged 23% during the three years of the 1968 - 1970 period. During the 1974 - 1976 period, the ratio averaged more than 50%. This increase in the ratio of public investment was of course due to reduction in the investment desire of the private sector. Investment in plants and equipment by the private sector during this period increased in real terms annually by only 3.9% on the average, substantially below the average growth rate of the GDP of 5.8% in real terms in the 1968 - 1976 period. This increase in public investment was mainly carried out by government enterprises rather than the Government itself. The weight of Government investment in total fixed capital formation

during this period was around 18 - 20%, showing almost no change. Three-fourths of the increase in public investment during this period was carried out by government enterprises.

As the role of public investment in the economy of Perú became more important, the priorities of public investment changed gradually. During the 1960 - 1966 period, about half of all public investment was for the development of infrastructures, while investment in the production sector was only about one-fourth of total public investment. From 1968 onwards, a major portion of the increase in public investment was on the contrary, directed towards the production sector. Among production sectors, priority was placed in particular on the petroleum, agriculture, and mining industries. These three sectors comprised only 6.8% of all public investment during the 1968 - 1970 period, but between 1974 and 1976 they comprised about 60% of the total. The weight of investment in infrastructures was reduced to about 15% of total public investment and, when calculated in real terms, this investment actually showed some reduction. At the same time, investment in such social services as education, health, water supply and sewage, housing etc. comprised about one fourth of all public investment in 1966, but this dropped to a little over 6% during the 1974 - 1976 period (See Table 2-6).

Table 2-6 Structure and Growth of Public Investment 1960 - 76

| | (Unit: %) | | | | | |
|-------------------------------|-------------------|---------|---------|-------------------|---------|---------|
| | Composition Ratio | | | Ratio against GDP | | |
| | 1968-70 | 1971-73 | 1974-76 | 1968-70 | 1970-73 | 1974-76 |
| Gross Fixed Capital Formation | 100.0 | 100.0 | 100.0 | 12.6 | 13.0 | 15.8 |
| Enterprise Sector | 81.9 | 76.4 | 80.6 | 10.3 | 9.9 | 12.7 |
| Private Sector | 77.4 | 61.4 | 49.9 | 8.7 | 7.9 | 7.9 |
| Governmental Enterprises (1) | 4.5 | 15.0 | 30.7 | 1.6 | 2.0 | 4.8 |
| Central Government (2) | 18.1 | 23.6 | 19.4 | 2.3 | 3.1 | 3.1 |
| Public Sector=(1)+(2) | 22.6 | 38.6 | 50.1 | 3.9 | 5.1 | 7.9 |

(Source) Ministry of Economy & Finance

We cannot overlook the fact that at the time when the weight of public investment was shifting to the production sector, investment was mainly concentrated in a small number of huge projects. As a matter of fact, more than two-thirds of the real increase in public investment during the 1968 - 1976 period was concentrated in twelve large-scale projects. Of these, ten projects were in the direct production sector and received one third of all public investment. Investment for the development of infrastructures occurred in only two cases: The hydro-power generation station at Mantaro and the road between Oroya and Aguatia, both of which began to be implemented well before the start of the military administration in 1968. Out of the twelve public investment enterprises, eight were run by governmental enterprises and received about 60% of the increase in public investment. Government investment was concentrated in three irrigation programs, namely at Majes, Chira-Piura, and Tinajones, and in the road project between Oroya and Aguatia. These four projects alone comprised about half of the fixed capital formation of the Central Government. As the reason for public investment concentration in only a few projects, we can point out, firstly that the projects included such projects as a petroleum development and a mine development which required a great deal of investment, and secondly, it was the objective of public investment policy until 1976 that the Government should complete a small number of large public projects in a short time so as to project a strong image of achievement to the people of Peru and other nations.

Finally, we shall analyze public investment by the geographical areas where investment was carried out. A noteworthy fact is that the Lima-Callao district received only 6% of all public investment funds while more than 90% was invested in other areas. The largest recipient of public investment by area was the north district, where investment related to petroleum was concentrated. This district received about one fourth of all public investment during the 1968-1976 period. Following this district, the southern district where the Majes irrigation project near Arequipa and the Cerro Verde copper mining project are located, received about 20% of the total. About 14% went to the eastern jungle zone where petroleum exploration and construction of pipelines was carried out. The central district, including Lima, received 12%, out of which more than half was used for the construction of a central expressway. The remaining one fourth was used for projects connecting the various districts such as telegraph and telephone networks, power transmission networks and the development of a primary expressway network. (See Table 2-7 and Table 2-8).

Table 2-7 Public Investment by Project Authorities and Sectors:
the Ratio of Composition and the Rate of Growth (1960 - 1976)

| | Ratio of Composition | | | | Average Annual Rate of Growth (In real term) | | |
|---|----------------------|------|---------|---------|---|---------------------|---------------------|
| | 1960 | 1966 | 1968-70 | 1974-76 | 1971-73/ 1968-70 | 1974-76/ 1971-73 | 1974-76/ 1968-70 |
| | (Unit:%) | | | | | | |
| A. Project Authorities | | | | | | | |
| Public Sector Total | 100 | 100 | 100 | 100 | 16.4 | 25.3 | 20.8 |
| Government | 70.0 | n.a. | 58.5 | 39.0 | 18.6 | 7.5 | 12.9 |
| Central | n.a. | n.a. | 42.7 | 34.0 | 25.4 | 8.0 | 16.3 |
| Others | n.a. | n.a. | 15.8 | 5.0 | -5.1 | 4.6 | -0.4 |
| Governmental Enterprises | 30.0 | n.a. | 41.5 | 61.0 | 13.2 | 46.5 | 28.8 |
| B. Sectors | | | | | | | |
| Public Sector Total | 100 | 100 | 100 | 100 | 16.4 | 25.3 | 20.8 |
| Primary product Production | 10.1 | 24.1 | 23.7 | 68.3 | 23.7 | 61.3 | 44.1 |
| Economic Infrastructure | 52.8 | 51.3 | 48.9 | 15.2 | 0.8 | -2.6 | -1.0 |
| Social Infrastructure | 28.5 | 24.3 | 8.6 | 6.2 | 23.9 | -4.4 | 8.8 |
| Multi-Sectors Investment | - | - | 1.5 | - | 125.4 | - | - |
| Decentralization, Social Welfare, Local Governments | - | - | 15.8 | 5.0 | -5.1 | 4.6 | -0.4 |
| Others | - | 0.2 | 1.5 | - | - | - | - |

Table 2-8 Ratios of Public Sector Revenue and Expenditure Against GDP* (1968-76)

| | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Current Revenue | 20.7 | 23.1 | 23.8 | 23.0 | 24.2 | 24.4 | 32.1 | 31.7 | 33.1 |
| Current Expenditure | 19.3 | 19.1 | 19.4 | 20.2 | 21.5 | 23.3 | 29.8 | 32.7 | 32.8 |
| Current a/c Surplus or Deficit | <u>1.8</u> | <u>4.5</u> | <u>4.6</u> | <u>3.2</u> | <u>2.9</u> | <u>1.2</u> | <u>2.9</u> | <u>-0.9</u> | <u>0.9</u> |
| Capital Expenditure (Of which Fixed Capital Formation) | 5.4 (3.7) | 5.7 (4.0) | 5.4 (4.0) | 5.6 (4.5) | 6.0 (4.9) | 6.7 (5.5) | 9.2 (8.1) | 9.1 (8.2) | 8.9 (7.6) |
| Aggregate Government Surplus or Deficit | <u>-3.6</u> | <u>-1.2</u> | <u>-0.8</u> | <u>-2.4</u> | <u>-3.1</u> | <u>-5.5</u> | <u>-6.3</u> | <u>-10.0</u> | <u>-8.0</u> |
| Repayment of External Debts | -2.4 | -2.0 | -2.0 | -2.4 | -2.3 | -2.5 | -1.9 | -1.9 | -1.9 |
| Funds to be Financed | <u>-6.0</u> | <u>-3.2</u> | <u>-2.8</u> | <u>-4.8</u> | <u>-5.4</u> | <u>-3.0</u> | <u>-8.2</u> | <u>-11.9</u> | <u>-9.9</u> |
| By Inflow of External Borrowing | 3.6 | 3.6 | 3.2 | 3.1 | 3.8 | 5.8 | 7.6 | 7.4 | 4.9 |
| By Domestic Borrowing (Net) | 2.4 | -0.4 | -0.4 | 1.7 | 1.6 | 2.2 | 0.6 | 3.5 | 5.0 |

(Note) * The difference between Table 2-4 and this table is that Public Sector is aggregated in this table.

(Source) Ministry of Economy & Finance

2-4 Public Investment Results and Problems

As mentioned earlier, public investment during 1968 and 1976 was concentrated in the production sector, in particular in large-scale projects. Let us now examine the results of public investment carried out so far and the anticipated future problem areas.

First of all, we can point to the following projects as success stories among the various projects carried out:

- (i) By the modernization of the copper refining factory in Ilo, efficiency of operations was further promoted.
- (ii) SIDER PERU succeeded in rationalization of the steel production process.
- (iii) Sima Perú improved its ship building capacity, and it now able to build almost any type of vessel at relatively low cost.

These three projects can be considered as successful examples without question.

The problem of public investment in the early years of the "Perú Revolution", i.e., during the 1968-1970 period, was that it was difficult to determine suitable projects for public investment. However, at present there are so many prospective projects that sometimes one wonders which projects should be selected. This change can be considered as great progress. Moreover, the fact that the Central Government and related agencies have accumulated experience and improved their capability for execution and management of projects through the implementation of various large-scale projects such as petroleum, mining, large-scale irrigation, power, water supply and sewage, can also be considered as favourable progress.

We would, however, also point out the undesirable effects which resulted from concentration of public investment in a small number of large-scale projects. To be sure, the three projects industry mentioned above were successful. But the majority of huge projects, including the three just mentioned, are characterized by capital intensiveness and do not contribute to a solution to employment problem which Peru faces. We should also note the fact that projects which might have contributed to the creation of employment opportunities if properly operated, and so many various problems that they could not produce the expected results. This tendency is particularly strong in the agriculture and fishery sectors.

Let us first examine agricultural projects. Investment amounting to about US\$500 million in 1978 dollars was made in two large irrigation projects in Chira-Piura and Majes. Both projects, however, have very low utilization rates.

The Chira-Piura project originated from the fact that while the quantity of water in the Chira River showed quite radical seasonal changes, Piura River water showed a shortage. The objective of the project was to construct a reservoir with a water capacity of 690 million m³ to control discharge, to construct a canal of 54 km to feed water into the Piura River and to develop an irrigation network in the Piura Basin. At the same time, the project intended to develop drainage facilities so that the land downstream in the Piura Basin, which had been suffering from salt damage due to poor drainage, could be improved. At the pre-investment study stage in 1968, construction costs for the reservoir and canal were estimated at US\$53 million, and for land improvement at US\$67 million. By 1977, the reservoir and the canal had been completed. However, since the drainage has not yet been completed, there is a possibility that salt damage in the downstream Piura Basin will be further aggravated if water is run through the canal under the present conditions. It is now thought that it may take seven more years to complete the drainage facilities. Up to the present, the equivalent of US\$220 million has been spent for construction of the reservoir and the canal. This is about four times the original estimate. For construction of the drainage, costs in excess of those for the reservoir and irrigation canal will be required, and the total may reach as high as US\$500 million. This means that US\$500 million would be spent for irrigation facilities serving about 150,000 ha at most. This is about US\$3,300 per one hectare and suggests that the economic viability of the project is very doubtful.

An important question has been raised also regarding the economic viability of the Majes Project. This project includes construction of a reservoir with a capacity of 200 million m³ on the Colca River (4,200 m above sea level) and construction of a canal of 140 km (of which half is through a tunnel), for irrigating an area of about 57,000 ha in the Majes area and Sigwas Basin (2,200 m above sea-level) and power generation of 270 MW. Every survey in the past 15 years has sounded warnings on the economic viability of the project because drawing water from the Andes Plateau area would be very costly and the proposed area for irrigation has low land productivity. However, the Government decided to begin first-phase construction to irrigate 27,000 ha in 1971. The cost of the project reached the equivalent of US\$243 million in 1978 prices up to the beginning of 1977; more than double the original estimate. If this situation continues, total construction costs for the project may reach as high as US\$1,000 million up to the 1984 - 1985 period when the first phase of the undertaking is expected to be completed. Under the circumstances, the construction cost per one hectare would be nearly US\$40,000. We must say that the economic viability of this project is extremely low even in comparison with the Chira-Piura project.

The same situation can be pointed out with respect to another large-scale irrigation project, i.e., the Tinajones

project. At present, about 200,000 ha are not usable due to salt damage of the irrigated land in Peru. It is quite possible to increase productivity of the land by construction of simple drainage facilities. There is a strong argument as to the effect that a project to utilize this presently unusable land would require far less cost (about US\$1,500 per hectare) than going ahead with the Majes project the economic viability of which is extremely low. Benefits of the project to a larger number of farmers (about two to three times more as compared with approximately 30,000 beneficiary farmers for the Majes project).

As regards the fishery industry, a large-scale fish processing facility at Paita near Piura on the northern coast was established by public investment. As far as the scale of this facility is concerned, it is the largest in the world. However, in addition to the fact that expected fishery resources have not been obtained, there were errors in the planning of the facility as well as technological and managerial problems. As a result, the largest fishery enterprise, Empresa Pública de Procesamiento de Pescado de Paita (PEPESCA), went bankrupt in 1977, and is now being liquidated. This enterprise was operated by public investment.

In respect to the mining industry, the first-phase project for the Cerro Verde copper mine which was taken up by Minerio Perú suffered from a delay of more than three years in the construction period and an increase in costs amounting to 2.4 times the original estimate due to the insistence of Minerio Perú on a mine development method without adequate preparation which required high-level technology. The Bayovar phosphorus mining project is an example of a project which has been taken up before a survey on economic viability has been completed, simply because that international market price of phosphorus was at a high level. In the end, the project had to be abandoned.

In the infrastructure sectors such as power and transportation, the results of projects have not been so unexpectedly bad as in the case of agriculture and fishery. There are, however, several problems here also. Firstly, all project schedules tend to be delayed due to topographical difficulties and actual costs tend to exceed original cost estimates. Secondly, there is so much red tape in the procedures of concerned Government offices, that the timing for undertaking of construction suffers. For example, in the power sector, preparations for construction of hydro-power generation and thermal-power generation stations following the construction of the Mantaro hydro-power generation station have not made any progress. Therefore, it is expected that the additional construction of diesel power generation stations will become necessary in the mid-1980s in order to meet power demand increases.

As regards the transportation sector, a budget for the rehabilitation of the espressway between Neshuia and Pucallpa has been in effect since 1974. Due to the fact that work has not actually begun at all, the present situation is that the expressway must be reconstructed completely, with construction costs expected to be three times more than the cost of rehabilitation.

We have pointed out the problem areas in each sector. It is also a fact that the process of planning public works program, the distribution of budgets, and the management of project implementation of the entire Peruvian Government is extremely complicated and inefficient. As to the flow of work from planning to execution, first plans are formulated in the sector planning office of the Government department in charge of the sector, then sent to the Sectorial Planning Office (SPO) concerned with that sector in the same department. After the SPO decides the priority of projects in the particular sector, the projects are sent to the Instituto Nacional de Planificación (INP). INP examines each project in line with national development objectives, the soundness of the project, the availability of investment funding, etc. After the project is approved, it is sent back to the department which formulated the project, and this department then requests formulation of investment fund planning to Corporación Financiera de Desarrollo (COFIDE), a development financing organization. At the same time, the Ministerio de Economía y Finanzas examines the project as to potential problems with foreign exchange financing. When borrowing from abroad is required, the project must be approved by the Cabinet. At each stage in the examination process, there are many complicated committee's examinations. Furthermore, even for a project being implemented, approval procedures of the concerned department and governmental enterprise with respect to bidding and import application are extremely complicated.

While the above-mentioned examination procedures with the objective of mutual control delay decision making, in the case of large-scale public projects which have been decided on a political basis, the project itself may already have been started at the same time has been under examination by INP, making the entire examination procedure meaningless. It is said that the petroleum pipeline project, Cerro Verde copper mine project, Majes irrigation project, Bayovar phosphorus mine project and fishery processing facility project, all of which have had serious problems, are projects which were decided on politically.

The problem which arises from complicated or political decision making is that execution and control of the gudget becomes difficult. Particularly, development expenditures in the fiscal years 1976 and 1977 exceeded the budget by a considerable amount in spite of the fact that no new projects were implemented, due to the fact that approval of the development budget was delayed into the latter half of the fiscal year during the three fiscal years of 1975, 1976 and 1977,

and adequate attention was not paid to the fact that expenditures for large-scale projects increase from the second year onwards.

2-5 Financial Source of Public Investment

Since the public sector gained control of the important production sectors of the economy of Peru, it has had to bear the responsibility for financing the required investment funds for development by mobilizing domestic savings. To our regret, however, we cannot say that the public sector has succeeded in effectively mobilizing domestic savings. During the first three years of the Velasco Administration, the government's financial position improved remarkably. Due to the excess of payments over receipts in Government finance during the 1964 - 1967 period under the Belaunde Administration, together with a slow-down in the export sector, the administration ran into financial crisis. The Velasco Administration made efforts to weather this crisis by implementation of the Economic Stabilization Program, of which the main policy was reformation of the Government financial system and reduction of current expenditures. As a savings in the public sector against GDP increased considerably, from less than 9% in 1968 to 19% in 1970. The ratio of domestic savings as the source of fixed capital formation increased remarkably, from 34% in 1968 to 85% in 1970. This improvement in Government financial position was particularly noteworthy because it was a time when the new administration began carrying out structural reforms in the ownership of important production facilities. The target of the government's financial policies at that time was to finance the reform of economic structures by domestic funds to the extent possible, and the Government intended to finance investment funds required for the development of priority sectors with the surplus accumulated in other economic sectors.

Unfortunately, this improvement in government finance ended within short period. From 1971, government finance became aggravated, and this tendency accelerated from 1973. The investment boom led by the public sector began in 1971 and 1972, and fixed capital formation by the public sector comprised more than 8% of the GDP. It represented more than 50% of the total fixed capital formation in the 1974-1975 period. However, savings by the public sector (the surplus of the current account of the Government) which could be used for investment began to decrease sharply, and some minus savings (deficit in current account) were recorded in 1975. As a result, the gap between investment and savings reached 12% of the GDP in 1975. During this period, Government deficit was coincided with the reduction in the rate of household savings, and the investment-savings gap could not be closed by domestic savings. Therefore, the dependence on foreign investment and borrowing, namely on the overseas savings, became much heavier. The ratio of gross expenditure of foreign investment and borrowings was 3.2% of the GDP in 1970, but this ratio increased sharply to 7.6% in

1975. From 1975 onwards, it became difficult to introduce medium-and long-term borrowings from foreign countries, reliance on deficit financing from domestic banking sector developed. This induced price increases through the increase in money supply.

When government financial position was improved by economic stabilization measures during the 1968 - 1970 period, the savings of the public sector which could be used for investment reached as high as 19% of government revenue. During the 1971 - 1976 period, this ratio dropped to 12%. If we make tentative calculations on the assumption that this ratio was maintained at 15% during the 1971 - 1976 period, the ratio of investable savings of the public sector against the total amount of actual public investment would have been 56% instead of actual 16%, and the ratio of the investment-savings gap against GDP would have been reduced from the actual 12% to 4.5%. It is considered that if the gap was in this order, apparently the difficulties could have been remedied without leading to a financial crisis. In the following paragraphs, we would like to look for the reason behind the reduction in the rate of savings in the public sector and demonstrate that the rate shown above as a hypothetical case could have been achieved without much difficulty.

2-5-1 The Central Government as a Source of Domestic Savings

The Velasco Administration could successfully overcome the financial difficulties which arose during the later part of the previous administration. As a result, the ratio of government current revenues against GDP, which was 15.3% in 1968, increased to 16.4% in 1970. The annual average rate of increase of Government current expenditures during 1966-1968 was 5.6%, but it was held down to 1.9% during the 1969-1970 period. The surplus of the current account in 1968 was 2% of current revenues, but this ratio increased remarkably to 16% in 1970. The deficit in the aggregate account was 3% of the GDP in 1968, but it was reduced to 1.3%. In 1970, fixed capital formation of the Central Government could be financed adequately by a surplus in the current account. However, Government financial position began to deteriorate from 1971, and in 1976, the current account went into deficit.

The primary cause of the deterioration of government financial conditions was that the increase in government revenues was less than the increase in government expenditures. The annual average rate of increase of aggregate government expenditures, including the redemption of government bonds during the 1971-1976 period, was 6.5%. As compared with an average annual rate of increase of GDP in real terms of 5.8%, the above rate for aggregate government expenditures cannot be considered as too high. Also, the ratio of aggregate government expenditures against GDP was 20.3% in 1968. This increased only slightly to 21.7% in 1976. On the other hand, the average annual rate of increase of government revenues in real terms over these six years was only 2.1%. The ratio of government revenues against GDP was reduced from 16.4%

to 13.6% during this period. If an increase in government revenues which matched the growth of GDP during this period could have been maintained, the ratio of the deficit of aggregate accounts of the Government against GDP would have been about 2.6% instead of the actual 4% in 1976.

Therefore, the first step which must be taken, in order to reconstruct government finances in Peru and secure a balanced budget over a long period is to try increasing government revenues to a level appropriate to the scale of the national economy. The ratio of the tax burden (ratio of tax revenues against GDP) in Peru was 13.8% in the 1966 - 1970 and 13.0% in 1971 - 1976, showing a decreasing tendency. An international comparison shows that the ratio in Peru has been low (it was 22.4% in Venezuela and 19.8% in Chile in 1976). Furthermore, the elasticity of tax revenues against GDP was 1.18 during the 1950 - 1965 period, but declined to 0.93 in the 1968 - 1976 period. A problem exists in such a tax system where the ratio of tax burden and elasticity are both low. This is due mainly to the fact that since the tax exemption point for personal income tax was set at an extremely high level, households paying tax comprise only 6% of all households. The tax exemption point for personal income in Peru in 1972 was very high in comparison with other Latin American countries. An international comparison made by converting different currencies at official exchange rates shows that the tax exemption point in Peru is nearly 40% higher than for Argentina, two times higher than for Uruguay and Brazil, about 12 times higher than for Chile, and about 19 times higher than for Venezuela. Also, for some kinds of income a fixed rate is applied instead of a progressive rate. Moreover, since various sizable tax exemption measures were progressively introduced for personal income taxes, the effective tax rate was reduced to an extremely low level. As a result, income tax proceeds (including corporate and other similar taxes), which comprised 36% of total tax proceeds in 1970, represented only 23% of the total in 1976. The reason for this drop was that out of all total income tax, personal income tax comprised 42.9% in 1970, but this share was reduced to less than 25% during the 1975 - 1976 period. Sizable tax reduction and tax exemption measures were also introduced into the corporate tax system.

With such a system of personal income taxes, it is clear that the tax system was not functioning effectively to redistribute income. Moreover, as the weight of income tax in total tax revenue proceeds gradually reduced, the dependence on tax revenues related to international trade became larger. About 65% of the increase in tax revenues during the 1973 - 1975 period came from international trade-related types.

The problems with tax revenues outlined above were further aggravated by a weak tax collection organization and complicated tax procedures. Out of all taxes in Peru, three kinds of tax, i.e. income tax, sales tax and import duties assessed on an ad valorem basis, comprise about

70% of total tax revenues. However, regulations on other taxes are so complicated that the Internal Revenue Bureau cannot entirely devote itself to the collection of most important taxes under the present system. One example is that there are 25 forms of indirect tax related to production and consumption, and the tax rates and other regulations to be applied in each case are different. Total proceeds of these indirect taxes are a little more than 1% of all tax revenues, and therefore we must conclude that such a tax system is imbalanced. If efforts are made to increase government revenues through such measures as the reduction of the tax exemption point, a cutback in tax exemptions and the strengthening of the tax collection organization, raising the rate of tax burden against GDP to 17 to 18% would not be impossible judging from other countries cases.

2-5-2 Government Enterprises as Sources of Domestic Savings

From the point of view of the important position occupied by government enterprises in the national economy, it is desirable that the basis of management of these enterprises be well established, and that the financial burden of the Central Government is not be increased. However, the actual situation has not displayed these characteristics. The financial position of government enterprises began to deteriorate rapidly from 1973. From 1968 to 1972, the importance of these enterprises was relatively small, but financial conditions were quite good. The savings of these enterprises, namely the total of surpluses in current accounts and revenue from capital accounts, reached about 20% of revenues, and such savings would finance about half of all capital expenditure. However, along with expansion of activities from 1973, capital expenditure increased, and by 1975 the scale of capital expenditure had tripled, comprising about 5% of GDP. At the same time, the ratio of government enterprise savings against GDP deteriorated rapidly from 0.9% during the 1970-1972 period, to minus 0.3% during in 1973 and 1974, and to minus 2.8% in 1975. Therefore, the entire amount of investment was financed by subsidies of the Central Government and borrowings from foreign countries. In 1976 the situation improved considerably, but savings of these enterprises were less than 5% of revenues and could finance only about 16% of capital expenditures.

The major causes of deterioration of financial conditions are considered to be the following: (i) the pricing policies of the Government, (ii) the management of government enterprises; and (iii) the special situation prevailing in the fishery industry.

(1) Price Policies of the Government

The Government has been carrying out rather inelastic price controls in order to provide insulation against the effect of changes in overseas prices on the domestic price system, and to hold down price increases.

Among government enterprises, Petro Perú, engaged in the domestic sale of imported petroleum products, and EPSA, responsible for the domestic sale of foodstuffs, were the two government enterprises affected most by the price policies of the Government. Even in 1973, domestic selling prices in Peru for petroleum products were very low. Perú belonged to a group of countries where in petroleum prices were the lowest among Latin American countries. This was one of the reasons why financial conditions at Petro Perú were unfavorable. However, during the 1971-1972 period, Petro Perú financed 87% of investment expenditures with its own funds i.e., 22 billion out of 25 billion soles were financed by self-generating funds. However, operating losses of Petro Perú in 1975 reached 0.9% of the GDP due to the fact that the Government of Peru was slow in response to the quadrupling of international crude oil prices during the oil crisis in 1973 and the dependence of Petro Perú on imported petroleum increased. At this stage, the government increased, in June 1975, the price of petroleum products from a US\$6.70 equivalent to US\$9.20 per barrel, a substantial increase of nearly 40%.

However, the average cost per barrel was then already reaching US\$10.50 per barrel, and therefore, it should have been necessary to increase the price by near by 60% in order for Petro Perú to realize operating profits. In January and June 1976, Petro Perú raised petroleum products prices considerably, and thus succeeded in finally wiping out operating losses.

But this situation was short-lived because the import price of petroleum increased due to gradual devaluation from September 1976 while domestic selling prices declined in terms of equivalent dollar value. For example, regular gasoline was US77 cents equivalent per gallon in September, 1976, but dropped to US66 cents in May 1977 due to devaluation of the sole. In June and October, 1977, the Government again decided to substantially increase prices of petroleum products, but the petroleum price level in Peru was lower than in other Latin American countries. The deterioration in the financial conditions of Petro Perú coincided with timing of large-scale investment for oil exploration and the construction of a pipeline, and therefore the required investment funds was introduced almost entirely from abroad. About 44% of the expenditures from foreign countries for project assistance during the 1972 - 1976 period was related to petroleum.

The operating losses of Petro Perú were the greatest factor in the deterioration of the financial performance of government enterprise as a whole. If the selling price of petroleum products had been fixed by adding the import price of crude oil, the cost of refinement and transportation, and other sales costs, it would have been higher by 78% than the price established by the Government. If this price had actually been applied, the ratio of financial results of government enterprise against GDP would have been plus 1% instead of the actual minus 0.9%.

We must say that it is not only undesirable from the point of view of energy policy but also from the point of view of income redistribution to maintain the price of petroleum products at an unrealistically low level. A household survey (Encuesta Nacional de Consumo de Alimentos) during the 1971 - 1972 period disclosed that about 70% of all gasoline was consumed by the highest income group residing in Lima City. Therefore, measures to keep gasoline prices at a low level were not appropriate in view of the government's policy target, the objective of which was to carry out fair income redistribution.

We have examined above the price policies of the Government with respect to petroleum. Similar points can be made regarding wheat, rice, vegetable oil and fertilizers. Foodstuffs are sold mainly by EPSA and fertilizer by ENCI in Peru. The operating losses of these government enterprises during the 1974 - 1976 period were as much as 1% of the GDP. The government instituted price controls in order to protect consumers by holding down increases in prices of foodstuffs after oil crisis. As a result, the domestic selling price covered only 60% of the import price at the end of 1974.

Efforts we made to reduce the operating loss sale enterprises by substantially increasing prices several times in 1975. Due to the gradual devaluation of the sole however, measures to increase domestic prices could not cover increases in import prices, as was the case for petroleum. From mid-1975, the government reduced the price of fertilizer so that consumers could buy it more easily, with the objective of increasing agricultural products. This measure, however, resulted in an increase in ENCI operating losses.

The policy of controlling domestic prices for necessary everyday commodities so that they would be available to consumers at low cost is meaningful as a short-term policy. But when the operating losses of government enterprises cannot be covered by the government and the resulting deficit is financed by the domestic banking system, resulting in an endless increase in money supply, the effects of low price policies is reduced by inflationary pressure. Moreover, the policy of giving subsidies for foodstuff clearly benefits upper and middle income groups in the cities in the case of Peru, as in the case of petroleum.

Although the scale of operating losses was not as large as with of petroleum, foodstuffs, and fertilizer, public utilities enterprises either suffered from a substantial reduction in operating profits or an increase in operating losses from 1970 to 1975, due to the fact that the system of utility charges had not been changed for a long time. This resulted in a reduction in their ability to finance investment programs with self-generating funds.

If it had been allowed for government enterprises to set selling prices in accordance with costs, the current account of the government enterprise as a whole would undoubtedly have been improved by 3-4% of the GDP.

(2) Management of Government Enterprises

As for causes of the decrease in profits of government enterprises, we would also like to point out, in addition to the low price policies of the government, the important fact that the Government did not set out conditions for rationalization of management to these enterprises. Therefore, it was unavoidable that the attitudes of management tend in the direction of an easy-going manner. As far as government enterprises are concerned, there is a tendency towards progressive loss instead of improving their own managements themselves because the government will usually cover any operating losses and may not give specific directions on rationalization of management. On top of this personnel affairs of government enterprises not only at the middle-level must be approved by the government. Also, contracts concluded by government enterprises and official trips taken by the staff must be government approved. Therefore, the authority given to the executive boards of government enterprises are reduced to very limited areas of responsibility. Moreover, 21 different documents must be submitted regarding budgets, and, as quarterly reports must be submitted every three months, 10 different documents are required. While the procedures are so complicated, no standards regarding improvement of efficiency can be established. This can be considered as a problem area which must be solved in future.

(3) Special Problems of Fishery Industry

Another important cause of reduction in profits of government enterprises as a whole during the 1973 - 1975 period was the special situation regarding Empresa Publica de Producción de Harina y Aceite de Pescado (PESCA-Perú). When the fishery industry was nationalized and PESCA-Peru established, the fishery industry was experiencing the worst conditions. There were too many fishing vessels and processing facilities and many fishing companies were on the verge of bankruptcy. PESCA-PERU disposed of a number of ships and facilities that it took over, but could not remedy excess employment, and has been employing an excess of at least 10,000 workers. Moreover, PESCA-PERU paid to the previous ship and facility owners a substantial amount of cash in compensation for nationalization and succeeded also to huge short-term debts of the previous owners. PESCA-PERU successfully converted all of the short-term debts to medium-term government enterprise bonds, but this certainly constituted one factor aggravating financial conditions. Poor catches of Anchovy thereafter further aggravated financial problems of PESCA. As a result of these factors, operating losses of PESCA reached as peak of 0.3% of GDP during the 1973-1975 period. In June, 1976 the Government formally decided to return operation of fishing to the private sector in order to lighten the burden of PESCA. Therefore, although depression in fishery industry may still continue to cause financial difficulties at PESCA in future, the huge losses of the previous several years will be avoided in future.

2-5-3 Social Security Funds as a Source of Domestic Savings

Since 1970, the only public sector institution which has been producing a fair amount of savings which can be used for investment is Social Security Administration (SAS). Financial resources of SAS are based on: (i) health insurance premiums for workers in factories and offices; (ii) retirement pensions fund; and (iii) accident and sick insurance premiums. The largest source of funds is the accumulated fund for retirement pensions, which comprises 45% of the total funds. Surplus funds amounted to 1.5% of GDP in 1974. These were mainly placed in time deposits at nationalized commercial banks, therefore, it can be said that these funds were used to cover deficits of other components of the public sector through the banking system. Workers who joined in the retirement pension fund numbered 1,300,000 in 1974, while beneficiaries of this fund numbered only 70,000. Therefore, the difference between the accumulated premiums and pensions paid out could be used as surplus funds.

However, as the number of retirees has since increased, surplus funds have been decreasing rapidly, reaching only 1% of GDP in 1976. Since this tendency should continue from now on, SAS estimates that fund operations will record a deficit in 1980, and no surplus will be produced thereafter.

The problems which SAS is now facing, besides the rapidly decreasing surplus fund, are as follows: (i) only banking time deposits are allowed for the use of surplus funds, and hedging against inflation is not possible, and (ii) there are some problems from the point of view of social justice with respect to income redistribution: the health insurance premium rates and retirement pension rates for lower income groups are higher than those for high income groups. For example, a factory worker with a monthly income of 10 thousand soles must pay 16.5% of his income (9.0% health insurance premium and 7.5% for retirement pension), while an office worker in the public sector with a monthly income of 75,000 soles pays only 5.7% of his income (1.3% health insurance premium, and 4.4% for retirement fund). This is not only a problem with respect to social equality, but also puts a higher burden on the employers of low income workers. It means that the cost of labor in labor-intensive industries is higher than capital intensive industries are favored. The present system is therefore a problem from the point of view of industrial policy.

2-5-4 Local Government Authorities as Sources of Domestic Savings

In Peru, where authority is highly centralized, tax revenues of local government authorities do not have a large weight. The tax revenues of these local comprise only 1.2% of all tax revenues of the Central and local governments. Among local government authorities, the Lima metropolitan area has the largest weight: it comprises 80% of total tax revenues of local government authorities and about 50% of total