

- 3) Strengthening of supporting services and improvement of facilities.
- a) Financial conditions of the villages in the rural areas shall be improved, institutions reformed, and measures devised to prevent the increase of production costs of the farmers. The Land Bank of the Philippines (LBD) and the Philippine National Bank (PNB) shall support the financial markets of the rural areas in such matters.
 - b) Research and extension services shall be activated to respond to the needs of the dynamic agricultural sector. The current Government funds for such activity amounts to 0.2% of the gross value-added in agriculture and shall be increased to 1% within the Medium Term Development Plan period. Particularly, the technical level of the state organizations related to agriculture, universities, and agricultural cooperatives shall be enhanced and distributed in the regions.
 - c) In order to expand non-agricultural employment and increase the farmers' income, the "Agricultural Investment Incentives Priority Plan" has to be reorganized to provide incentives for the establishment of the small scale agro-industries and the agricultural inputs manufacturing industries. Also, dispersal of the industry into the regions shall be promoted and the development of labor-intensive local rural industry utilizing indigenous materials shall be given priority.
 - d) Measures to reduce agricultural risks
To encourage investment in agriculture, crop insurance, guarantees, and other similar systems to cover the maximum number of crops shall be introduced to reduce the risks of agriculture, in line with the priorities for agricultural development.

Furthermore, the improvement of irrigation facilities, furnishing of cultivation technology, allocation of extension service experts, provision of roads and ports, dissemination of information on the links between markets and the producing areas, weather forecast information, warning of pests and diseases and other environmental matters shall be undertaken.

e) Strengthening of farmers' organization

As a particularly important institutional reform, the organization of farmers through cooperatives etc., shall be promoted.

(2) Industrial sector

The targets of the Medium Term Development Plan set forth for this sector are as follows:

- a) Strengthening of the linkages with the agricultural sector and the natural resources sector to promote the development plan and to enhance the gross national product of the Philippines
- b) Promotion of labor-intensive, micro, cottage, small and medium industry based in the rural areas
- c) Maintenance of the balance between development plans, for regions and sectors
- d) Structuring of the movement of goods between the production centers and the market centers, between the producers and consumers, and of the service system
- e) Establishment of self-sufficiency in consumer goods, raw materials and intermediate goods on a national basis
- f) Development of products that are competitive in the world markets by utilizing the abundant resources and the excellent manpower available

- g) Provision of incentives for investment in markets that are imbalance
- h) Reduction of government intervention in business and strengthening of its role in supporting industrialization and disseminating information
- i) Strengthening of technology transfer by promoting the induction of foreign capital
- j) Effective utilization of international and inter-regional cooperation including assistance programs

The industrial sector is targeted for an annual growth of 8.8% during the Plan period, and in particular an annual growth rate of 8.3% is set for employment. To attain these targets, the following measures shall be taken:

1) Sectoral development program

During the Plan period, the key industrial sectors particularly the existing industries shall be promoted and modernized and the liberalization of trade and promotion of investment shall be pursued.

- 2) Promotion of MCSMEs is the major task in attaining the generation of employment and dispersal of industries. The support program of the Government includes such measures as assistance to research and development, financial aid, provision of markets and technology, strengthening of linkages between MICSMEs and the large enterprises.

3) Promotion of investments

It is necessary that investments in the future be directed with priority given to industries which will bring benefits to the rural areas, and which will generate employment in areas where the productive capacity is the limiting factor to export-oriented industries, agro-based industries and import substitution industries.

The following measures shall be taken to promote investments.

- Strengthening of fiscal incentives
- Simplification of control and procedures of trade
- Improvement of the incentives under taxation laws
- Simplification of the procedures for foreign investment

4) Liberalization of trade

- a) Reduction of excessive protection implemented at the expense of specific firms or consumers
- b) Abolishment of mandatory licenses that restrict imports
- c) Reorganization of the customs tax system that matches the Medium Term Development Plan

5) Promotion of domestic trade

- a) Efforts will be focused on the structuring of flow system for goods and services between the producing areas and the markets, and between the producers and the consumers.

Improvements shall be made in communication facilities, infrastructural factors such as roads, bridges, ports, and transportation facilities such as inter-island shipping.

- b) Information service to the producers regarding sources of raw materials and supplies, prices, skilled workers, and other producers goods in a specific area, and training shall be institutionalized.
- c) The facilitation and promotion of domestic trade shall be strengthened by organizing trade associations who will form the core of activity.

- d) With respect to product standards, inspections of the product and quality assurance standards of the plant shall be carried out from time to time in systematic compliance with the international standards system.
- 6) Dispersal of industries in the region
- a) The dispersal of industries shall be promoted in line balance with the regional development plan and the sectoral plan.
 - b) Information on the resources and technology which will be needed in industrialization of a specific region shall be collected.
 - c) The government agencies which are involved in individual trade services and industry shall be dispersed both geographically and organizationally.
- 7) Promotion of exports
- a) Initial exporting goods shall be focused on the main non-traditional products having comparative advantages for the Philippines, that is, fresh and processed food, apparel, electronic parts, toys, furniture, fashion products, footwear, leather and hide products, and construction materials.
 - b) The second group of exports are the other non-traditional products, particularly the resource-oriented products, light industry products, intermediary products and services.
 - c) The target export markets are the U.S.A., Japan, E.C., ASEAN countries, Australia, Canada, China, Kuwait, New Zealand, Saudi Arabia, Korea, and the U.S.S.R.
 - d) Furthermore, export supporting work for the private firms in product design, packaging technology,

enhancement of product quality, source of raw materials and processing technology, testing and certification, product development and the development of the export market shall be strengthened.

2.1.4 Present Status of the Agro-based Industry in the Philippines

Among the manufacturing industries only the food industry and the apparel industries show growth. Comparing the productions of 1986 to those of 1972, the value-added for the total manufacturing sector was 1.6 times, of which the food industry amounted to 2.4 times and the apparel industry accounted for 3.2 times. Other products such as tobacco, lumber, furniture, paper, leather and hide, rubber, and chemicals showed a stationary trend or a slight loss.

The reasons are considered to be as follows:

- 1) Low growth in the domestic demand because of lower purchasing power and lack of effort to develop the markets
- 2) Deficiency in the supply system of producers goods for production
- 3) Lack of export incentives and severe import restrictions
- 4) Decline of competitive quality and lack of stability in supply
- 5) Insufficiency of measures for the development of small and medium industries implemented in recent years
- 6) Delay of production control, and of research and development systems in matching the changes in the world environment

As stated in the preceding paragraphs, the followings are the important reconstruction targets of the Philippine economy:

- a) Alleviation of poverty and enhancement of demand through expansion of employment in the rural areas
- b) Improvement of the external environment for inputs needed for production in the existing small and medium industries
- c) Shortage of technology for quality, productive capacity and production efficiency
- d) Development of markets and of the flow of goods between producing areas and consuming areas
- e) Development of post-harvest technology and technology for the effective use of agricultural resources
- f) Precise demarcation of work at the central level and at the local levels, or among sectors, and establishment of a responsibility system

In specific terms:

- 1) Enhancement of production efficiency and quality of the existing industries (food, agro-based, chemical, construction materials industries, etc.)
- 2) Market exploitation and technical development aiming at enhancing the value added of the agricultural resource-oriented industry and the enhancing of competitiveness against foreign products
- 3) Development of industrialization technology for non-traditional products (activated carbon, citric acid, starch derivatives, coconut derivatives, alcohol, phenol, particle board, etc.)
- 4) Development of commercialization technology of cottage type micro, small industries for products of daily use based on local resources

- 5) Establishment of industries based on agricultural resources and agricultural wastes
- 6) Adjustment among sectors at the central level, establishment of regional centers and technical support systems, and strengthening of functions for the improvement of the environment

On the other hand, the Medium Term Development Plan of the Government formulated for the period 1987 - 1992 takes a clear position to realize the above measures, and the rehabilitation of the Philippine economy is proceeding in a healthy way.

2.2 Tasks Required of a Technical Support System to Establish the Agro-based Industry

The supportive technology required for existing agri-industry and new enterprises of similar types is indicated as follows:

(1) Supply of information on markets and technology

Periodical information on foreign products competing with export products of the Philippines, their quality and the quality standard, and market propensity in the importing countries is lacking. The need for a given product in the domestic market is not easily grasped, and it is said that even information on the markets of an adjacent province is lacking. Also, the availability of information to industrial plants on the sources of raw materials and auxiliary materials, quality and prices suffer from bottle necks. The supply of an overall management information system for plant operations is needed.

(2) Support of planning technology and production technology

The incentives to the entrepreneurs are passive because there is insufficient organization in determining the requirements and potential for non-traditional products down to commercialization according to regional and sectoral plans as coordinated in line with the policies of the

central government. Therefore, closer coordination of functions such as splitting roles among sectors at the regional level is required. However the activities of TLRC and BSMBD are being intensified.

Also, in the existing small and medium industries, the process improvement for enhancement of productive capacity, resource-saving, energy-saving, quality upgrading and the tests and research necessary for these lack the necessary inspection functions, manpower, and equipment, and so block the expansion of demand, import substitution and increase of exports.

Particularly, in the industrialization of products that utilize indigenous materials, the commercial operation of the manufacture of high value added products, and of the import substituting industries, the identification of the project, package type project information, and information on the incentives for the project are lacking.

2.3 Tasks Required of ITDI

2.3.1 Government Agencies

(1) Bureau of Small and Medium Business Development (BSMBD)

CSMEs account for 98% of total establishments, 50% of total employment, and 25% of total value added in the manufacturing sector of the Philippines. BSMBD under DTI provides supervision and supporting services to CSMEs.

(A) Definition of CSMEs

The definition of CSMEs in the Philippines is as follows:

1) Classification by size of assets:

Cottage enterprises	Total asset less than 500,000 pesos
Small enterprises	500,000 - 5,000,000 pesos
Medium enterprises	5,000,000 - 20,000,000 pesos

2) Classification by number of employees:

Cottage enterprises	10 employees or less
Small enterprises	10 - 99 employees
Medium enterprises	100 - 199 employees

3) Classification by management structure:

An enterprise in which the owner or management performs the varied tasks stipulated in the contract on his own without specified staff or officers.

(B) Problems of CSMEs

Current problems of CSMEs in the Philippines are as follows:

a) Problems

1) Financing

- High interest rate inhibits development of CSMEs.
- Collateral requirements especially by official lending institutions are stringent.
- The paper requirement for securing funds is excessive.
- The loan processing duration is long.
- Raising capital is difficult.

2) Production

- Insufficient skilled labor
- Low productivity of the workers
- Limited technical knowhow and low level of technology
- Unavailability of and poor quality and high price of raw materials

3) Marketing

- Up-to-date market information is inadequate and knowledge of export procedures is lacking.
- Market is limited.
- Competition is very strong.
- Demand for products is limited and seasonal.
- Ocean transportation facilities are not adequate.
- Channels of distribution are inadequate.
- Credit system is inadequate.
- Product design, packaging, pricing, and servicing are lacking.

b) Requirements of the CSMEs

- A better loan system is needed.
- Upgrading of technical and management skills
- Establishment of common service facilities, such as common raw materials and auxiliary materials purchasing, common packaging facilities, etc.
- Management services

- Marketing assistance
- c) Financial assistance to SMEs
- 1) Promote use of financing system by SMEs
 - Simplify documents, collateral and other procedures
 - Periodic review of interest rate policy
 - Adopt feedback system by check and review of the financial situation of SMEs
 - Intensify campaign for financing programs
 - 2) Adoption of specialized financing programs for SMEs
 - Establish innovative and non-traditional funds to supplement the financial sources of the sector
 - Involve more banks and strengthen and expand credit. Strengthen the banking institutions and private voluntary organizations (PVOs) to support the entrepreneurs in the countryside.
- d) Entry and Expansion of SMEs' products in the domestic market
- Induction of market intelligence network
 - Decentralization and strengthening of market information
 - Strengthening of product research and development
 - Establishment of a common market center wherever feasible
 - Promotion of subcontracting arrangements between small and large enterprises as a means of expanding the small enterprise's market

- e) Promotion of the export of SME's products
 - Promotion of export financing by exporters and improvement of export guarantee systems
 - Training service to exporters to enhance competitiveness of products
 - Simplification of the administrative systems and procedures

- f) Development of technology and improvement of production systems
 - Transfer of appropriate technology and improvement of product quality and values are to be encouraged.
 - Technology centers and common service facilities shall be set up to support the production activity of SMEs.
 - Government technical assistance to SMEs shall be augmented through increased support to application and/or development activities.
 - Productivity of production inputs shall be improved to generate high value added for products.
 - Information on new and improved applied technologies and simplified and modern production systems will be packaged and disseminated to SMEs at lower cost but as effectively.
 - In order to promote development of new products, recognitions, awards and incentives shall be given to outstanding entrepreneurs, designers and workers.
 - Commercialization shall be promoted by encouragement and standardization of new product design

technology and processes for high quality, high value added products.

g) Promotion of production, development, and utilization of indigenous raw materials and other basic materials

- Maximum utilization of the indigenous raw materials will be emphasized.
- New sources of raw materials will be developed.
- Locally produced and imported producers goods shall be made available and their local production shall be expanded.

(2) Technology and Livelihood Resource Center (TLRC)

TLRC is an implementing agency of the Presidential Management Staff to promote industrialization with the objective of generating employment by supporting industrialization. Its aim is to contribute to the economic development of the Philippines through the supply of appropriate technology. The main mandates are as follows:

- a) to fulfill the role of science and technology center which is the implementing agency of the Government for delivering technology
- b) to extend the necessary technical and financial assistance to prospective individuals and SMEs following the government program for employment expansion
- c) to perform the service of an information center to introduce appropriate technology to the enterprises
- d) to conduct promotional services for enterprises of the region regarding industrialization projects through identification of the project, dissemination of information relating to raw materials used, mediation of process technology, and assistance in packaging technology

TLRC is constituted of the Livelihood External Assistance Program Office (LEAPO), which renders financial assistance to the agri-industry, the Technology Information and Dissemination Department (TIDD), which plays the role of a technical information center, and the Technology Ventures and Information Systems Department (TVISD), which conducts computer network services for government offices and private enterprises. TIDD, in particular, actively implements the following programs:

- a) Technology bank program
Stores technical information and disseminates this in packages to SMEs.
- b) Business technology training program
Implements training for users in three courses; home-business, agri-business, and aqua-business.
- c) Technology extension program
Organizes schools and communities into associations which will use and promote the application of appropriate technologies in everyday activities.
Conducts distance study by correspondence.
- d) Technology promotion program
Undertakes the dissemination of technology information via the mass media.
- e) Technology publication program
Coordinates the production of publications such as how-tos, manuals, pamphlets and monographs on agri-business.
- f) Technology films and video program
Coordinates with film production agencies production of film and video training courses.

(3) Micro, Cottage, Small and Medium Enterprises Council
(MICSMEC)

In November, 1987, MICSMEC was organized around DTI. The organizations participating in the Council are as follows:

1. Department of Trade and Industry (DTI)
2. Development Bank of the Philippines (DBP)
3. University of the Philippines - Institute of Small Scale Industries (UP-ISSI)
4. Department of Local Governments (DLG)
5. Department of Science and Technology (DOST)
6. National Economic and Development Authority (NEDA)
7. Department of Agriculture (DA)
8. National Manpower and Youth Council (NMYC)
9. Department of Environment and National Resources (DENR)
10. Philippine Chamber of Handicraft Industries (PCHI)
11. Philippine Chamber of Commerce and Industry (PCCI)
12. Philippine Business for Social Progress (PBSP)
13. Technology and Livelihood Resource Center (TLRC)
14. Small Enterprise Research and Development Foundation (SERDEF)
15. Chamber of Furniture Industry of the Philippines (CFIP)

The objective of the Council is to provide overall assistance to existing micro enterprises, cottage enterprises, and small and medium enterprises. Representing DOST, Dr. Lirag, Director of ITDI and the Chairman of the present project participates in MICSMEC and is in charge of technical development and technical services. The development of the "cottage fresh coconut plant" in particular is an achievement of recent years which is most promising. Also, the Chairman of the Council is Mr. Follocco, Deputy Minister of DTI in charge of research and development, generally acknowledged to be a fervent proponent of agri-industry.

Among the relevant government agencies are DOA, NFA, Philippines Coconut Authority (PCA), UP, and NEDA. DOA, UP, and NEDA place high hopes on ITDI (CMD) through the National

Development Plan or the abovementioned MICSMEC. PCA, who are faced with grave problems which the Association must resolve, such as decline of the exports of coconut related products, inter-cropping at coconut farms, replanting, and import restrictions of copra meal on account of the aflatoxin regulation, basically evaluate the research activities of ITDI. NFA, on the other hand, who used to administer rice, maize, wheat, fish, and other foods, and who now administer rice and maize only, has shown an interest in the treatment of and effective utilization of rice hulls and in the rice bran oil industry.

2.3.2 Private Companies

The following is a list of requests to ITDI from the private companies:

- a) Research on improvement of the processes of the existing SMEs, such as solar salt plants, activated carbon plants, etc.
- b) Technical assistance related to the above in the laboratory or the plant
- c) Training related to the above (including training in analytical methods)
- d) Joint research and development work relating to the manufacture of soap
- e) Technical consultancy relating to upgrading of quality and enhancement of productive capacity
- f) Technical consultancy and tests relating to conversion of raw materials and the modification of product grades

Although such needs exist, the present state of ITDI does not allow for an adequate response due to the following:

- a) When requested to conduct pilot plant tests on the results of the table scale tests of ITDI, it could not conduct these because of the lack of equipment.

- b) Since ITDI has been engaged in process development for a long time it has chemical engineers and welders who are able to design and fabricate test equipment, but because of the deficiency of equipment, this cannot be done adequately.
- c) Although there are themes ready for basic experimentation among the industrialization projects based on agricultural resources which have been presented to DTI, BSMBD, TLRC and MICSMEC, experiments cannot be carried out to determine the basic structure of the process because most of the equipment is inoperable or does not meet the purposes required.
- d) ITDI receives samples of products from enterprises in the area interested in agri-industry and is requested to study applications for them. In many cases, the required analytical equipment is lacking in the Institute, and it is difficult to collect even the basic data.
- e) With regard to ITDI's technical training conducted, such as for salt manufacturing, edible oil manufacturing, soap manufacturing, activated carbon manufacturing, slow release type fertilizer manufacturing etc., they are inadequate because of deteriorated or damaged equipment.
- f) Although it is anticipated that feasibility studies on the cottage industry projects will increase in number, the capability and the equipment for such work are lacking.

2.4 Present Status of ITDI

ITDI is a research organization with a long history which took over the Chemical Research Institute established in the Research Bureau of the Government of the Philippines in 1901. Its main function is academic research and it has functioned, for approximately 50 years. Subsequently, efforts were directed towards

industrialization research. It now consists of seven divisions for research and development and three divisions for technical services. Among the laboratories related to agriculture, chemical industry and food industry, who will be playing a central role in this project, is the laboratory which is in close cooperation with the University of the Philippines, Food Development Center, and the Food Development Divisions in ITDI. It differs from these, giving priority to research and development of chemicals that utilize agricultural products, and activities are concentrated on the development of industries of small and medium size, particularly cottage industries. It is characterized by the research and development of technology in the practical peripheral agriculture, chemical and food industries, instead of in pursuit of purely academic research.

2.4.1 Superstructure of ITDI

At the end of January, 1987 the previous National Science and Technology Agency (NSTA) was reorganized into DOST, and as a direct sub-organization, the present ITDI was formed by the merger of the Material Science Research Institute (MSRI) and the previous Natural Science Research Institute (NSTA).

As shown in Fig. 2-1, DOST has under it a science and technology service group of six organizations besides ITDI, which relate to nuclear energy, advanced sciences, forestry products, food and nutrition, metals, and textiles.

2.4.2 History of ITDI

Table 2-1 shows the history of ITDI.

2.4.3 Objectives and organization of ITDI

The objectives of ITDI are as follows:

- (1) to conduct applied research for the technological development and innovations in the fields of the manufacturing industry, minerals and energy

Fig. 2-1 Department of Science and Technology (DOST)
 Organization Chart
 (E.O. 128, 30 JANUARY 1987)

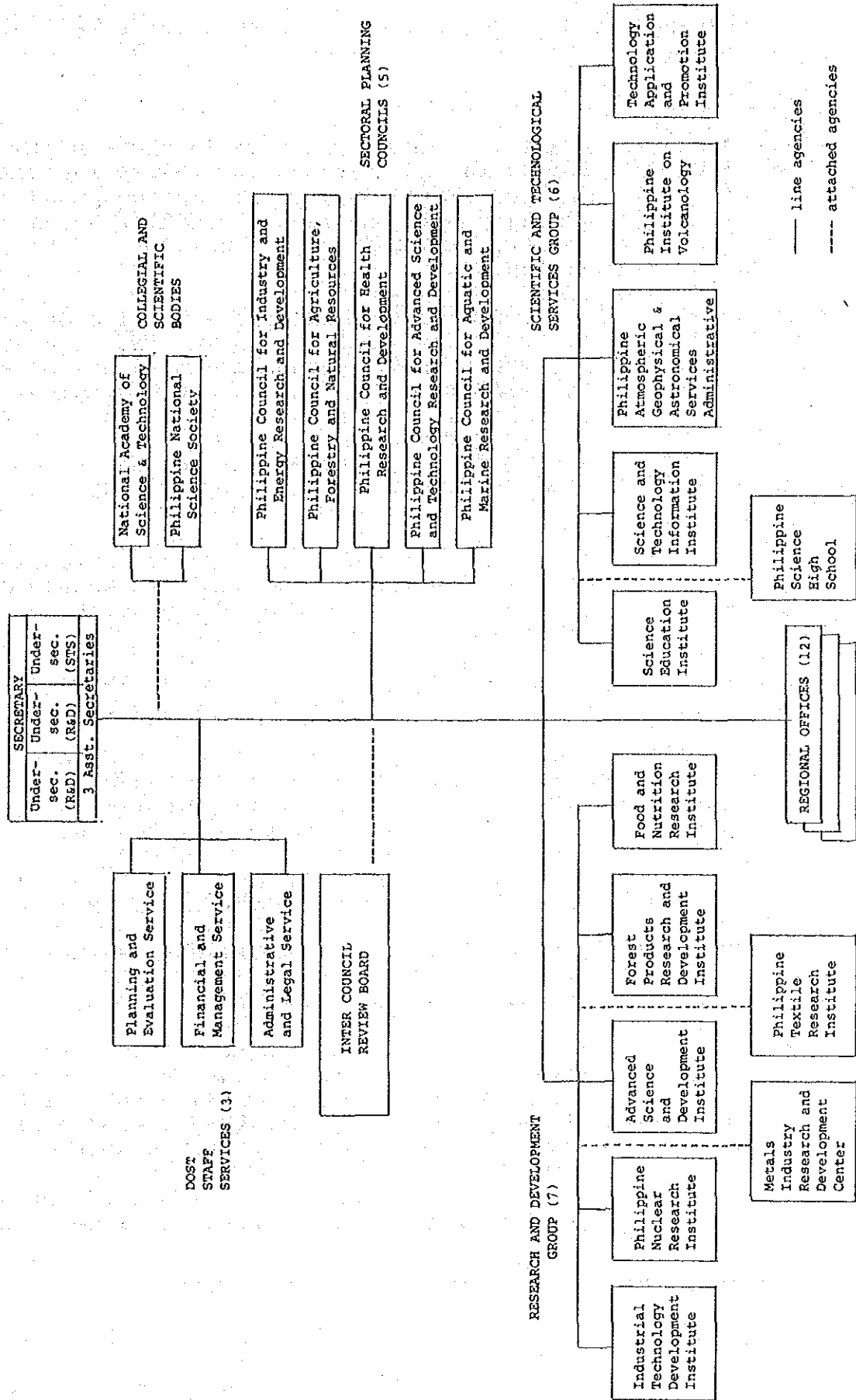


Table 2-1 (1) Brief History of Industrial Technology Development Institute (ITDI)

1901	The BUREAU OF GOVERNMENT LABORATORIES (BGL) came into existence through the Philippine Commission Act No. 156 of July 1; It was composed of the biological and chemical laboratories, a science library, and the Serum Laboratory of the Board of Health.
1905	By virtue of the Philippine Commission Act No. 1407, the BGL was reorganized into the BUREAU OF SCIENCE (BS) and expanded its functions to include the Bureau of Mines and the Ethnological Survey Division of the Bureau of Education.
1934	<p>The headship of the BS was passed on for the first time to a Filipino chemist, Dr. ANGEL S. ARGUELLES.</p> <p>The present-day Bureau of Soils, Bureau of Mines, Bureau of Fisheries and National Museum developed initially as part of the Bureau of Science during the pre-war years.</p>
1947	The BS was transformed into the INSTITUTE OF SCIENCE (IS) by virtue of Executive Order No. 94.
1951	The IS was renamed INSTITUTE OF SCIENCE AND TECHNOLOGY (IST) by virtue of Executive Order No. 392 and for the firsttime primarily concerned itself to industry-oriented research.
1956	<p>Congress approved R.A. No. 1606 authorizing the establishment of the NATIONAL SCIENCE BOARD (NSB).</p> <p>IST was changed to the NATIONAL SCIENTIFIC AND INDUSTRIAL RESEARCH INSTITUTE (NSIRI), and was placed under the supervision of NSB.</p>
1958	<p>Under the so-called "Magna Carta of Philippine Science" R.A. 1067, NSB was reconstituted as the NATIONAL SCIENCE DEVELOPMENT BOARD (NSDB) which was designed to coordinate and supervise all scientific activities in the country.</p> <p>NSIRI, became the NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY (NIST) under the supervision of NSDB.</p>

Table 2-1 (2) Brief History of Industrial Technology Development Institute (ITDI)

- 1973 As part of the overall reorganization of the Executive branch of the government, the NIST was reorganized, but retained the same name. With the merger of the Agricultural Research Center, Biological Research Center and Medical Research Center, only 2 technical R & D centers remained, namely the newly merged Biological Research Center and Industrial Research Center. In addition, there were the Tests and Standards Laboratory and the Scientific Instrumentation Division to provide standardization and technical services.
- 1982 By virtue of Executive Order No. 784 dated 17 March 1982, the NSDB was reorganized into the NATIONAL SCIENCE AND TECHNOLOGY AUTHORITY (NSTA). Under this reorganization NIST remained as one of the R & D institutes under the NSTA.
- As reorganized, research on agriculture was transferred to UPLB while the ceramics center emerged into an independent institute (MSRI). The Biological and Industrial research centers were also abolished and in their place, three (3) centers were created namely: the National Research and Development Center (NRDC), Chemical Research and Development Center (CRDC), and the National Standards and Testing Center (NSTC). Under the NRDC and CRDC are seven (7) programs to undertake R & D activities, while NSTC provides standardization and technical services.
- 1987 The NSTA was reorganized into the DEPARTMENT OF SCIENCE AND TECHNOLOGY (DOST) by virtue of Executive Order No. 128 dated 30 January 1987.
- Under this reorganization, NIST was renamed INDUSTRIAL TECHNOLOGY DEVELOPMENT INSTITUTE (ITDI) and remained one of the R & D institutes under DOST. All centers were abolished and ITDI now has ten (10) technical divisions with MSRI now absorbed by ITDI. Seven (7) divisions to undertake R & D activities, three (3) to render technical services and two (2) support divisions were created.
-

- (2) to furnish the results of this research, either directly or through the linking agencies of the government, to the end users
- (3) to conduct technical support services such as technical consultancy, education and training for the clientele in the industry and the end users, without being limited by specifications. Analysis and examination services specified by laws or sought by industry.

Fig. 2-2 shows the organization of ITDI.

CMD is constituted of the following sections:

Organic Chemical Section:

conducts research and development relating to the manufacture of organic chemicals, intermediates, import substitutions or exports, and relevant substances which are important to the industry.

Inorganic chemical Section:

conducts research on the manufacture of inorganic chemicals which utilize the indigenous resources of the Philippines and provides the results of such research.

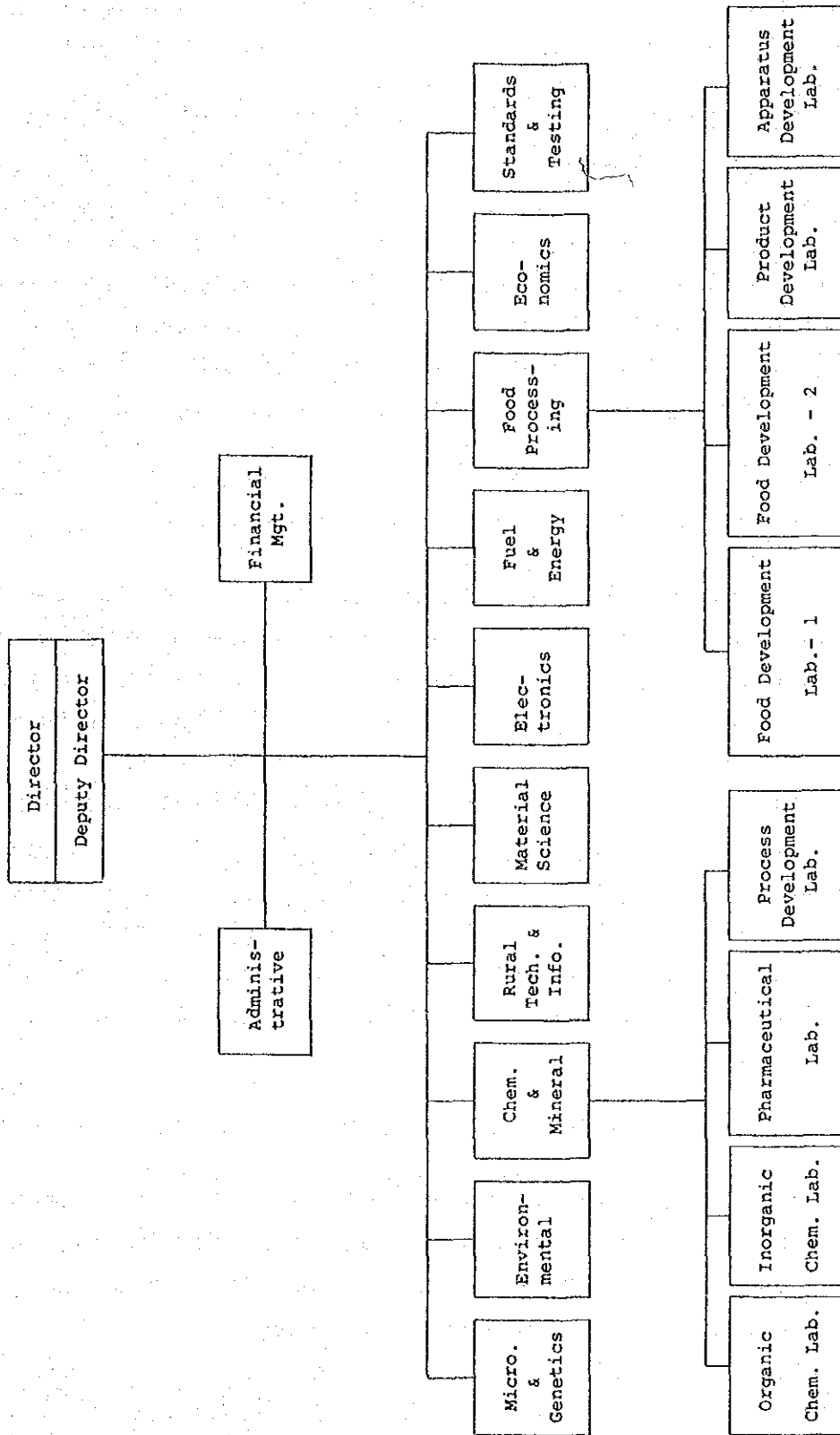
Pharmaceutical Section:

conducts research on the manufacture of pharmaceuticals and cosmetics which utilize regional resources, application research for pigments, edible oil, and other additives, and research on plant chemistry.

Chemical Process Development Section:

conducts the development of processes relating to chemicals and allied products, development of scale-up processes relating to chemical manufacture, design and fabrication of equipment.

Fig.2-2 Industrial Technology Development Institute (ITDI)



2.4.4 Relationship of ITDI (CMD) with Other Organizations

(1) Micro, Cottage, Small and Medium Enterprises Council
(MICSMEC)

As stated in Clause 2.3, the objective of this council is to provide an overall support to the existing micro enterprises, the cottage enterprises, and the small and medium enterprises. Dr. Liraq, Director of ITDI, participates in the council as representative of ITDI and implements and promotes projects which result from the research and development of ITDI, develops or renders technical assistance for such technology along the lines of the support program of MICSMEC.

(2) Technology and Livelihood Resource Center (TLRC)

TLRC is also a member of MICSMEC and is in close relationship with this. The themes under present development have a high possibility of being incorporated into the support program of TLRC. The results of the projects developed by ITDI or improvements made by ITDI on existing processes are promoted or otherwise, the agri-industrial technology of ITDI is incorporated into the Technical Utilization System (TUSS) of TLRC, through the Agricultural, Small and Medium, Industrial Lending Program (A-SMILE), Export Industry Modernization Program (EIMP), Guarantee Fund for Small and Medium Enterprises (GFSME), and Industrial Guarantee and Loan Fund (IGLF).

(3) Bureau of Small and Medium Businesses Development (BSMBD)

TLRC referred to above provides mainly financial support, while BSMBD is service-oriented, and provides mainly a processing technology service at present. ITDI supplies BSMBD with agri-industrial chemical technology.

(4) Philippine Coconut Research and Development Fund (PCRDF) is a private firm, but maintains a close relationship with PCA. They are conducting development programmes for industrial-

zation of the coconut farms in remote areas, with the cooperation of ITDI. RCRDF is particularly well versed in the handling and treatment of coconut palms, and at the present time, they are developing a drier for the drying process and are in a position to cooperate with ITDI on the cottage type edible oil development test which has been completed by ITDI.

(5) National Food Authority (NFA)

NFA is a state organization that controls the purchasing, marketing and external trade of rice and maize, conducts the Institutionalized Procurement Program (IPP), warehouse renting, and lending system for extension services on applied post harvest technology.

Since ITDI are planning research and development of rice bran oil and the development of an industry to utilize rice hulls, they will receive the special cooperation of NFA in their rice milling modernization program.

2.4.5 Details of Research

ITDI (CMD) classifies their research activities according to the categories described below, each having the objective of research on agro-based chemicals.

The research activity of ITDI in 1987 was as follows:

(1) Regular research

Research which is administered by the ITDI budget for research themes applying for approval each year.

(2) Assisted research

Research which is administered by aid funds from government agencies (TLRC, PCA, etc.), private organizations (PCIERD, PCHRD, etc.), and international organizations (UNDP, ASEAN-COST, UNIDO, etc.).

(3) Contract research

Research by contract with private firms.

The research activities of ITDI in 1987 was as follows:

- Research on chemicals using coconut oil as the starting material (catalytic cracking of coconut oil, coconut monoglyceride, etc.) 19 projects
- Research on derivatives of indigenous vegetable oils (rice bran oil, corn oil, etc.) 7 projects
- Research on processes to produce charcoal, activated carbon and other fuels (gasification of cassava and manufacture of activated carbon from urban garbage, tropical plants, and coir of coconut) 10 projects
- Research on plant biomass resources (manufacture of fructose from starch wastes, manufacture of sugar, alcohol, etc. from fibrous agricultural by-products) 7 projects
- Research on inorganic fine chemicals (manufacture of magnesium sulfate and fertilizer grade potassium chloride from bittern) 11 projects
- Research on chemical processes (manufacture of coconut milk and other by-products, manufacture of edible oil from fresh coconut, etc.) 4 projects

Further technology transfers and contract researches during the 5 year period covering 1983 - 1987 totalled 30 projects as follows:

- Technical assistance and joint research relating to the manufacture of edible oil and soap from coconut 10 projects
- Technical assistance and joint research relating to the manufacture of industrial salt 6 projects
- Technical assistance and joint research relating to the manufacture of activated carbon 5 projects
- Technical assistance and joint research relating to the manufacture of charcoal 3 projects
- Technical assistance and joint research relating to the manufacture of diesel oil from coconut oil 2 projects
- Others 4 projects

In the past 5 years, there were 19 research projects conducted under contracts with private firms and 42 projects of technical assistance. These are basically conducted by contract and the other party will pay the costs of the raw materials and auxiliary materials including utilities.

(Refer to Table 2-2)

The period for research is usually 3 - 6 months and the cost is 30,000 - 50,000 pesos per project.

2.4.6 Present Status of the Facilities

The present building of ITDI (CMD) is situated on the 1.4 ha. complex of DOST and is the sturdy building of reinforced concrete with two floors.

Present status of the facilities

- 1) There is some damage observed to ceilings, partitions, and doors.

- 2) There are many defects in the electric distribution panels, sockets on the laboratory walls and sockets set in the laboratory tables.
- 3) There are many blockages in the water supply facilities, particularly the faucets of the water supply plumbing to the users.
- 4) There are many blockages of the drain pipes on the first and second floors and the drainage, etc.
- 5) Removal and re-arrangement of defective equipment, defective reagents, etc. scattered on the central table, side table and in the drawers is necessary.
- 6) The maintenance of the wells, transformers, LPG cylinder shed, etc. is poor.

ITDI is fully aware of the above situation regarding facilities and its schedule is to complete the amelioration of the above defects by the end of January, 1989.

Table 2-2 (1) Present Research Activities of ITDI (CMD)

R & D Theme	Classification of Research Theme	Objectives of R&D					R&D Scale and Type of R&D					
		Improvement of Quality	Upgrading of Production Efficiency	Recovery of Wastes	Improvement of Process	Substitute of Energy	Basic Research	Table Scale Test	Bench Scale Test	Pilot Plant Test	Training	Technical Consultancy
1	Production and Development of a Diesel Fuel Substitute from Coconut Oil				*	*						
2	Production of Petroleum Fuel Substitutes by Catalytic Cracking of Coconut Oil				*		*					
3	Development of Process for Transparent Soap Manufacture from Indigenous Materials	*					*					
4	Sulfated Monoglyceride Detergents for the Philippines				*		*					
5	Coconut Fatty Acid Esters by Alcoholysis				*		*					
6	Isolation and Purification of Food Grade Coconut Monoglycerides	*										
7	Laboratory Studies on the Preparation of Coconut Diethanolamides	*					*					
8	Soapstock Utilization for Household Soap	*					*					
9	Pre-pilot Plant Studies on the Production of Coconut Monoethanolamide (CMA)	*						*				
10	Alkanolamides from Coconut Methyl Esters	*					*					
11	Preparation of coconut Monoethanolamide (CMA)	*					*					
12	Simplification Process on the Preparation of Toilet/Bath Soap				*		*					
13	Simplified Laundry Soapmaking by the Cold Process				*		*					
14	Simplified Edible Oilmaking Technology from Fresh Coconut for Rural Use				*		*					
15	Conversion of De-laval Protein Solid from Coconut into Soluble Form as Stabilizer											
16	Isolation of Protein from Coconut Skim Milk						*	*				
17	Alkanolamides from Coconut Oil Methyl Esters						*	*				
18	The Ozonolysis of Phil. Unsaturated Oils	*					*					
19	Improvement of the Drying Property of Lumbang Oil				*		*					
20	Methanolysis of Lumbang Oil	*					*					
21	Preparation of Fatty Acids from Lumbang Oil				*		*					
22	Urea Complexation of Lumbang Oil Fatty Acids						*	*				
23	Extraction and Characterization Studies of Mango and Calamansi Seed Oil						*	*				
24	Methyl Ester from Castor Oil	*					*					
25	Feasibility Study on the Establishment of Powdered Activated Carbon Plants			*				*				
26	Research on Pyrolysis of Industrial and Urban Wastes into Usable Products			*				*				
27	Continuous Fluidized Bed Gasification of Cellulosic Wastes for Power Generation			*	*				*			
28	Production of High Quality Adsorbents from Tropical Plants			*	*			*				
29	Production of Activated Carbon by Fluidized Bed Method with Chemical Pre-treatment	*		*			*					
30	Production of Activated Carbon from Coconut Coirdust by Fluidized Bed Method			*				*				

Table 2-2 (2) Present Research Activities of ITDI (CMD)

Classification of Research Theme		Objectives of R&D						R&D Scale and Type of R&D				
		Improvement of Quality	Upgrading of Production Efficiency	Recovery of Wastes	Improvement of Process	Substitute of Energy	Basic Research	Table Scale Test	Bench Scale Test	Pilot Plant Test	Training	Technical Consultancy
31	Production of Charcoal by Fluidized Bed Method				*			*				
32	Production of Charcoal from Agri-Waste by Open Hearth Furnace			*	*			*				
33	Fluidized Bed Method of Carbonization of Cellulosic Waste Materials			*	*			*				
34	Production of High Glucose Syrup, and Single Cell Protein from Starchy Waste Materials	*		*	*			*				
35	Production of Sugar and Alcohol from Cellulosic Agricultural By-Products			*				*				
36	Chemical Pulping Studies of the Coconut Leaf			*				*				
37	Cellulose Determination of the Different Varieties of the Coconut Leaf						*	*				
38	Chromatographic Determination of Glutamic Acid in Some Philippine Edible Beans and Nuts	*			*		*					
39	An Investigation on the Economic Feasibility of Producing Natural Dyes from Local Sources			*			*	*				
40	Production of Manganese Dioxide from Local Manganese Ores				*			*				
41	A Study on the Recovery of Manganese Sulfate from Local Manganese Ores			*				*				
42	Production of Potassium Permanganate from Local Manganese Ores			*	*			*				
43	Laboratory Scale Study on the Recovery of Magnesium Sulfate from Bitterns			*	*			*				
44	Laboratory Scale Study on the Recovery of Fertilizer-Grade Potassium Chloride			*				*				
45	A Bench Scale Study on the Recovery of Fertilizer Grade Potassium Chloride			*	*			*				
46	A Study on the Improvement of the Paranaguetype Solar Saltmaking Technology				*			*				
47	Preparation of Aluminum Sulfate from Aluminum Dross			*				*				
48	A Study on the Processing of Copper Sulfate from Local Copper Ore as Chalcopyrite		*					*				
49	Integrated Pilot Plant for the Production of Canned Coconut Milk and Other By-products								*			*
50	Pilot Plant Production of Edible Oil from Fresh Coconut	*	*		*				*			
51	Bench Scale Production of Edible Oil from Copra Suitable for the Rural Areas	*	*		*				*			
52	Design and Fabrication of the Equipment/Machineries							*	*			
53	Production of High Quality Activated Carbon from Tropical Plants				*			*	*			
54	Feasibility Study on the Establishment of Powdered Activated Carbon Plants	*		*	*				*			
55	Pyrolysis of Industrial and Urban Wastes into Usable Products			*		*		*				
56	Production of Slow Release Type Fertilizer from Philippine Dolomite and Rice Husk	*	*	*	*		*	*				
57	Industrial Chemicals from Indigenous Carbohydrate Raw Materials	*		*				*				
58	Production of USP Grade Dextrose for Intravenous Fluids	*						*				*
59	Production of Simplified Technology for Laundry Soap Using Coconut Fatty Acids		*		*			*				*
60	Technical and Consultancy Services on Soap-making	*										*

Table 2-2 (3) Present Research Activities of ITDI (CMD)

R & D Theme	Classification of Research Theme	Objectives of R&D						R&D Scale and Type of R&D					
		Improvement of Quality	Upgrading of Production Efficiency	Recovery of Wastes	Improvement of Process	Substitute of Energy	Basic Research	Table Scale Test	Bench Scale Test	Pilot Plant Test	Training	Technical Consultancy	Contract Research
61	Technical and Consultancy Services on Soap-making	*	*		*							*	
62	Production of Solid Fuel from Selected Raw Material	*			*							*	
63	Design and Fabrication of Cashew Nut Processing Machine	*	*									*	
64	Technology Transfer For Transparent Bath Soap and Process of Manufacture											*	*
65	Soapmaking and Edible Oil Making	*	*										
66	Improved Production of Coconut Diethanolamide				*								*
67	Production of Bleaching Clay from Bentonite	*		*									*
68	Development of CFA-Based Detergent Bar Formulation	*					*						*
69	Development of Process for Local Production and Synthesis of Specialty Cosmetic Chemicals	*			*		*						*
70	Technology Transfer Project on Industrial Salt Production	*	*		*							*	
71	Training of Chemists in Analytical and Testing Procedures for Activated Carbon	*	*		*					*			
72	Technology Transfer on Charcoal Production from Coconut Husk by Open Hearth Furnace			*				*					*
73	Consultancy and Technical Services on Soapmaking	*	*		*							*	
74	Diesel Fuel Production from Coconut Oil	*				*		*					*
75	Production of Liquid (Syrup) and Solid (Candy) Cough Medication	*	*					*					*
76	Pilot Plant Production of Activated Using Sawdust, Coirdust and Coconut Shell			*					*				*
77	Technology Transfer of an Improved Method for Industrial Salt Production	*	*		*					*			
78	Improvement of Technology for Charcoal Production from Ipil-ipil Wood			*	*			*					*
79	Technology Transfer on Soapmaking by the Cold Process				*							*	
80	Technology Transfer Project on Soapmaking from Coconut Oil by Cold Process				*							*	
81	Laundry Soap Production by the Cold Process and Promotion Distribution				*				*				
82	Technology Transfer of Improved Solar Salt-making Technology	*	*		*							*	
83	Production of Petroleum Fuel Substitutes from Coconut Oil					*		*					*

Present status of the utilities

1) Utilities

a) Electricity

Electricity is received by underground cable through two lines of 475 amperes at the power receiving station on the east side of the laboratory building and distributed to the laboratories from the control center in the building. There is no problem as to capacity because it is received at the rated capacity of 450 kW. However, there are areas in the power receiving station and the control center where maintenance is inadequate.

b) Water

Water is lifted from the well (215 m deep) on the north side of the laboratory building, and is stored in the elevated water tank to a capacity of 19 cu.m and distributed through 4B pipes, and as the capacity is estimated to be 50 cu.m/hr there is no problem in the water supply. At present, there are only 2 or 3 faucets per laboratory that are usable, and there are rooms and lavatories where water can not be supplied, and therefore repairs are needed.

c) Facilities for LPG and special gases

There are two cylinders of 100 kg placed outside on the southern side of the building, and hydrogen cylinders are placed inside the building. It is necessary from a safety standpoint that the hydrogen cylinders be placed in the cylinder shed for a centralized piping.

d) Boilers

There is a boiler with a capacity of 300 kg/hr, 12 kg/cm²G steam on the north side of the laboratory building which is excessive for use in experiments, and is hardly used.

2) Drainage

There are blockages in the waste water pipes and sewage, and no inspection openings in the waste water drainage. The drainage system is the main item for repairs in the present Project. Also, there is no consideration given to waste water treatment. Installation of at least API system with 3 sinks and a separation collector of the effluent of chemicals is recommended. There is also an incinerator of simple type which is usable.

2.4.7 Present Status of the Equipment

Compared with the contents of the research activities for research on manufacture of chemicals, the number of analyzers is small, and there is no proper equipment for experiments.

- (1) There are pilot plant facilities but these are largely inoperable.
- (2) As for analyzers, there is only one Gas Chromatography and one Ion Chromatography available. Adequate results cannot be expected under such conditions.
- (3) There are many problems with the equipment for laboratory research on the reaction of substances, separation and purification.
- (4) There are numerous troubles with the electric heaters, (electric furnaces, dryers, hot plates, etc.)
- (5) Ground glass implement spares are inadequate.

2.4.8 Research Personnel

The composition of the personnel of ITDI (CMD) as of the end of July, 1988 is shown on Table 2-3 along with those for the past two years and the plan for additional personnel in 1989.

Table 2-3 Staff Assignment for ITDI (CMD)

	'86	'87	'88	'89
Chief Officer	1	1	1	1
Assistant Officers	-	-	4	4
Technical Staff*	48	48	38	57
Assistant Staff	22	22	20	21
Clerical Staff	2	2	2	2
Total	73	73	65	85

* Includes chemical engineers, researchers.

As indicated before, the types of research undertaken by ITDI (CMD) are classified as Regular, Assisted, and Contract research, and the number of personnel by type of research and laboratory are shown on Table 2-4.

Table 2-4 Staff Assignment Classified by Project for Research Lab.

	Total	Regular	Assisted	Contract
1. Organic Lab.	14	12.5	-	1.5
2. Inorganic Lab.	14	11.5	-	2.5
3. Process Development Lab.	17	15.5	-	1.5
4. Pharmaceutical Lab.	15	12.5	-	2.5
5. Administration	5	5	-	2.5
Total	65	57		8

There are four sections with a total 65 persons, of which 90% are university graduates, mostly researchers in the field of chemistry, including 7 chemical engineers. The following points are raised:

- 1) There are very few chemical engineers who are able to do the basic design work and also perform the selection and design of equipment.

2) There are very few researchers who can carry out maintenance of analyzers.

3) In the pilot plant, modifications have to be made to meet the changes in the conditions and the flow of the test. It is considered that there are adequate engineers capable of this are not available.

2.5 Contents of the Request

2.5.1 Record and Contents of the Request

In the Medium Term Development Plan covering the period from 1987 through 1992, the Philippine Government placed emphasis on the expansion of agricultural production, and on the industrialization using the resources of agriculture, forestry, and fishery, the enhancement of the income of the farmers and the non-agricultural workers, the generation of employment, and the alleviation of poverty.

Coconut and rice are the two major agricultural products of the Philippines. With respect to coconut, the Philippines accounts for 85% of the world market, and 50% of the population of the Philippines receive their living from the benefits of coconut in one way or another.

In 1986, the Philippines produced 2,632 thousand tons of coconut in terms of copra, out of which 1,238 thousand tons of coconut oil were exported, and it is expected that the value added will be enhanced by converting coconut oil to soap, detergents, surfactants, polymers plasticizers, adhesives, etc.

Also, activated carbon is made from the shells of coconut and is a high value added product utilizing the coconut resource.

On the other hand, according to the statistics of 1984, the Philippines produce 8,200 thousand tons of rice, while 20% of that amount, or 1,600 thousand tons of rice hulls are discharged along with the by-product rice bran. Rice bran contains 20 - 25% of useful rice bran oil. Under such conditions, the effective

utilization of rice hulls and the manufacture of edible oil from rice bran are of profound interest to the National Food Authority (NFA).

ITDI (CMD) has a long record of research and development work on the laboratory scale through pilot plant scale with respect to the manufacture of chemical industrial products from agricultural resources and agricultural wastes. They have set forth a plan to transfer the results of the research into industrial development of the rural areas.

At present, as the themes that have been completed at the laboratory level of research and development and the themes for the cottage type industry, include the process of manufacturing edible oil and soap from fresh coconut, and of manufacturing activated carbon from coconut shells or agricultural wastes, etc. The process for manufacturing monoglyceride and medium chain glyceride from coconut oil with the objective of import substitution or export of products has completed the basic research phase. The process for manufacturing slow release type fertilizer from rice hulls is in the stage of primary collection of engineering data. The existing research and development equipment of ITDI (CMD), however, has deteriorated and much is inoperable, and this is totally inadequate for any advance in research and development of these technologies. The requests for development work for technical consultancy, and for training assignments which are increasing recently from the small and medium enterprises can not be met.

Against this background, the Philippine Government clearly designated ITDI (CMD) as the source of technology for rural industrialization, its aim being to strengthen the technical support services to the small and medium industries. The government formulated a plan to upgrade the equipment of the institute and requested a grant aid from the Japanese Government.

The contents of the request of the Philippine Government are outlined below.

(1) Objective of the project

The objective of the Project is to contribute to the development of the economy of the Philippines by strengthening the functions of CMD in the field of agri-industrial development, enhancing, in particular, the industrialization and productive capacities of rural areas, and contributing to the generation of employment and to an increase of income for the rural population.

(2) Project site

The Science Complex of DOST, Bicutan, Taguig Metro Manila

(3) Implementing agency of the Project

Industrial Technology Development Institute (ITDI)

(4) Equipment to be upgraded

1) Pilot plant equipment

- a) Slow release type fertilizer test equipment
- b) Equipment to treat, expell, extract and purify fresh coconut (used also as rice bran test equipment)
- c) Equipment to manufacture soap from fresh coconut

2) Analytical equipment

- a) Analyzers for edible oil
- b) Analyzers for fertilizer
- c) Analyzers for silica gel
- d) Equipment for thermal analysis

3) Process development/machine tools

- a) Unit operating equipment
- b) Machine tools

4) Training equipment (including furniture and fixtures)

- a) Personal computers
- b) Copying machines
- c) Vehicles
- d) Furniture and fixtures

(5) Existing facilities for the Project

Utilizing the existing ITDI building, the scale of the facilities is as follows:

Some modification works are underway.

1) Inorganic Lab.	280 m ²
2) Organic Lab.	280 m ²
3) Pharmaceutical Lab.	145 m ²
4) Pilot Plant Lab.	200 m ²
5) Workshop Lab.	675 m ²
6) Others	945 m ²
Total	2,525 m ²

(6) Activities of ITDI (CMD)

- 1) Pilot plant tests of the results of the table scale tests
- 2) Improvement of the training function provided to small and medium industries
- 3) Research and development of chemicals that utilize rice hulls
- 4) Research and development into the uses of rice hulls
- 5) Joint research with government agencies or private firms

In response to the above request made by the Philippine Government, the Japanese Government sent two experts, Dr. Kazuji Ishibashi, Senior Researcher, Government Industrial Department Laboratory, Hokkaido Agency of

Industrial Science and Technology, Ministry of International Trade and Industry and Dr. Akio Kato, Director, Amagasu Chemical Industry Co., Ltd. to conduct a study regarding the grant aid cooperation project in March, 1988

2.5.2 Details of the Request

(1) Objectives of ITDI (CMD)

- 1) Conducts research and development which will contribute to the generation of employment, enhancement of income, alleviation of poverty, import substitution, and promotion of exports resulting from the establishment of the industry for producers goods for agricultural production using agricultural resources and agricultural wastes as the raw material and industries for the daily consumable goods in the rural areas.
- 2) Strengthens the functions of education and training by improving the laboratory equipment, analytical equipment and pilot plant equipment which have training functions, for the education of scientists, technologists, and technicians in the industry.
- 3) Conducts research and development of vegetable oils and their derivatives such as coconut oil which is an indigenous agricultural resource of the Philippines as one particular objective among the agricultural products. (For the time being, coconut oil and rice bran oil and their derivatives shall be the particular objectives).
- 4) Conducts research and development of industrialization which will contribute to import substitution, export promotion, and reduction of the cost of the producers goods for agriculture such as fertilizers by developing processing technology and application technology. Emphasis, for the time being shall be on slow release type fertilizer, sodium silicate, and silica gel which use rice hulls.

- 5) Conducts joint research with entrepreneurs or government agencies who plan to enter into development of the applications for the agricultural products (particularly, chemical substances).

(2) Facilities

A space of approximately 2,500 m² in the existing building shall be utilized.

(3) Contents of the equipment

Detail equipment list requested by ITDI (CMD) is shown on ANNEX-7.

2.5.3 Results of the Study by the Experts

The following points were ascertained and recommended by the team who conducted the study in March, 1988.

- (1) In response to the research themes that were proposed by ITDI (CMD), the following were selected and recommended as subjects for technical co-operation;

Organic Chemical Laboratory

- 1) Cottage type coconut oil extraction process
- 2) Process for extraction and purification of coconut oil with a small apparatus
- 3) Process to manufacture laundry soap and toilet soap
- 4) Process to manufacture medium chain triglyceride and monoglyceride from coconut oil
- 5) Process to manufacture biodegradable detergent
- 6) Process to manufacture surfactants
- 7) Process to extract rice bran oil with a small apparatus
- 8) Process to purify crude rice bran oil for food use or for industrial raw material

Inorganic Chemical Laboratory

- 1) Process to manufacture sodium silicate using rice hull ash
 - 2) Process to manufacture silica gel
 - 3) Process to manufacture slow release fertilizer
 - 4) Manufacture of soil conditioners and deacidifiers from rice hulls
 - 5) Adsorbent for emulsified oil, etc.
 - 6) Process to manufacture white carbon and colloidal silica
 - 7) Process to manufacture silica for adsorbents, etc.
- (2) Contents of the equipment

The equipment required by the technical cooperation subjects were selected and confirmed.

**CHAPTER 3 CONTENTS
OF THE PROJECT**

CHAPTER 3 CONTENTS OF THE PROJECT

3.1 Objectives

ITDI (CMD) plays the vital role of development center for agricultural processing technology in the Philippines, and is planning to promote and strengthen research on agricultural processing technology, the development of industrialization technology for cottage type agricultural products, and technical assistance to the small and medium industry, in collaboration with state organizations such as DTI, DA, MSMBD, TLRC, NFA, PCA, etc. and with private firms.

To attain the above objectives, upgrading of the following research and development equipment is under consideration.

- 1) research and development equipment for utilizing agricultural resources
- 2) equipment to support consultancy and technical improvements of the small and medium industries that are at present involved in the agricultural products industry
- 3) equipment for training the small and medium enterprises and manufacturers in the rural area

In particular promotion of the research and development of cottage type industrialization technology and of the high level utilization of coconut (being the most important agricultural product in the Philippines) and the hulls and bran of rice (being the major agricultural product) are central, and ITDI has conducted basic research, laboratory research, and research and development for industrialization of these. Moreover the necessity of such activities is recognized by the related government agencies who have shown a keen interest in all these projects.

To attain the above objectives, the Project will concentrate its efforts on the following research and development work:

- a) strengthening of research and development and practical application research of the cottage type agricultural products industries
- b) strengthening of process research and the feasibility study capability needed for the above
- c) activation of technical support work for the small and medium private enterprises
- d) strengthening of the basic research for effective utilization of the resources of the agriculture and fishery sectors
- e) promotion of research on the manufacture of non-traditional chemical products

In the Project, Japanese Government is requested to improve the equipment as a grant aid for ITDI (CMD) to upgrade the works stated above.

3.2 Consideration of the Contents of the Request

In view of the background described in the preceding chapter, ITDI (CMD) has made a request to the Japanese Government for the following research and development equipment:

- 1) Research and development equipment for the industrialization of cottage type coconut processing
- 2) Test equipment for the manufacturing process of slow release type fertilizer utilizing agricultural resources
- 3) Test equipment for the manufacturing processes of sodium silicate and silica gel utilizing agricultural waste, such as rice hulls
- 4) Equipment to conduct required analysis

- 5) Test equipment for the manufacturing processes of derivatives of coconut oil and rice bran oil
- 6) Equipment for technical assistance, training, and technical services to the small and medium industries
- 7) Equipment to maintain the above such as vehicles and furnitures

Points concerning the contents of the Request for equipment were considered from the standpoint of their appropriateness in light of the objectives of ITDI (CMD) Project and as grant aid assistance were as follows:

(1) Consideration of the existing building

The Project plans to utilize the existing building for the installation of the equipment. As described above, utilizing approximately 2,500 sq.m of the laboratory, while expanding part of this and moving the pharmaceutical section, it is possible to secure an area of approximately 3,000 sq.m.

The building is sufficiently usable, being of a sturdy reinforced concrete construction, and repairs of the roof and partitioning are planned.

(2) Consideration of the facilities

With respect to the facilities, a few defective areas were found, which IDTI is modifying and repairing under an authorized budget of 2.1 million pesos with completion scheduled for the end of January, 1989.

1) Electrical equipment

No problem is posed by the power receiving station since it has a rated capacity of 450 kW. New installations and repairs are scheduled beyond the control center of the laboratory building because feeders are lacking and laboratory plugs are out of order.

2) Supply water facilities

A 19 cu.m elevated tank has been constructed into which well water is pumped and the main pipeline to the laboratory is 4 inches, so there is ample allowance in volume. As with the electrical equipment, however, repairs are also scheduled as there are blockages at terminal points.

3) Equipment for LPG and special gases

LPG is delivered through a centralized pipeline from the outside cylinder shed. New pipings for hydrogen gas and other special gases are planned.

4) Waste water facilities

As there are some blockages in the floor waste water system from the sinks of the laboratory tables and each waste water outlet and in the fume ducts of the outside structure, repairs are planned.

(3) Consideration of the equipment

- 1) In the case of the industrialization of cottage type coconut processing, a product structure of edible oil, soap, vinegar, charcoal, and coir fiber, etc. is conceivable. But, in line with the Request, edible oil and soap were adopted, since incomplete in the technical sense.

With respect to the research and development equipment for this research project, pretreatment equipment, oil press equipment, and purification equipment for coconut and test equipment for soap are required.

With respect to the capacity of the equipment, the number of the types of equipment were reduced in view of their primary use for collecting of engineering data, and the size of equipment should be scaled down to realize savings in costs for raw materials, auxiliary

materials, lighting and heating, and to permit multi-purpose utilization.

Also, it was agreed that procurement would be carried out on the Philippine side as far as possible, in view of maintenance factors.

- 2) Test equipment for the manufacturing process of slow release fertilizer utilizing agricultural resources

This research project comprises as the first step, ashing of the rice hulls discharged as agricultural wastes, addition of dolomite, potash, iron powder, molasses, etc. to ash, and then heat-treating and granulating the mixture to produce a slow release fertilizer for rice cultivation. The project has been underway for the past three years as a joint research with the Agency of Industrial Science and Technology.

In the selection of the equipment, consideration will be given to equipment of reduced size with good heat recovery, as well as their future applicability to other uses in organic fertilizer manufacture, to for numerous other similar uses in fluidized furnace and in solidification technology.

- 3) Test equipment for manufacturing processes for the manufacture of sodium silicate and silica gel utilizing rice hulls

This research project is a part of the rice hulls utilization above, and ITDI (CMD) is conducting screening tests to develop this further and to proceed or to the basic test stage.

Therefore, given the nature of this project a decision was made to select a table scale test equipment.

4) Analytical equipment

The analytical equipment requested are considered appropriate since they are essential to research and development work of 1) through 3) above and are of types that will have wide applications in future research of chemicals which utilize agricultural resources.

However, an NMR proposed for use in analyzing molecular structures was deleted from the list after discussions as to its need and urgency for this.

5) Research on the manufacture of derivatives from coconut oil and rice bran oil

ITDI (CMD) has conducted table scale tests on this project and from the derivatives, considered attention will be given to subjects which are promising and have import substitution possibilities such as medium chain glyceride, monoglyceride, fatty acid alcohols, etc.

6) Equipment for technical services such as technical assistance and training for the small and medium industries, etc.

The service functions are to provide assistance in production technology to the small and medium industries or to extend training to the managers and staff of the small and medium industries. This covers industries such as salt plants, isomerized sugar plants, activated carbon plants, inorganic chemicals plants, soap plants, small and medium scale edible oil plants, etc. For such technical services, equipment required includes field survey equipment, inspection equipment, general test equipment, personal computers, overhead projectors, slides, etc., in addition to those listed in 1) through 5) above.

7) Maintenance equipment, vehicles and furniture

The demand necessitates that ITDI (CMD) modify the pilot plant of the institute and fabricate its own trial development equipment, according to the objectives of the research, in order to carry out the industrialization research or technical diagnosis of and assistance to the small and medium industries, in addition to routine maintenance.

Equipment requested is judged to be in accord with such objectives and is considered appropriate in view of the nature of the research activities involved.

Since ITDI has a duty to supply cottage type industrialization technology as a part of the activities of MISCMEC as described in Chapter 2, the transportation of field test equipment, raw materials and auxiliary materials for use in tests in the institute is one of its important functions.

3.3 Outline of the Project

3.3.1 Implementing Organization and Operation System

The actual execution of the present Project will be carried out by the Executive Committee organized in July, 1988 composed of six members who represent the relevant sections of ITDI. The chairmanship of the committee will be held by the director of ITDI, who will direct the necessary business related to the present Project, and conduct negotiations with the relevant organizations.

On the other hand, the repair and rehabilitation of the buildings and facilities of ITDI (CMD) is to be executed by a team of six members differing from the above, the chairman being the director and the work progressing on a schedule to be completed by January, 1989.

ITDI (CMD), as mentioned in the preceding chapter, is composed of the Organic Chemicals Research Section, the Inorganic Chemicals

Research Section, the Pharmaceuticals Research Section, and the Process Development Research Section. The present staff is composed of 65 members, but will be increased to 85 members, with the addition of 20 members at the execution of the present Project.

The decrease in the number of members in 1988 was due to the transfer of the group working on the manufacture of activated carbon and the group working on the manufacture of slow-release fertilizers to the Fuel and Energy Division. The researchers and technologists of both groups, however, will participate in the implementation of the present Project.

Among the equipment requested under the present Project, the equipment suitable for shared use by the entire ITDI, (for example, some of the analyzers,) will be used by the entire staff under the control of the joint committee of ITDI.

The record of annual expenses of CMD for 1986 and 1987, the budget for the current year, and the budget after the execution of the present Project (applied for approval of DOST) are shown in Tables 3-1 and 3-2. As can be seen from Table 3-1, the research budget is not adequate, and there is hardly any purchase or repair of the research equipment noted. But after 1989, it is unofficially decided that the budget for the present Project will be approved when it is submitted.

3.3.2 Details of Activities

- (1) Research and development and pilot plant tests on the cottage type small and medium industry and the industrialization technology

As stated in Clause 3.1, for the two research and development projects suitable for the villages described below, which were of interest to the related government agencies and the private firms, laboratory tests were conducted and joint research in part with related firms and technology transfers were conducted from part of the research for cottage type industrialization technology. The plan is to con-

duct research for industrialization of these technologies in approximately two years and subsequently to put them into practice.

1) Cottage type fresh coconut oil plant

The laboratory tests at ITDI have been completed, and as a scale of 5,000 coconuts per day is conceived as a commercial stage cottage type plant, research and development for a scale of about 500 coconuts per day will be conducted to collect the engineering data.

2) Soap manufacturing plant

As there is a history of five years of research in laundry soap, research and development will be conducted on the manufacture of laundry, toilet, and powder soap using coconut oil, a by-product of fresh coconuts, and rice bran oil. Also, development of technology for hydrogenation necessary to the manufacture of toilet soap will be conducted.

(2) Research and development into the utilization of the resources of agriculture and fishery sectors

An agreement with the National Food Authority, on the plan for effective utilization of rice bran and rice husk means that the enhancement of the value added of the resources of agriculture and fishery and recycling of resources are important themes for the Department of Agriculture too. Research and development of the following themes in particulars are planned:

a) Pilot plant tests on the manufacture of slow-release fertilizer utilizing rice hulls

b) Basic research into the manufacture of sodium silicate and silica gel utilizing rice hull ash

c) Research on the manufacture of rice bran oil

(3) Technical assistance to small and medium private firms

Technical assistance and training have been conducted for the small and medium scale manufacturers of activated carbon, salt, soap, etc. regarding the enhancement of quality and production efficiency and improvement of past processes too. However as the activity of MICSMEC was initiated as mentioned before, the existing equipment will be strengthened since such activities are expected to intensify in the future. In particular, equipment to extract and purify rice bran oil will be installed and used for development and technical assistance.

(4) Research on the manufacture of non-traditional chemical products

ITDI has been engaged for many years in the research of medium chain glycerides, monoglyceride and derivatives of fatty acids of food and pharmaceutical grades from coconut oil. It plans at present to make a fundamental improvement in the research equipment for making non-traditional chemical products from vegetable oil resources. In particular, research and development on the synthesis of surfactants and detergents utilizing coconut oil as raw material and on the manufacture of various chemical products from rice bran oil will be conducted.

(5) Research and development on processes for designing of cottage type plants and strengthening of the feasibility study capability

For (1) above, it is necessary to develop equipment for the pretreatment of fresh coconut. This development work is to be done jointly with PCRDF Research and Development Fund (a simplified dryer for copra is under development), and consideration is to be given to joint research on expellers, and the development of extractors.

Despite the fact that the cottage type fresh coconut processing plant is in the development stage, because of capa-

Table 3-1 Running Cost for 1986/1987 and Budget for 1988 and Estimated Annual Cost after the Completion of the Project (in Thousand Pesos)

	1986	1987	1988	After
1. Personnel Expenditure	2,380	1,458	2,420	2,768
2. Electricity (398.3 kW)	318 (5.6)*1)	275 (0.4)*1)	300 (5.8)*1)	600
3. City Water	45	50	-	-
4. Special Gas	-	-	-	120
5. Chemical and Other	260	186	258	720
6. Consumables	-	-	-	120
7. Equipment	-	-	-	120
8. Stationaries	5	7	9	240
9. Labour	-	-	-	180
10. Maintenance	45	54	624	720
1) Architecture			559	553
2) Bench Equipment			65*2)	65
3) Instruments				60
4) Spare Parts				12
5) Vehicles				30
11. Communication	-	-	-	60
12. Gasoline	6	2	4	60
13. Travelling	10	6	2	72
14. Security and Insurance	60	52	112	240
15. Others, Subscription, etc.	-	-	3	60
TOTAL	3,072	2,086	3,567	5,864

Note: *1): From Contract Research
*2): Includes From 2) to 5)

Table 3-2 Personnel Expenditure

Items	1986						1987						1988					
	Total No.		Total Salary/YR		Average/Person		Total No.		Total Salary/YR		Average/Person		Total No.		Total Salary/YR		Average/Person	
	NIST	CMD	NIST	CMD	NIST	CMD	ITDI	CMD	ITDI	CMD	ITDI	CMD	ITDI	CMD	ITDI	CMD	ITDI	CMD
Executive Director	1	-	75,000	-	75,000	-	1	-	144,000	-	144,000	-	1	-	158,400	-	158,400	-
Deputy Director	1	-	67,000	-	67,000	-	1	-	132,000	-	132,000	-	2	-	290,400	-	145,200	-
Chief Officer	3	-	150,876	-	50,292	-	6	-	426,918	-	71,153	-	13	1	1,017,416	78,268	78,268	78,268
Assistant Officer	3	1	123,696	41,232	41,232	41,232	6	1	349,878	58,313	58,313	58,313	37	4	2,373,136	256,555	64,139	64,139
Technical Staff	239	48	11,442,084	1,275,108	47,874	47,874	284	48	12,586,292	1,402,612	44,318	29,564	332	39	14,401,226	1,704,503	43,377	43,705
Researcher	98	22	1,452,684	344,508	14,823	15,659	125	22	2,267,129	378,959	18,137	17,225	150	19	3,809,243	463,808	23,807	24,411
Clerical Support	19	3	191,898	27,864	10,099	9,288	30	3	228,790	30,650	11,439	10,217	12	-	219,754	-	18,313	-
Administrative Support	92	-	1,459,920	-	15,868	-	114	-	2,214,032	-	19,421	-	77	-	1,916,911	-	24,894	-
Total	456	74	14,963,158	1,688,712			557	74	18,349,039	1,870,534			834	63	24,186,485	2,503,135		

bility of doing feasibility studies of the project is deficient, research activity will be directed towards analysis of the capital requirement, financial and economic analyses of the project, in line with the activity of MICSMEC mentioned above.

Grant aid is requested to the Japanese Government for the equipment necessary to promote the plan to upgrade research as set forth in (1) through (5) above.

3.3.3 Personnel Plan

The present research staff was described in 2.4.8 above. After the upgrading of the equipment, the research staff will be assigned to the research sections as follows:

Table 3-3 Scheduled Staff Assignment Classified by Function after Completion of the Project

	Analysis	Basic	Processing	Total
1. Organic Lab.	7	8	10	25
2. Inorganic Lab.	9	7	10	26
3. Process Development Lab.	7	-	18	25
4. Pharmaceutical Lab.	2	2	2	6
5. Administration	-	-	-	3
Total	25	17	40	85

As mentioned before, the classification of the staff by type of research is planned as follows:

Table 3-4 Scheduled Staff Assignment Classified by Project after the Completion of the Project

	Total	Regular	Assisted	Contract
1. Organic Lab.	25	23.5	-	1.5
2. Inorganic Lab.	26	24	-	2
3. Process Development	25	23	-	2
4. Pharmaceutical Lab.	6	5.5	0.5	-
5. Administration	3	3	-	-
Total	85	79	0.5	5.5

Also, after the upgrading of the equipment the personnel plan by research theme is planned as shown in Table 3-5.

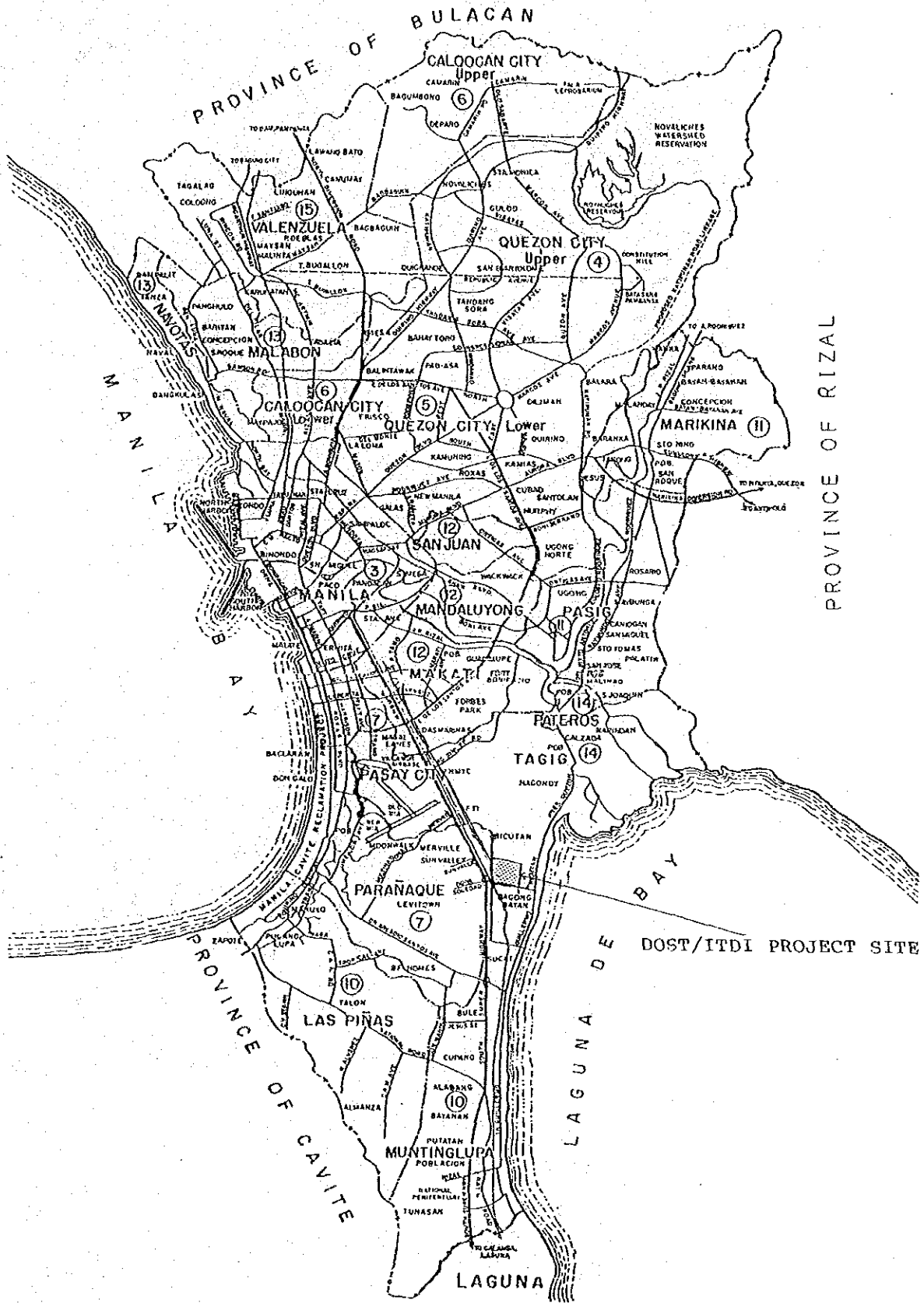
Table 3-5 Scheduled Staff Assignment Classified by Equipment after the Completion of the Project

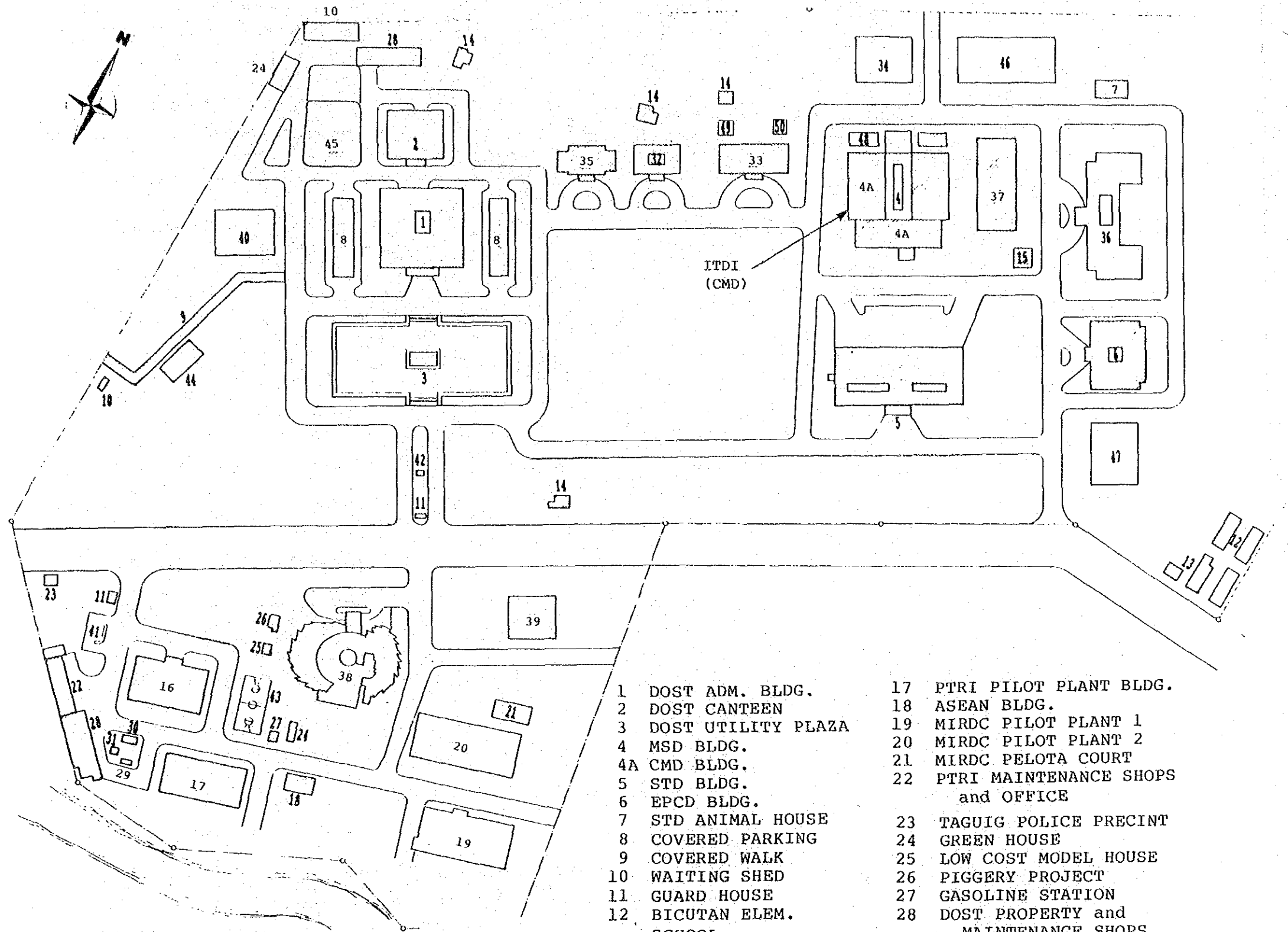
	Organic	In-organic	Process Development	Pharma- ceutical	Adminis- trative	Total
1. Edible Oil	12	-	5	2	-	19
2. Soap Making	6	-	3	2	-	11
3. Slow-release fertilizer	-	12	6	-	-	18
4. Silica Delivatives	-	7	4	-	-	11
5. Analysis	7	7	7	2	-	23
6. Administrative	-	-	-	-	3	3
Total	25	26	25	6	3	85

3.3.4 Proposed Project Site

The site of the present Project is on the complex of DOST located at Bicutan, Taguig, Metro Manila. The required equipment will be installed in the improved area of the research sections (second floor) and the process development section (first floor) of CMD, ITDI, which will be rehabilitated and a new workshop built on the same premises. The project site is shown on Fig. 3-1 and 3-2.

Fig. 3-1 ITDI(CMD) PROJECT SITE

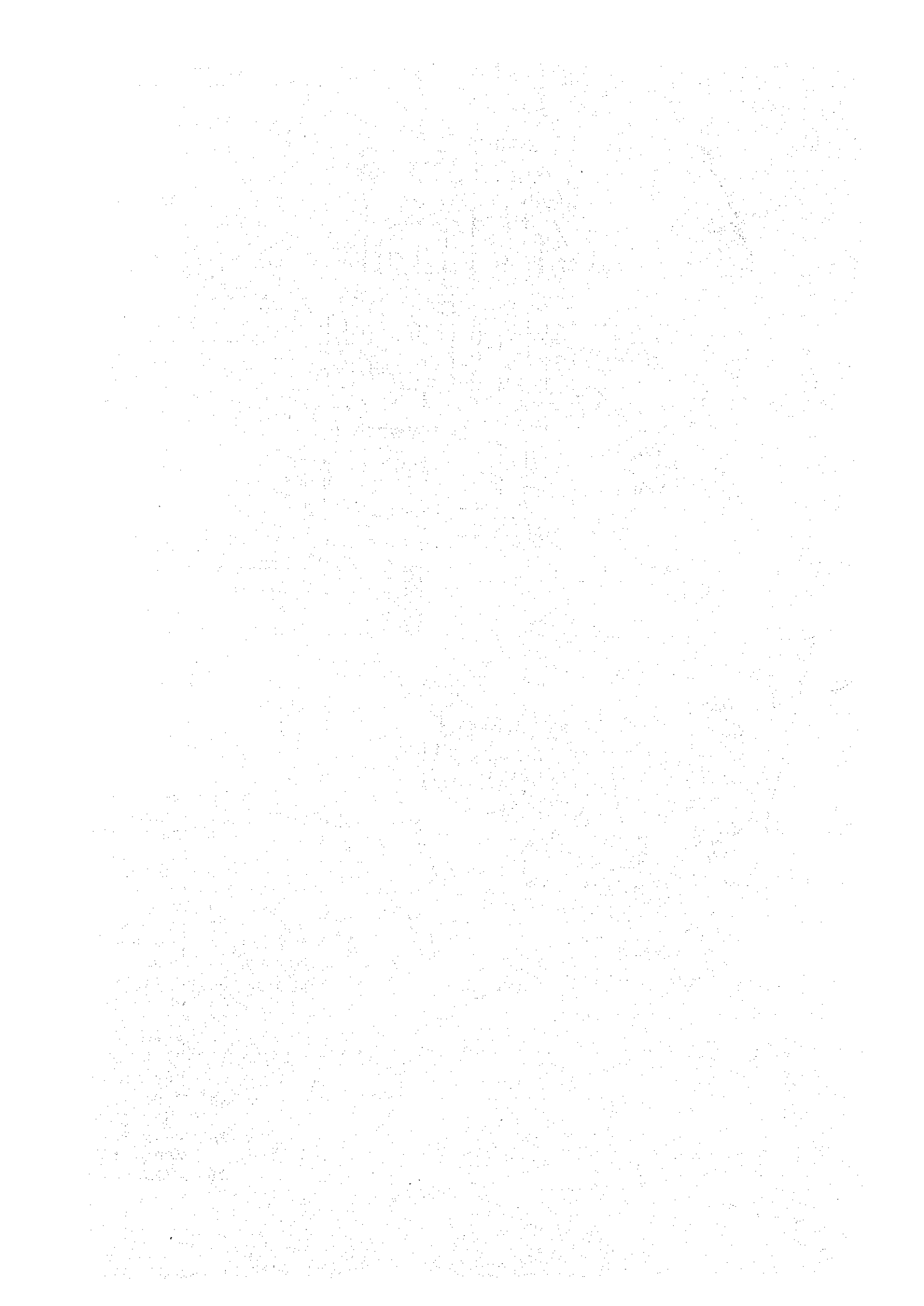




- 34 FOOD TECH. LAB.
- 35 SCIENTIFIC LIBRARY BLDG.
- 36 ITDI ADM. BLDG.
- 37 MSD CERAMIC CENTER
- 38 SFD BLDG.
- 39 PNSS BLDG.
- 40 PSTC BLDG.
- 41 PARKING AREA
- 42 SCIENCE MARKER
- 43 BASKETBALL COURT
- 44 TENNIS COURT
- 45 BULWAGANG TUKLAS LAHI
- 46 FNRI BLDG.
- 47 MD BLDG.
- 48 ITDI-ASEAN FOOD PILOT PLANT BLDG.

- 1 DOST ADM. BLDG.
- 2 DOST CANTEEN
- 3 DOST UTILITY PLAZA
- 4 MSD BLDG.
- 4A CMD BLDG.
- 5 STD BLDG.
- 6 EPCD BLDG.
- 7 STD ANIMAL HOUSE
- 8 COVERED PARKING
- 9 COVERED WALK
- 10 WAITING SHED
- 11 GUARD HOUSE
- 12 BICUTAN ELEM. SCHOOL
- 13 BICUTAN HEALTH CENTER
- 14 DOST PURCHASED HOUSE
- 15 TRANSFORMER VAULT HOUSE
- 16 PTRI ADM. BLDG.
- 17 PTRI PILOT PLANT BLDG.
- 18 ASEAN BLDG.
- 19 MIRDC PILOT PLANT 1
- 20 MIRDC PILOT PLANT 2
- 21 MIRDC PELOTA COURT
- 22 PTRI MAINTENANCE SHOPS and OFFICE
- 23 TAGUIG POLICE PRECINT
- 24 GREEN HOUSE
- 25 LOW COST MODEL HOUSE
- 26 PIGGERY PROJECT
- 27 GASOLINE STATION
- 28 DOST PROPERTY and MAINTENANCE SHOPS
- 29 BOILER HOUSE
- 30 MACHINE HOUSE
- 31 WATER TANK
- 32 COMVOL BLDG.
- 33 PIDI BLDG.

Fig. 3-2
DOST COMPLEX
GENERAL
LAYOUT PLAN



3.3.5 Plan of Expansion and Modification of the Existing Building and Facilities

ITDI (CMD) is proceeding the repairing work of the building of which content is shown as below:

- 1) Replacement of corrugated roofing sheets
- 2) Rearrangement of damaged and/or un-operable equipment
- 3) Expansion of organic chemistry laboratory
- 4) Expansion of process development laboratory
- 5) Installation of new water line and removal of dead circuits and rewiring
- 6) Installation of new drainage system for the entire second floor of the building
- 7) Removal of the Pharmaceutical laboratory
- 8) Removal of the work shop
- 9) Repair and replacement of all deffective laboratory furniture
- 10) Arrangement of the room for training and expert

The room arrangement plan after the completion of the project is shown in Table 3-6 compared with the existing one.

3.3.6 Budget for the Repairing Work of the Building and Facility and its Implementing Schedule

As for the repairing work of the building and facilities, a total budget of 2,100 thousand pesos was approved and ITDI has already completed the contract with a local contractor.

This repair work is scheduled to be completed by the end of January, 1989.

Table 3-6 Expansion Plan of The Building

	Existing (m ²)	After Expansion (m ²)
Inorganic Chemistry Lab.	279	311
Organic Chemistry Lab.	279	401
Oil Lab.	-	342
Pharmaceutical Lab.	145.3	113.8
Fertilizer Lab.	-	204
Silica Lab.	-	171.7
Autoclave Lab.	-	35.7
Pre-treatment Lab.	-	153.0
Miscellaneous Lab.	127.2	70.5
Alcohol Pilot Plant	204	-
Warehouse	113.8	143.7
Staff Room	321.3	130.3
G.M Room	48	48
Conference Room	36	153
Expert Room	-	54
Training Room	-	54
Drafting Room	82	31.5
Measuring Lab.	25.9	25.9
Tool Room	18.9	-
Workshop	674.2	500
Shower Room	58.4	58.4
Male Toilet	38.5	38.5
Female Toilet	31.0	31.0
Control Center	25.8	25.8
Locker Room	17.0	17.0
Total	2,525.3	3,113.8

3.3.7 Outline of Equipment

As for the equipment required, the following equipment classified by the categories was selected after a detailed study of the expansion plan of ITDI (CMD) and the existing equipment.

- Equipment for the processing of fresh coconut
- Equipment for manufacturing of slow release type fertilizer
- Equipment for preparation of silica derivatives
- Analyzer
- Equipment for preparation of derivatives from coconut oil and rice bran oil
- Equipment for technical service and training, etc.
- Others

The objectives and contents of equipment are outlined below:

(1) Equipment for the processing of fresh coconut

This equipment includes testing equipment for the preparation of edible oil and soap.

1) Equipment for preparation of edible oil

<Tests>

- Pretreatment equipment for fresh coconut
- Separation test paler and meat
- Expelling test
- Extraction test
- Evaporation test
- Steam stripping test
- Cooling test

<Major equipment>

- Milling machine
- Liquid cyclone
- Expeller
- Steam stripping apparatus
- Evaporater
- Dryer
- Solvent extraction apparatus

2) Equipment for preparation of laundry and/or toilet soap

<Test>

- Saponification test
- Cooling test
- Drying test
- Mixing test
- Extruding test

<Major equipment>

- Mixing reactor
- Cooling roll machine
- Extruder
- Dryer
- Preparation machine

(2) Equipment for manufacturing of slow release type fertilizer

<Details of test>

Basic experimental study is to be conducted by a process in which rice husk ash is mixed with dolomite, molasses, potassium salt and iron powder and crushed, blended and finally extruded.

<Major equipment>

- Various type of crusher
- Carbonization furnace
- Blender
- Extruder
- Malumerizer
- Calcinator

(3) Equipment for preparation of silica derivatives

<Details of test>

Research of manufacturing of silica derivatives such as silica gel, etc. is to be prepared from the intermediate which is to be prepared by treatment with caustic soda or by acidification, after carbonization of the rice husk.

<Major equipment>

- Material handling equipment
- Rotary kiln
- Heating furnace
- Autoclave
- Heating and melting furnace

(4) Analyzer

<Details of test>

- Quantitative analysis of the content of water, fat, and aflatoxin in a fresh coconut
- Analysis of chemical and/or physical properties and composition of coconut oil and/or rice bran oil
- Analysis of product quality of soap
- Analysis of slow release type fertilizer
- Analysis of silica derivatives
- Identification and quantitative analysis of derivatives of coconut oil and rice bran oil
- Training

<Major equipment>

- Moisture measuring apparatus
- Fat and oil measuring apparatus
- Aflatoxine measuring apparatus
- Gas chromatography
- High pressure liquid chromatograph
- GC-MS system
- Atomic absorption flame emission spectrophotometer

- X-ray fluorescence spectrometer
- X-ray diffractometer
- SiO₂ testing apparatus
- Surface tensiometer
- Analytical balance

(5) Equipment for preparation of derivatives from coconut oil and rice bran oil

<Details of test>

- Manufacturing test of middle-chains triglyceride
- Manufacturing test of mono-glyceride
- Manufacturing test of sugar ester
- Manufacturing test of fatty acid, methyl ester, and glycerin from coconut oil
- Hydrogenation and hydrolysis test of coconut oil

<Major equipment>

- Esterification reactor
- Vacuum distillation apparatus
- Fractional distillation apparatus
- Molecular distillation apparatus
- Hydrogenator
- Autoclave for hydrogenation

(6) Equipment for technical services including training

<Details of technical services including training>

Education and training on unit operations, process improvement technology and quality control will be conducted to technical staff engaged in the existing MCSMEs and/or to the SMEs going into the agro-based industries.

<Major equipment>

- Experimental equipment included in the items (1) to (5) listed as above
- Spray dryer

- Vacuum dryer
- Compact-type measuring equipment such as pH meter
- Materials handling equipment
- Overhead projector
- Slides, etc.

(7) Others

- Vehicle and furniture/appliances for the activities of the MICSMEC

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 Design Policy

4.1.1 The Research Function of ITDI

As stated in Chapters 2 and 3, the objective of the research at ITDI is to contribute to the economy of the Philippines through the development of technology which utilizes the indigenous resources of the Philippines. This includes the industrialization of technology, enhancement of the value-added involved in the research and development of the secondary processed products, improvement of quality and productive capacity, development of import substitutions and export products, and the development of technology for an effective utilization of industrial wastes including agricultural wastes. The products covered are agri-industrial chemicals, and a group of products that relate to foods, pharmaceuticals, construction materials, non-ferric metals, etc.

Also, ITDI, in close contact with the other agencies of the Government under the Cottage Industry Program, is to advance joint research and projects using task forces, and are to carry out a broad range of activities.

Consequently, ITDI needs to conduct various basic research, table scale research and pilot plant research on the industrialization needed for the utilization of agricultural resources.

On the other hand, ITDI, in a joint research and technical cooperation with the Agency for Industrial Science and Technology of the Ministry of International Trade and Industry of Japan has been successful for many years in the industrialization research of the processes for the manufacture of activated carbon utilizing coconut shells and agricultural wastes. The research on slow-release fertilizers which is being planned is an offspring of the basic research conducted over a period of three years in collaboration with the Hokkaido, Agency of Industrial Science and Technology as the ITIT Technical Assistance.

The future research activities of ITDI are described in Chapter 3. On the other hand, these specific research and development themes have life cycles and from the nature of the institute, once the technology reaches the stage of industrialization, the activities expected of the institute would change to production related themes such as improvement of processes. Consequently, in the basic design of the equipment, while it is important to focus on specific items, evaluations were made from the standpoint that research of a wide scope is needed such as will facilitate and make possible the development of secondary processed products. The following points were given attention.

- 1) Tasks for pilot plant tests for the next two years, are to be the cottage type fresh coconut industrialization tests and the slow release fertilizer manufacture tests, which have both completed their table scale tests recently.
- 2) For research on the manufacture of rice bran oil, the first step is to conduct table scale tests although a part of the equipment referred to in 1) above can be used, and to conduct feasibility studies to focus research activities to match the progress of the joint task force with other government agencies.
- 3) The research on silica derivatives will consist mainly of basic and screening research so as to develop towards research on the manufacture of inorganic fine chemicals.
- 4) The research and development of the manufacture of high value-added products such as monoglyceride and medium chain glycerides from vegetable oil are important.
- 5) In addition to the above, technical support activities such as technical consultancy, contract research, analytical services, training, etc. are emphasized.
- 6) Also, because of the nature of a research and development orientated laboratory, the ability to perform minor modifications and rearrangements of the pilot plant for special uses by the institute in addition to the ability to perform analyses for process development is of importance.