"The ITDI's role in technology transfer consists of presenting some ways and means on the management of the transfer of its developed technologies to the users."

The Management of Techno-Transfer: The ITDI Experiment *

by
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INTRODUCTION

Technology transfer plays a pivotal role in the overall socio-economic development plan, especially of developing countries. Success in this competitive world is realized only through improved technologies, better products and processes and acquisition of machineries and technical expertise. Thus, the introduction and adoption of technological innovations in order to achieve advancement in the country's industrial structure, cannot be overemphasized. These scientific and technological advances which contribute to the society's economic development and productivity improvement, are the driving force towards economic growth and social progress.

Technology generation is central to the socio-economic well-being of the country, for technology innovation offers an improved standard of living, increased public and private sector productivity, creation of new industries and employment opportunities. This, in essence, is the raison d'etre why technology should be transferred.

However, the mechanism for a more effective technology transfer management is as important a factor as this generation of technologies. The time and costs already spent for research and development (R & D) efforts are tremendous, and hence, could be enough grounds for the need to move technology/research results with potential economic and social values, from technology generators to adopters through appropriate channels, for absorption and assimilation in the production process.

As defined, technology transfer is the process of moving R & D results out into the communities, whether private or public. The achievement of a practical purpose by any entity, which has not been able to accomplish said purpose before, is the hallmark of technology transfer. It is not simply transferring knowledge from one entity to another, although know-how transfer is a very important step in the technology transfer process. There is a need to find ways to bring unsatisfied needs and existing technology together, which infers societal use.

Technology transfer is a complex system that covers many conditions and terms, in order for one to comprehend its nature and application. It is the object of this paper to present the managerial component of technology transfer by looking into its concepts and issues, mechanics and mechanisms of transfer, and factors related to the transferor and acquirer of technology. Finally, the ITDI's role in technology transfer consists of presenting some ways and means on the management of the transfer of its developed technologies to the users.

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TECHNO-TRANSFER: A CONCEPTUAL APPROACH

First of all, let's consider the vital factors in technology transfer, which include the following:

i) Transplantation of technology from within one set of well-defined conditions to another set in which at least one key variable may differ, and how the recipient or acquirer applies the technology may vary greatly from the transferor/donor's mode.

ii) A sence of opportunitism/recognition of opportunity.

iii) A rich variety of mechanisms and relationship between recipient and donor.

iv) Nature of the technology being transferred and how it is transferred.

Modes of Techno-Transfer

Technology transfer, according to its role in offering solutions to user's problems, is classified into three modes: passive, semi-active, and active.

The most familiar and widely used form of passive techno-transfer is the "cookbook", where knowledge can be self-taught. Similar forms of passive techno-transfer are how-to-do manuals and kits, which work on the assumption that the recipient/acquirer of the technology has already an elementary familiarity with, and competence in the subject. This mode of techno-transfer does not include the introduction of skills that come from practice under instruction. It is simply a knowledge transfer brought about by the availability of ready-to-use technical information material.

In the semi-active mode of technology transfer, the technology transfer agent plays an active role in screening available pertinent information to eliminate redundant and superfluous information. However, here the techno-transfer agent does not go beyond the role of a communicator. In the semi-active mode, the agent has not actively participated in the application of the technology.

Lastly, the active mode of techno-transfer carries the process through to an actual demonstration. This form of technology communication recognizes that words alone may not sufficiently communicate, but only a model actually demonstrating the technology that is being transferred will suffice. This active mode is comprised of the following elements in the demonstration process during the transfer cycle: 1) a statement of user need, 2) clearly stated solutions, 3) a firm commitment by the user to remain actively associated during and after the transfer, 4) a participation of interested organizations, 5) a market analysis, 6) a manufacturer, and 7) a champion and an entrepreneur.

Because technology is more than just information, the transfer of technology calls for more effort on the part of the transferor/donor than merely providing information on the subject. Technology transfer is a comprehensive socio-economic process requiring management integration and planning, and not simply an information flow process.

Techno-Transfer and Sense of Opportunism

The transferor/donor which is the entity possessing the technology views techno-transfer as a transfer process, while the entity desiring to have the technology views techno-transfer as an acquisition. The techno-transfer process takes place when the two parties view the transaction as mutually beneficial, based on a give-and-take relationship. Both parties recognize the existence of each other, as techno-transfer begins with the recognition of an opportunity by the transferor and the acquirer.

The non-recognition of any opportunity afforded by any technology prevents techno-transfer. Thus, it would be necessary for the transferor to magnify the benefits or opportunities an acquirer could derive from the use of a technology being transferred. Since technology acquisition involves some uncertainties, the acquirer must be fully convinced that opportunities exist before making the final decision to invest. One who recognizes the opportunity, and is willing to take the challenge is called the technology champion.

Forms and Types

Techno-transfer forms, according to origin, can take place within the country (endogenous transfer), and also outside the country (exogenous transfer) mostly from developed to less developed countries.

Most developing countries have resorted to importation of technologies through foreign investments, as a less expensive and speedier means of economic development. The lack of institutional infrastructure, dearth of manpower capabilities, lack of financial resources, and absence of a technological environ are major reasons that necessitate the importation of technologies among developing countries. The trend on the need for imported technologies will undoubtedly continue to increase in meeting domestic requirements.

Table 1 shows that the Philippines ranks third in the importation of technologies with a total of US$68M expenditures based on a three-year average from 1972-1982. Japan leads with $1,470M while Republic of Korea ranks second with $102M. The total cost of techno-transfer includes the cost and payment for technical assets, technicians, training, machineries, and equipment.

Table 1. Payments for transfer of technology: selected ESCAP member countries, 1972-1982 (* US million)

Country	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	Total	3 yrs. Average 79-81
Developed countries												
Japan[a]	572	715	718	712	846	1,027	1,241	1,260	1,439	1,711	10,241	1,470
Developing Countries												
India[b]	7.78	3.43	8.23	3.58	8.18	4.87	11.48	7.12	11.25	12.55	78.47	10.31
Republic of Korea[c]			96.51			58.06	85.07	93.93	107.23	107.10	547.90	102.75
Republic of the Philippines[d]	16.76	23.56	34.01	55.73	60.00	63.08	62.20	63.63	72.91	67.92	519.80	68.15
of which Royalties/ technical fee	5.81	8.83	13.62	16.56	22.01	28.51	28.56	30.74	36.32	37.59	228.55	34.88
Salaries + fees	10.95	14.73	20.39	39.17	37.99	34.57	53.64	32.89	36.59	30.33	291.25	33.27
Thailand[e]	6.79	9.83	11.12	14.55	17.75	24.74	26.71	35.11	45.42	57.86	249.88	46.13
Developing countries combined			377.81			150.75	185.46	199.79	236.81	245.43	1396.05	227.34

Sources:

[a] Science and Technology Bureau, *Reports on Annual Introduction of Foreign Technology*, Tokyo (in Japanese), 1981

[b] Foreign Investment Board, Government of India.

[c] Technology Transfer Centre, Government of Korea.

[d] Central Bank of the Philippines.

[e] Bank of Thailand.

The selection and acquisition of foreign technologies must, however, pass careful assessment based on the country's national science and technology (S & T) priorities. The importation of technologies must be linked with the local institution of the acquiring country. The basic objective is to strengthen local capabilities to boost research and the development of technologies suited to the needs of the country using available resources. Lastly, importation of technologies must be on a selective basis, particularly in areas where there is a need for latest technology to bolster research, and thus, accelerate economic development.

Techno-transfer types may be classified into: a) foreign direct investment package from a single source, and b) contract agreements which include licensing arrangement involving transfer of the right to use certain patents, trademarks/names, transfer of skills, experiences, and knowledge which are already in the public domain, like technical assistance, know-how agreements.

Table 2 shows the top three percentages obtained from the Technology Transfer Board (TTB) from 1978-1981, based on 324 techno-transfer contracts it had approved from foreign countries.

Table 2. TTB Percentages on Technology Importation (Top 3 Figures)

Technology Sources (Foreign)	Industrial Sector As Foreign Technology Recipients	Types of Techno-Transfer
U.S.A. – 42%	Electrical Supplies/Appliances – 15%	Know-how/Trademark – 32%
Japan – 22%	Metals – 12%	Know-how only – 30%
Switzerland – 7%	Textile, Apparel – 10%	Patent/Trademark/ know-how – 24%

Despite this increasing trend in technology importation, the country continues to direct its efforts in strengthening R & D institutions and establishing indigenous research capabilities, using existing resources. Public and private R & D institutions are vital agents of techno-transfer, internally or even outside the country, this time to foreign end-users.

R & D activities should establish closer interaction between the technology generators and the end-users, so that actual needs can be identified and attended to immediately. Foreign technologies may be adopted with the local research institutions introducing innovations to adapt to local conditions and materials.

The issue on technology transfer, whether or not the developing countries should import technology from an advance industrialized society, has proven to be out of the question. The wide gap between an industrialized and a developing economy should not prevent exogenous transfer of technology. In this day and age of competition, it is an accepted fact that no country, big or small, can survive without importing technologies. A developing country may adapt an available "outside" resource to solve problems "within". The question is not whether to acquire foreign technologies or not, but *which* technologies to acquire that could be adaptable to the specific needs, resources, and environment of the developing country. Adaptation of "outside" technology has one big advantage – it avoids reinventing the wheel.

TECHNO-TRANSFER INSTITUTIONS

Technology Transfer Board (TTB)

The screening of imported technology is undertaken by the Technology Transfer Board (TTB), an interagency under the Department of Trade and Industry created in 1978, and composed of the representatives of the following agencies: Department of Science and Technology (DOST), Board of Investments (BOI), Central Bank of the Philippines (CBP), Phil. Patent Office (PPO), National Economic Development Authority (NEDA), and Technology Resource Center (TRC). The TTB keeps a registry of foreign Techno-Transfer contracts, to make certain that what is obtained is of maximum benefit and greatest use in pursuit of the country's developmental goals, at reasonable cost.

Board of Investments (BOI)

Created under the Investment Incentives Act of 1967, it directs and encourages investments in preferred areas identified by the government. It formulates and publishes yearly priority plans. It also looks into the pioneer projects which will make new products not yet manufactured in the country on a commercial scale, and which uses technology new to the country.

Technology Resource Center (TRC)

A corporate agency of the government created in 1977, it is mandated to promote, foster and spread the use, application and commercialization of all kinds of technology, for socio-economic benefits. The TRC offers a package of services, technical advice, trainings on managements, financing and marketing assistance for making use of new technologies. One of TRC's programs, the Technology Utilization Support System (TUSS) develops technology ventures and projects that are nearing "commercially mature" stage for the rural areas.

Department of Science and Technology (DOST)

This agency was created in 1958 as the central coordinating body of all scientific and technological activities in the country. As mandated, the DOST formulates and implements policies and programs that would effectively give direction to the S & T efforts in meeting the socio-economic needs of end-users. This is being undertaken by its R & D institutes undertaking major areas of research which include agriculture, energy, and industry, health and nutrition, among other technology fields.

TECHNO-TRANSFER – THE ROLE OF ITDI

Role of R & D Institute

The Industrial Technology Development Institute (ITDI), a multi-disciplinary research and development (R & D) institute of the DOST is mandated to pursue the industrialization program of the country by developing technologies with socio-economic impacts. Appendix 1 lists the ITDI programs and technologies with potential impact to target users. The role of the R & D institutes in technology transfer process can be classified under three (3) major steps according to the UNDP-UNIDO Evaluation Report No. 6 published in 1982, as follows:

Step I Information on Selection of Technology
- maintain up-to-date technological information service
- identify alternate technological possibilities

Step II Acquisition and Application of the Technology to be transferred
- provide technical informations during negotiations
- absorption of transferred technology

Step III Maintaining, Supporting and Further Developing Transferred Technology
- provide technical services for transferred technology
- carry out R & D for technology improvement
- continue training of industry personnel
- maintain information surveillance in the related field of transferred technology

The total amount of resources given to industrial R & D institutes adapting an existing technology is relatively small, compared to the cost of developing a new technology. Because a new technology undergoes several tests on its applicability, it is sometimes difficult to provide assurance that the newly developed technology meets industrial requirements. Chances are the industry doesn't get easily convinced to take some investment risks. The R & D institutes opting for the adaptation of exogenous technology may generate big savings for the government and at the same time, result in speedier technological development.

ITDI Mechanisms of Techno-Transfer

At the Institute, there are various mechanisms of transfer which need to be explored to ascertain their suitability. These methods include, among others, transfer by documentation, by demonstration, by workshop and exchange of research experience, by training, by joint pilot agreement and by commercial ventures.

Transfer by Documentation — This involves the translation and interpretation of technology information for dissemination to various users. Information on the process, apparatus, equipment and other requirements is done by the Institute, and is made available to the acquirer/recipient of technology. Media commonly used are scientific journals, brochures, and popular channels like public announcements. On the part of the recipient, the possession of a certain level of technical know-how which will enable the acquiring mechanisms or a system of dissemination and assimilation of tested packages must be implemented.

Transfer by Demonstration — The best way to show if a given technology works is through demonstration. The Institute greatly utilizes this method in food processing lecture-demonstration being conducted in the rural areas, where there is abundant supply of food raw materials. Mostly, this demonstration is done with kitchen-type technologies with greater appeal to backyard or small-scale entrepreneurs. A listing of these technologies for community-based projects is given in Appendix 2. In making the demonstration, the ITDI shows the process, and elucidates on the principle on which the process is based, and whenever possible, prescribes the use of locally designed equipment.

Transfer by Workshops Conferences — In this transfer, the transferor and the acquirer recipient are presumed to be in similar level of preparation. The transferor relates experiences and thoughts about the technology being transferred, and the acquirer recipient comments or asks questions about the technology. Recently, the ITDI held a workshop on the Development in Fish and Fruit Processing and Waste Utilization which was attended by entrepreneurs of Cebu. After the workshop, consultations between ITDI and the recipients were conducted.

Transfer by Training — The transferor, in this case the ITDI, which possesses the know-how on a given technology takes a limited number of trainees from industry. Through a training leader, the trainees become acquainted with the mechanics of the process, or the machine design and fabrication. In contract agreements, the ITDI usually provides the technical staff who stays and supervises the operation of the factory, plus the training of the acquirer's technical personnel.

Transfer by Commercial Ventures — A commercial venture such as the food industry, alcohol distillery, or sugar mill could be a recipient of technology developed at the Institute, which provides opportunity for the technical staff in the plant to learn about the process, perform various jobs in the plant, and do other related functions in a commercial enterprise. If a new commercial plant is to be set up, some of the trained people in the old plant can be tapped to run the new commercial venture. The Institute launched five techno-transfer projects for commercial venture in 1984.

TECHNO-TRANSFER – THE FIVE CASES

Since 1947, the ITDI was already mandated to conduct researches necessary for the promotion and development of industry. However, sad to say, despite the long years of scientific research and technological development, the Institute has not been successful in its efforts to transfer technology to industry.

The biggest problem in the transfer of locally-developed technology was due to the failure to establish direct linkage between existing industries and the R & D institute. The Institute was faced with multiple problems of offering the technology, demonstrating the process, helping develop the market for the developed product, assisting in securing loans, and providing techno-economic studies. All these efforts were in vain, since the Institute at that time, has no expertise in marketing, feasibility studies and financial analysis. Notwithstanding, the entrepreneur lacks the necessary capital to put up the business, and therefore, the new enterprise eventually flops.

Other problems identified in the techno-transfer efforts of the Institute included: 1) premature attempt to commercialize a technology that is not yet tested and proven, 2) inability of the Institute to sustain techno-transfer effort, 3) the researcher's secrecy of data and hesitance in providing information needed to insure successful technology transfer.

Cognizant of the mandate on industrialization, the ITDI started an assessment of technologies developed in the recent years to determine which were perfected enough for transfer to industry. For the first time, the (ITDI) has established a more formal linkage with industry, and as a result, the Institute has become more credible to industry through its techno-transfer and contract projects, which now have become part of the mainstream of this R & D institute.

The techno-transfer initial efforts identified 17 technologies compiled in a brochure entitled *Mature Technologies* which was disseminated to the public. Further evaluations were done to select technologies for immediate transfer. Two basic criteria were followed in the selection: 1) that the commercialization of the technology developed will not result in too many technical problems, and 2) that the industrial-recipient who will need the technology, who will financially support the transfer process, and who will push the marketing of the product can be found. Finally, five (5) technologies were chosen for transfer to five selected industries. These were: 1) an improved alcohol fermentation technology using highly-active flocculating yeast fusant to Victorias Milling Company (VMC) in Negros Occidental, 2) accelerated fermentation process for the production of premium quality soy sauce to Universal Foods Corp. (UFC) Quezon City, 3) improved industrial salt making technology to Negros Fisheries Corp. (NEFCOR) Negros Occidental, 4) technology for the production of essential oils from local plants to Helen's Pharmaceutical Laboratory (HPL) in Cagayan de Oro, and 5) a new technology for the production of coconut water beverage to Harman Foods Inc. (HFI) in Caloocan.

Potential end-users of the technologies were identified based on their production activities and product lines, availability of raw materials and facilities, and marketing capabilities — factors which greatly affect the commercial success of the techno-transfer efforts. All techno-transfers are covered by a memorandum of agreement, stipulating the responsibilities and benefits of the ITDI and the contracting industries.

The recognition of opportunity in the technologies transferred to the five selected industries was the main factor why the recipients got sold to the idea of the technology innovation. Here are the tangible results of ITDI's technologies which have been recognized by the recipients as opportunity to help prosper the business venture:

1) *The improved alcohol production* process utilizes an active highly-flocculating yeast fusant. Fermentation, conducted with minimal cooling and agitation, yields up to 12 percent alcohol in the beer using molasses as feed-stock while the necessity for cell recycling is eliminated. Thus, considerable savings in operating expenses can be realized.

The ITDI introduced a yeast fusant coded F-95 to the VMC distillery. Initial runs utilizing batches of 45,000 and 50,000 L of molasses at 14° Brix yielded 270 and 300 L of anhydrous alcohol per ton molasses, respectively. No improvement in alcohol yield was observed due to the lack of a cooling system in the fermentors; the increase in vat temperature during the initial stages of fermentation inhibited further conversion into alcohol.

Subsequently, some process modifications were introduced. Equipment for the agitation, aeration, circulation, and cooling of the fermentation medium was installed and succeeding runs were made using smaller batches of 10,000 and 20,000 L. Furthermore, a thermo-tolerant yeast fusant, coded Fatt-2, was developed to meet the requirements of high conversion efficiency and continued productivity at high temperature.

2) *The improved soy sauce production* technology involves the use of pure microbial cultures, while the industry practice is to use cultures left over from previous batches. Process parameters are therefore easily controllable, and the quality and integrity of each batch are assured. In addition, fermentation time for the process is only three (3) months, while the traditional process requires 8-12 months.

At the time the project was initiated, UFC has a stockpile of three (3) tons of navy beans. For this reason, it was agreed that navy beans would be substituted for soybeans during the transfer of technology. Some process modification had to be made, however, owing to the larger size and lower moisture content of navy beans compared to soybeans. Also, because navy beans have a lower protein content, the resulting sauce is expected to have a similarly reduced protein content.

The technology was modified by extending the soaking period of the beans from 12 hours to 24 hours and cooking the beans by boiling instead of steaming. The product was a clear, dark, caramel-colored solution with a distinctly salty taste, and was rated highly acceptable after sensory evaluation.

3) *The improved industrial salt production technology* is based on fractional crystallization and superior brine management techniques. The product is industrial-grade salt, with a purity in excess of 97 percent and a value four (4) to five (5) times that of ordinary solar salt produced by traditional methods.

The project was allotted 80 crystallizer beds to take actual production runs using the improved technology. Preliminary project activities included: 1) site preparation, i.e., cleaning of production facilities, construction of drainage canals, and modification of the crystallizer flow scheme to allow for better brine management; 2) sampling and analysis of the brine, and 3) design of washing apparatus to further increase purity and promote crystallization of the salt.

Production of industrial salt was commenced after the end of the rainy season. Industrial salt of 98.2 percent purity (after washing) was produced, with productivity in kg. per unit area by the ITDI process almost double that of the traditional process. Since the value of industrial salt is four (4) to five (5) times that of traditionally-produced salt, this means a tenfold increase in product value per unit area.

4) *The technology on essential oil production* utilizes steam distillation to obtain essential oils from local plant materials. Essential oils are used to enhance the odor and flavor of pharmaceutical and cosmetic products, and their production on a bench scale has been conducted by ITDI.

HPL operates a pharmaceutical laboratory in Cagayan de Oro City, and its distribution network encompasses the whole of Mindanao. HPL products include mineral oil, talc, liniment, cough syrup, antipyretic tablets and other medicinals.

Four (4) essential oils were produced at HPL using ITDI equipment, namely: calamansi oil; lemongrass oil, eucalyptus oil, and ilang-ilang oil.

Trial substitution of the essential oils produced for imported oils in various HPL product formulations was conducted; it was found that the substitution does not adversely affect product quality and acceptability. To confirm this result by actual market tests, 960 bottles of baby oil scented with calamansi and ilang-ilang oils were distributed to different outlets; which prove to be quite marketable. To date, 1,000 bottles of baby oil and 75 bottles of baby powder were manufactured using the locally produced essential oils.

5) *The technology for coconut water beverage production* is aimed to convert coconut water, a high volume, highly pollutive waste product of dessicated coconut plants, into a beverage-type drink suitable for human consumption.

HFI currently produces fruit-flavored drinks packed in laminated containers and marketed under the brand name "Zest-O". HFI has complete facilities for handling, processing and packaging the beverage. It has also a well-established product name and an extensive marketing network.

HFI purchased the coconut water as raw material from New Sunripe Corporation, Inc. (NSCI) a dessicated coconut plant in Magdalena, Quezon, at a price of P0.40/gal. Coconut water samples collected from NSCI were processed and monitored as to physico-chemical, microbiological, and organoleptic properties over a six-hour period to establish suitable conditions for transport of the beverage to the HFI plant in Caloocan City. It was found that centrifuging, the addition of food-grade acid, preservative, and sugar, and chilling to 10-15°C prevented spoilage.

After the establishment of storage requirements during transport, three (3) production runs using a total of 322 gal. of coconut water were made, producing 3,784 200-ml packs at an average cost of P1.78 each. Product samples were tested and found negative for microbial count, and rated highly acceptable by a sensory panel. Samples were also tested after two (2) months of storage, and no evidence of spoilage was found.

CONCLUSION

After technology development, it is imperative that a mechanism whereby a more effective transfer and delivery system of research results can be brought to the communities be established. As a developing country, our need for technology transfer goes beyond the question of whether or not we should import technologies from developed countries. Our concern must be focused more on which technologies to acquire that could be adaptable to our local needs. Undeniably, there may be technologies "outside" that can solve some problems "inside". Reinventing the wheel is deemed unwise.

The ITDI as a multidisciplinary research institute is dedicated to the task of transferring technologies for the country's industrial growth. As a generator of technologies, the Institute could offer a number of R & D opportunities for industries to recognize, and apply in commercial ventures. It is this recognition of opportunity that will initially spark the desire of an industry to acquire a certain technology, and thus, make the final decision to invest. The Institute looks forward to its role of transfering more developed and commerciable technologies to industry, as this is the mandate, and responsibility of the ITDI to our nation.

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Appendix 1 – Target Users of ITDI Technologies With Potential Impacts

PROGRAM	TARGET CLIENTELE	POTENTIAL IMPACTS
Management and Utilization of Agro-Industrial Wastes (i) Production of Coco-Water Beverage (ii) Feeds from Food Processing Wastes (iii) Anaerobic Treatment of Industrial Effluents (iv) Biogas from Selected Industrial Wastes	Food and beverage industry, coconut industry, agriculture sector, manufacturing sector	Improved production systems resulting in an increase of P166 million in aggregate income of target clientele; abatement of pollution/environmental hazards
Beneficiation of Ceramic Raw Materials and Formulation of Ceramic Bodies and Glazes	Ceramics industry, mining industry	Improved product quality and reduced raw material imports, resulting in increased foreign exchange income of US $16 million; additional employment in mining and ceramics industries.
New and Improved Food Products from Local Sources (i) Mango Leather (ii) Dehydrated Spices (iii) Condiments	Food and beverage industries, mango industry	Improved production systems and reduced spoilage of produce, resulting in savings or additional income of P8.5 million
Design & Fabrication of Equipment for Small & Medium Scale Industries (i) Soap-Maker (ii) Essential Oil Extractor (iii) Low-Temperature Dryer (iv) Copra Oil Expeller	Small and medium scale companies involved in processing agricultural and marine products	Indigenous design and fabrication of equipment, resulting in direct savings of P780,000 to end-users; increased employment for equipment fabricators and metalworkers.
Chemicals and Related Products from Indigenous Materials (i) Agar-Agar from Local Seaweed (ii) Local Production of Intravenous Fluids (iii) Production of Essential Oils (iv) Production of Citric Acid (v) Improved Ethanol Production (vi) Simplified Laundry Soap Production (vii) Charcoal and Powdered Activated Carbon from Sawdust (viii) Production of Industrial Salt (ix) Coconut Diethanolamide Production Standards, Testing, and Others	Food and beverage industries soap and detergents industry, pharmaceuticals and cosmetics industry, chemical industry	Improved production systems resulting in increased income of P136 million to end-users; direct employment for some 520 personnel and indirect employment
Technical Services (i) Tests and Analyses of Materials and Products (ii) Instrument Calibration and Repair (iii) Evaluation and Certification of Formula of Manufacture	Manufacturing sector, government agencies, academic and research institutions, rural inhabitants and village-scale enterprises	Reduced chargers for technical service and improved product quality assurance and control, resulting in savings of P88 million to clients •

PROGRAM	TARGET CLIENTELE	POTENTIAL IMPACTS
(iv) Scientific & Technological Manpower Training (v) Countryside Technology Transfer		
Utilization of Local Raw Materials for Construction (i) Ceramic Bricks, Blocks, and Roof Tiles (ii) Reinforced Waste Board Construction Panel	Construction industry, ceramics industry, potential homeowners	Reduced construction and imports for production of construction materials, resulting in savings of P300 million in government resources allocated to the housing program and US $ 26 million in foreign exchange, and additional income of P6 million for the agricultural sector; direct employment for some 3,000 workers.

Appendix 2
ITDI-MATURE (KITCHEN-TYPE) TECHNOLOGIES FOR COMMUNITY-BASED INDUSTRY

I. Chemical Products
   1) Soapmaking by cold process
   2) Edible oil from copra and fresh coconut meat
   3) Charcoal/activated carbon production from agro-industrial wastes
   4) Salt production by improved solar-evaporation method

II. Microbiological Products
   1) Vinegar production from coconut water and other raw materials
   2) Mushroom growing

III. Food Products
   1) Fruit wine-making
   2) Fish sauce/paste production
   3) Soy sauce production
   4) Kropeck production (fish, shrimp, and tokwa 'sapal' kropeck)
   5) Canned fish/shellfish (bangus, tulingan, tambacol, tahong, pusit, etc.)
   6) Fish polvoron
   7) Ham and tocino making (fish and meat products)
   8) Skinless longanisa, sausage, and quekiam (meat and fish)
   9) Crispy dilis
   10) Corned beef
   11) Canned meat/poultry products (pork adobo, binagoongan, chicken pork, etc.)
   12) Nata de coco production
   13) Vegetable pickling
   14) Salted/pickled egg production
   15) Instant 'dry' tokwa
   16) Banana blossom/coco/soyburger (meat substitute technology)
   17) Banana food products (catsup, sauce, chips, flour, and pastilles)
   18) Kamias/balimbing prunes production
   19) Papaya candy
   20) Tamarind balls/whole fruit candy
   21) Fruit juices (duhat, tamarind, guava, orange, piña, santol, etc.)

22) Fruit jam/jelly (pineapple, papaya, mango, langka, etc.)
23) Buco-fruit/fruit cocktails
24) Mango food products (pickled mango, leather, osmotic-dried, juice, etc.)
25) Santol food products (candy, jelly, chutney, juice, etc.)
26) Tomato food products (concentrate, sauce, paste, catsup, candy, etc.)
27) Piña food products (juice, jam, marmalade, osmotic-dried, etc.)
28) Dehydrated vegetables (garlic, ginger, onion, carrots, etc.)
29) Kalabasa food products (flour, catsup, nata, vinegar, etc.)
30) Coconut food products (mazapan de coco, chips, bukayo, jam, pretzel, etc.)
31) Agar *(gulaman)* production from seaweeds
32) Fish drying/smoking
33) Canned coconut milk 'gata' production

IV. Others

1) Essential oil production from local plant sources
2) Biogas production from agro-industrial animal wastes