Gender and Technology

Amelia C. Ancog
The author, Dr. Amelia C. Ancog, is the Director of the Biotechnology Coalition of the Philippines, a professional lecturer at the Ateneo School of Government, and a seasoned lecturer at the Technology Management Center of the University of the Philippines. She holds the degrees of Bachelor of Laws, Master of Public Administration and Doctor of Public Administration from the University of the Philippines. She also took special courses in Development Law from the Institute of Law, Rome, Italy.

Dr. Ancog is vice-president of the National Research Council of the Philippines and member of the Management Board of Science Council for Asia and the Research Advisory Group of the Asia-Pacific Gender Equality in Science and Technology Project. She specializes in science and technology policies, intellectual property rights, business organization, human resource development and public administration.
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The commitment of these S&T officials, their supervisors, and personnel to bring knowledge and technology to the countryside is truly remarkable. May their tribe increase!

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ABSTRACT

The study entitled Gender and Technology aims to contribute to APEC’s efforts in building lessons and literature in science and technology and in micro, cottage, and small and medium enterprises (SME). It describes selected research undertaken by research and development institutes (RDIs) of the Department of Science and Technology (DOST), the technologies developed and transferred to individuals and firms, the opportunities and constraints which technology adopters faced as they commercialized the technologies, and the participation of women and men in these endeavors.

Technologies selected were herbal medicine technology (sambong and lagundi), nutritious food technology (canton noodle with squash), and technology for the manufacture of furniture (spray booth and tunnel drying). Data were obtained from respondents including scientists, and adopters from Metro Manila, Regions III and VI, and key officials, supervisors, and researchers of the RDIs, DOST, and the University of the Philippines (UP).

The data reveal that, generally, adopted technologies were perceived to be simple, easy to adopt, and can be commercialized quite profitably. Opportunities for enhancing or improving the technology were seized by the innovative adopters, tapping in the process the technical advice and services of scientists and researchers. The accessibility of the scientists contributed to the success of some entrepreneurs in the same manner that the financial assistance provided by DOST through the Technology Application and Promotion Institute (TAPI) facilitated the acquisition of equipment to increase productivity.

Limited capital, irregular supply of raw material, untrained manpower, and absence of institutional buyers were among the factors pinpointed by the adopters, that hindered the effective commercialization of the technologies. Nevertheless, adopters with creative sourcing talent succeeded in mobilizing resources from the community and other institutions to build a stronger capital base.

The Technology Transfer Guidelines of DOST are fair and transparent. They provide for the sharing of royalties between DOST, its agencies, the scientists/researchers, and the adopters.

Women scientists and researchers fulfill key roles in R&D and technology adoption and in managing microenterprises and SMEs. In R&D, women as well as men hold the positions of project leaders. Men and women technology adopters share a common perception about the
exceptional skills of women in handling financial matters and combining colors for the design of beautiful gifts, toys, and housewares. They also recognize that women are persevering, reliable, and committed to their profession and work.

Policy initiatives may focus on strengthening collaborative work among the RDIs, academic institutions, and the private sector to ensure that the needs of the private sector are given full consideration in the development of R&D programs. This will result in a demand-driven policy thrust that will support the needs of the private sector, particularly the microenterprises and SMEs for technological innovation and services.

Flexible, creative, and liberal credit mechanisms for microenterprises and SMEs are necessary particularly if the funds are needed for technology acquisition and technology enhancement. Continuous training of adopters to enhance their skills can hasten the growth of techno-based enterprises. An entrepreneurship-training program that includes intellectual property rights (IPR) will help scientists and researchers improve their knowledge and technology transfer skills.

Continuing activities on data collection, segregation, and analysis on gender equality and access must be supported by the public and private sectors. Regular monitoring of compliance by government agencies in providing funds for gender programs will enhance the participation of women in S&T and related activities. The information obtained will be useful in documenting good practices and using them as models on gender equality and access. These will be distinct contributions to the Asia Pacific Economic Cooperation’s (APEC) policy and program development on gender in science and technology.
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Executive Summary

Introduction

The Asia Pacific Economic Cooperation (APEC), UNESCO (United Nations Educational, Scientific, and Cultural Organization), and other multilateral agencies encourage the adoption and implementation of gender-friendly policies and programs and documentation of good practices. A significant area is the study and analysis of the extent of contribution of women in research and development and technology adoption. Such a study will provide insights on policy initiatives and reforms that will strengthen equality of access to opportunities in S&T and business endeavors. Gender equality in science and technology however, can only be meaningfully assessed within the context of the national conditions.

S&T policy experts agree that commercialization of the results of research and development will be facilitated by the presence of the following factors: (i) demand-driven partnership between research institutions/universities and industry; (ii) availability of funds for small and medium-sized industry for product improvement and new product and process development, and (iii) royalty from commercialization of R&D outputs. It is important to ascertain whether these factors are present in the Philippine setting. The various research and development institutes (RDIs) of the Department of Science and Technology (DOST) have many available technologies, a substantial number of which had been transferred to adopters. Some have been commercialized successfully.

While there are some studies on gender in research and development, there is a need to document experiences in technology transfer with women as adopters, proprietors, or owners of microenterprises and SMEs. Lessons from their experiences and involvement in R&D including technology adoption and commercialization will provide insights on the opportunities and constraints to gender access and equality.

Scope and Methodology

The study identifies and describes selected technologies of RDIs which had been commercialized; describes and documents the role and contribution of women scientists in the research, technology transfer, and commercialization of the technologies that had been identified; the processes and activities relating to technology transfer, adoption, and commercialization and proposes policy initiatives which will enhance the role of women in S&T.
The technologies chosen were production of nutritious food particularly canton noodle with squash, herbal medicine specifically *lagundi* and *sambong*, and a forest product technology consisting of tunnel drying and spray booth. An interview guide and a questionnaire were developed and administered to respondents in Metro Manila, Region III and Region VI. Likewise reports of agencies, official documents such as circulars and other administrative issuances were analyzed.

A short interview guide was used to elicit information about the adopter, experience on the use of the technology, improvements undertaken, gender distribution on functions and responsibilities, level of success in technology commercialization as indicated in volume of sales, factors which contribute to or hinder the effective use of technology, and the distinct contributions of women and men in the firm.

The questionnaire for the technology generator asked about the following items: respondent’s profile, description of duties/responsibilities, research activities, initiator of research, description of the technology resulting from the research, source of fund, complement of research team, number of adopters, factors which contributed/hindered the technology transfer efforts, and the role of women in R&D commercialization. An open-ended item was included in the last part of the questionnaire for the respondent’s comments and suggestions.

For the technology adopter, the questionnaire covered: respondent’s profile, description of duties, description of technology used, date of technology transfer, type of business organization, number of personnel employed, gender distribution vis-a-vis assignment of responsibilities, raw material requirements, volume of investment, technology transfer agreement, technology enhancement or modification, factors which contributed to or hindered the effectiveness of technology transfer, and the role of women in R&D commercialization. An open-ended item was included for additional comments of the adopter.

The instruments were pretested in the Philippine Textile Research Institute (PTRI) and among selected adopters. Revisions were undertaken as a result of the pretest.

Eight directors and deputy directors, 2 regional directors and 16 division chiefs, senior research specialists, and researchers were interviewed. Field visits were made in the plants/offices of six adopters in Region VI, four in Region III, and two in the National Capital Region. Twenty-five adopters were interviewed. Sixty questionnaires were sent to adopters; 35 responded. Several did not provide information on volume of sales, revenues generated, and raw materials used. Information on the amount of investment was also not revealed by most of the adopters.
Findings
Herbal Technology Medicine Technology: *Lagundi* and *Sambong*

Prominent women scientists and researchers fulfill a crucial role in the research and development of herbal technology including the preparation of the technology transfer document. The R&D for herbal medicine is a continuing research entitled the National Integrated Research Program on Medicinal Plants (NIRPROMP). It has six component projects on “Scientific Validation Studies to Determine Plant’s Efficacy, Safety and Adverse Reactions,” developed by scientists in the University of the Philippines Los Baños (UPLB).

NIRPROMP adopted a two-mission approach. Mission 1 is geared toward the production of crude medicinal preparations against common diseases for distribution and use in rural areas. Mission 2 focuses on the conduct of in-depth studies on purified drugs extracted from medicinal plants and the promotion of commercialization efforts for domestic and export purposes. The production of medicine from local plants is expected to lessen the dependence on imported drugs for common ailments. This will put affordable medicine within the reach of many Filipinos.

The Philippine Council for Health Research and Development (PCHRD) has been providing funds to NIRPROMP since 1997. From 1977 to 1982, the Program completed crude herbal preparations (decoction/infusion) for 102 plants used by *herbolarios* or traditional healers; that passed rapid clinical screening establishing their efficacy/safety for common diseases. From 1982 to the present, it identified 10 priority plants that underwent toxicologic, bioassay, mutagenicity, dosage formulation, metal analysis, cultivation, and propagation studies.

The leadership of the projects was almost evenly distributed between males and females. The program manager is a male, while three project leaders each are male and female. In one male-led project, the co-leader is also a male; in another, the co-researcher is a female. The research positions are dominated by women (11 of 14 research positions). The preparation of the technology transfer documents (TTDs) for *lagundi* and *sambong* is female dominated. The TTDs are important documents for the use of adopters since they contain information on the plant description, agriculture, preclinical studies, pharmaceutical studies, and clinical studies, among others. They are the main instruments for technology transfer and commercialization.

The adopter of *lagundi* and *sambong* technologies is Altermed, a subsidiary of a Filipino-owned corporation, Pascual Laboratories. The head and principal stockholder of the company is a male who has a Bachelor’s Degree in Chemistry and a Doctor of Philosophy Degree in
Pharmaceutical Chemistry. He sits in the Governing Board of PCHRD, representing the private sector; has strong entrepreneurial orientation; and is well-informed on indigenous pharmaceutical products. His consultant is a Filipino physician who is an expert in traditional medicine, the founding program manager of the Traditional Medicine Program of the Department of Health, and a trustee of the Philippine Institute for Traditional and Alternative Health.

The license for the manufacture of lagundi and sambong will subsist for 5 years, which is nonexclusive and renewable. A technology transfer fee and royalty payments for 5 years are stipulated in the technology transfer agreement. Lagundi’s brand name is Ascof (300 mg plain and 600 mg forte), while sambong’s brand is Releaf (250 mg plain and 500 mg forte). Lagundi is an anticough and antiasthma medicine, whereas sambong is useful as a diuretic and a remedy for urolithiasis. These herbal products bested 100 other products and inventions and received silver medals in the 25th International Exhibition of Inventions, New Techniques, and Products in Geneva, Switzerland on 11-20 April 1977.

The support of the past administrators and the current executive director of PCHRD, the positive relationship between the University of the Philippines and its scientists in pursuing NIRPROMP’s objectives, and the involvement of the private sector in the Council’s policy formulation processes contributed to the development of practical rules for technology transfer. The Council’s Technology Transfer Guidelines, which include intellectual property rights, are transparent and understandable. They provide rewards/incentives to scientists, researchers, funding institutions, and technology adopters. This policy instrument fosters the adoption of a locally developed technology with reasonable sharing of royalties among the institutions and scientists involved in R&D and the adopter/user of the technology.

**Nutritious Food Technology**

The Food Nutrition and Research Institute (FNRI) of DOST conducts periodic surveys to assess the nutritional status of the population. Its 1993 and 1998 nutritious surveys revealed that vitamin A deficiency, iron deficiency, iodine deficiency disorders, and protein-energy disorders adversely affect the health of many Filipinos.

To address these problems, FNRI undertakes research to develop food products using indigenous materials and which are enriched with vitamins.

One of the nutritious products are canton noodles, which are quite popular with Filipinos. They can be cooked quickly and are readily
available in fast food counters or five star restaurants or in “instant” ready-to-eat packages. As early as 1981 various food technologies were developed as part of the project “Commercialization of Technologies”. Some products include kroepeck from rice, mongo, and other root crops. By 1995, the formulation, piloting, and storage of vitamin-enhanced noodles using local vegetables particularly squash and saluyot were completed.

The team, which undertook the study was headed by a woman who holds the degree of Doctor of Philosophy in Food Science. There were eight researchers (including the project leader) in the team and only one person was a male. The technology transfer team, on the other hand, was headed by a male staff member who also holds a PhD degree in Food Science. Three of the five team members were female.

Squash canton noodle is rich in β carotene and is prepared from a blend of wheat flour, squash puree, salt, egg, and noodle improver. It is a fried product, golden yellow in color, and contains 13 g protein, 1.12 mg β carotene, and provides 512 kcal per 100 g food. A 50-g serving provides 16 percent, 20 percent, and 24 percent of the recommended dietary allowance (RDA) for energy, protein, and vitamin A, respectively of 4-6-year-old children.

The technology transfer fee is quite minimal and a royalty payment is not required since FNRI’s objective is to disseminate the technologies to potential enterprises and encourage adopters of nutritious food technology. However, the size of the market is considered in transferring the technology to subsequent adopters. FNRI seeks to foster the survival and viability of the initial adopter.

As of November 2000, there were 19 adopters of the technology on canton noodles with squash. Eleven adopters were from Luzon, five were from Mindanao, and three were from the Visayas. The president/general managers adopters consisted of six men and five women in Luzon; two men and two women in Mindanao, and three women and one man in the Visayas. Based on the 30 June 2000 survey, the total investment of six adopters amounted to P11 million. Direct labor consists of 62 workers. Due to the confidential nature of information on income generated, no data was reported.

A well-known woman restaurateur based in Metro Manila popularized the canton noodles with squash, improved the formulation, produces the noodles commercially, and offers them in her five-star restaurants. Similarly, a female microentrepreneur based in Negros Occidental started a small noodle enterprise in La Castellana. With a modest financial assistance from the Technology Application and Promotion Institute (TAPI-DOST) for acquiring the equipment, technical
advice/services from FNRI, and effective networking skills of the adopter with the local communities and nearby provinces, the business is thriving.

Adopters found the technology simple and easy to implement. They recognized the important role of FNRI and TAPI in increasing their business opportunities. One of the problems encountered by the adopters in Metro Manila was the lack of continuous supply of the right variety of squash, a not very common problem among adopters in the southern provinces. Credit facility was also perceived as important as raw material supply. For the adopters who intended to expand their operations, availability of funds to upgrade their equipment and improve the quality of packaging materials was essential.

Adopters who are effective in their enterprises do not hesitate to use their networks aggressively to source funds, expand markets, or seek assistance to improve their products.

Two of the successful women entrepreneurs who adopted the technology improved the formulation, networked well with the technology providers and communities, and seized market opportunities outside of the site of their business operations.

**Forest Products Technology**

To assist furniture manufacturers improve the quality of their products, the Forest Products Research and Development Institute (FPRDI) developed two technologies: a well-designed spray booth and drying tunnel. A male engineer developed the technologies and a female staff officer coordinated technology transfer activities.

Spray booths are box-like enclosures used during the finishing for removing overspray. They extract the varnish particles and solvents from the work areas, prevent fogging and misting of surfaces, thus keeping the atmosphere free from fumes and improving the work environment. There are two types of spray booths: the dry filter and the wash or wet filter. Both are made of GI sheets with steel framings. Each type is provided with an exhaust fan and water filtering system.

The drying tunnel hastens the drying of finished furniture. It may either be a container van or a chamber made of steel framings. It is provided with a heat source, centrifugal blower, and air ducting. It can either be fixed or demountable. The drying process can be batch type or conveyorized.

A number of the successful adopters of the technologies are based in Pampanga, some of whom export the furniture to Europe, United States, Middle East, Singapore, Korea, and Taiwan. Two of the adopters whose products are in foreign markets started as family enterprises with

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a small capital. The firms are managed by husbands and wives, with the 
former handling the production aspects and the latter, the financial and 
administrative services. At the factory level, there were more men than 
women. Men were assigned to metal works and welding, whereas women 
performed sanding activities and packing. Support services were also 
generally handled by women.

The adopters assert that the technologies are easy to use and modify. 
Productivity increased by 60 percent because of the technologies. They 
also recognized the availability of the scientists from FPRDI who provided 
technical advice and services upon request. They however pointed to the 
need for sources of financing for expansion and product improvement.

Region VI: Insights on Technology Adoption

Technology adopters in Region VI used food processing technology 
for canton noodles with squash, banana and mango chips or puree, 
pickled vegetables, fish, and shrimp paste, (9 adopters); drying of 
handicraft materials, production of gifts, housewares and decorative items, 
banana furniture, ceramics (3 adopters); plant culture for propagation 
of orchids and ornamental plants (1 adopter) and dyeing of clothing 
materials from indigenous material such as raffia and abaca (2 adopters); 
candle making (1 adopter); vermicomposting (1 adopter); and gemstone 
processing (1 adopter). Majority had small investments or below P1 
million. Only six of the adopters invested more than P1 million; the 
biggest was P3.4 million. Very minimal information was obtained on 
revenues/income generated. Three of the six corporations were 
exchanging their products. Four are cooperatives and the rest were 
individual proprietorships.

Data obtained from 12 adopters show that 61 percent in 
managerial, administrative, and financial were women; 57 percent were 
in production/quality assurance, and 43 percent were in marketing. The 
data are not comprehensive but nevertheless indicate the strong 
involvement of women in microenterprises and small enterprises.

The technologies adopted were perceived as “easy to use and adopt,” 
helpful, and contribute to increased productivity or lowered production 
cost. Women were seen to be good in appreciating colors and color 
combination, a quality which is useful in producing handicrafts, decorative 
items, gifts, toys, and housewares. They were also recognized for their 
patience, creativity, commitment, and reliability.

The factors that ensure the successful transfer and adoption of 
technologies are their simplicity, viability, availability of labor, capability 
of the adopters, and demand for the products. The constraints identified
by the adopters were lack of capital, seasonality of the supply of materials and demand for their products, lack of trained manpower, absence of institutional or big buyers, and unavailability of good packaging materials.

**Analysis**

Most of technologies that were transferred, adopted, and commercialized were relatively simple. They were initiated as R&D projects on the basis of the mandate of the RDIs and expertise, inclination and interest of the scientists. One exception was the drying tunnel/chamber that was designed based on the need of clients from the furniture industry.

Technologies are offered by the RDIs in technology fora, seminars, exhibits, and other means of dissemination. The experts/scientists handle the transfer of knowledge and skills, often with the assistance of the TAPI. In the regional offices, the Provincial Science and Technology Officers in tandem with the scientists/experts from RDIs, disseminate and share information on technologies to the countryside.

The Technology Transfer Guidelines of PCHRD and DOST are transparent and fair. They provide for the sharing of royalties between DOST and its agencies, the scientists/researchers, and the adopter. The technology transfer fee is relatively low and in the case of the nutritious food technology, no royalty payment is required.

Women scientists and researchers are active in research and development. Similarly, there are more women scientists/researchers than men who are involved in technology development and transfer, except in the case of the technologies of FPRDI. The proprietorships or firms that adopted the technologies were also dominated by women who were recognized for their ability to handle finance and for their creativity and reliability. Men were generally involved in production activities in most firms. There appeared to be no bias against women in S&T endeavors.

**Recommendations and Conclusions**

The use of simple technologies is essential to countryside development and improving the quality of life in rural areas. Access to technologies and support services including finance for microenterprises will contribute to the viability of the adopters’ enterprises. Thus, collateral requirements usually imposed by financial institutions for loans to microenterprises must be reviewed. Flexible and liberal lending policies for microenterprises that use or enhance technologies will upgrade their capability and productivity. In addition, credit schemes which are forward
looking and supportive of technology adoption and enhancement will ensure the competitiveness of technology adopters.

The relationships between the private sector and RDIs must be assessed to ensure that the latter’s needs are taken into consideration in developing R&D programs. More focused demand-driven R&D programs will hasten the commercialization of research outputs. Strategic alliances between the private sector, RDIs, and academic institutions need to be explored. Pooling of resources is vital specially in developing projects that are capital intensive.

Continuous upgrading of the technological capability and entrepreneurial skills of micrenterprises and SMEs may be collaboratively undertaken by DOST, the Department of Trade and Industry (DTI), appropriate private sector associations, and local government units where the enterprises are located.

A practical human resource development program for scientists and researchers on entrepreneurship and IPR should be included in joint fora and consultations. Constant dialogues and interactions involving multisectoral representatives such as industry associations, academic institutions, and policymakers should be enhanced by DOST.

A review of the conflict of interest principle as it applies to scientists in the public service who invest in companies that commercialize their technologies may be undertaken. Other countries in the region have liberal policies that allow scientists in public service to invest in commercializing their technologies. However, there is a need to balance ethical principles to foster greater creativity and reward scientist’s efforts.

On gender equality, the women’s role in research and development, technology generation, and commercialization may be enhanced by supporting associations/organizations that foster excellence in these endeavors. Career paths for key and senior positions of women scientists may be improved by increasing assignments/appointments to significant positions.

Continuing activities on data collection, segregation and analysis on gender equality must be supported by both the public and private sectors. Regular monitoring of compliance by government agencies in providing funds for gender programs will enhance the participation of women in S&T activities. The information obtained will be useful in documenting good practices and using them as models to promote gender equality. Furthermore, studies on gender must be encouraged and funded to build the basis for policy formulation at the national and APEC levels.
Introduction

Technology transfer is a major goal of the Department of Science and Technology (DOST). Its mandate covers not only the coordination of the research programs of various government research institutions but their technology transfer efforts as well. To carry out its mandate the research and development institutes (RDIs), regional offices, Technology Application and Promotion Institute (TAPI), and the councils are involved in various degrees of technology transfer.

There are many technologies, which are ready for commercialization and adoption by entrepreneurs and companies. The extent of commercialization, however, is not as extensive presumably due to the reluctance of many entrepreneurs to embark on undertakings using locally developed technology. More often than not technologies are licensed from foreign sources or are brought into the country by multinationals and used in their operations.

The acceptance by investors from the private sector of locally developed or “indigenous” technologies usually takes a long time. Unless technologies are promoted or advertised or subsidized by the government or foundations, adoption may be quite problematical. Since the demand for the product has not yet been proven, it becomes the responsibility of the RDIs to entice the private sector to adopt the technology and invest its resources in commercializing the product.

The documentation of the experiences of scientists, researchers, technology transfer personnel and adopters in the processes of commercializing the results of R&D will shed some insights on the dynamics of such processes. Reports on Technology Business Incubators (TBI) of DOST reveal a mix of successes and failures.

* The author is a faculty affiliate of the Technology Management Center, University of the Philippines, Diliman, Quezon City.
The role of gender is also important since in past studies on technology transfer, gender is often not seen as an integral part of the analysis. Thus, highlighting technologies that have exhibited various levels of successes will yield insights on the interplay of factors that hastened commercialization.

In this regard, there are technologies that are suitable for micro and small enterprises which will bring more substantial benefits to communities outside the urban areas. These technologies can be in the form of machinery or equipment, tools, formulation for food products, or housing materials. Technologies are available in the RDIs, which are the results of research efforts of men and women scientists and researchers, many of whom spent the best years of their lives in the academe and laboratories.

**Purpose and Significance of the Study**

This study aims to discuss the processes involved in transferring technology by selected RDIs of DOST, the role of women in research and development and technology transfer, use and commercialization of technology, and implications for policy reforms.

Many women scientists and researchers are involved in R&D on nutritious food products, natural fiber, and genetic engineering to produce high-yielding varieties of plants, among others. However, a lesser number are undertaking technology transfer activities. An analysis of the extent of their contributions not only in R&D but also in technology transfer will yield insights on gender access or constraints to opportunities in S&T activities.

While there are several studies on gender in science and technology in the Philippines, there is still a need to document the processes of technology transfer that have succeeded or failed. Lessons from practical experiences are useful in developing best practices for promoting women’s participation and gender equality in S&T. In addition, the role of women scientists and researchers, when documented, can provide insights on the opportunities and constraints to gender access and equality.

Consequently the study hopes to contribute to the knowledge on commercializing research results and provide insights on enhancing the participation of women in S&T activities, including technology adoption and commercialization. Likewise, it offers recommendations to foster
closer linkages between RDIs and the private sector or other adopters; identify the gaps and strengths in technology transfer mechanisms and practices; and propose some policy reforms and innovations. Ultimately this study hopes to contribute to the Asia Pacific Economic Cooperation or APEC’s efforts in building lessons and literature on gender in science and technology and in micro, cottage, and small and medium enterprises (SMEs).

Specifically, the study aims to attain the following objectives:
1. To identify and describe selected technologies of RDIs which had been commercialized;
2. To describe/document the contribution/role of women scientists in the research, transfer, and commercialization of technologies that had been identified;
3. To describe the processes and activities relating to technology transfer, adoption, and commercialization; and,
4. To recommend policy initiatives/reforms that will enhance the role of women in commercialization.

Review of Literature and Framework

The success stories of some RDIs in technology transfer reveal that commercialization entails the dynamic relationship between the scientists/researchers serving as technology transferors and/or with the assistance of others; the commitment of science administrators to advocate and support commercialization of technologies; and the willingness/dedication of entrepreneurs/business firms to assume the risks of investing in locally developed technologies and mobilize resources for production. Likewise there must be a technology transfer structure, mechanisms, and policies that are transparent and understandable to technology adopters. In addition, location, raw materials, and markets must be present or potentially available in anticipation of increased demand for the products and services. Similarly, financial assistance or credit facilities must be available to enable technology adopters to operate their enterprises and expand their markets.

Research and Development, and Technology Transfer

Yap (1986) showed the direct and indirect relationship between the creator of research outputs, the role of government and the private
sector, engineering design, and the production of goods. The coupling model likewise integrates R&D activities with market demand and the private sector’s aggressive use of research outputs to meet market pressures (Beijie 1998). Other writers emphasize the importance of the presence of proactive scientists, who advocate strategic alliances with the private sector to promote technology transfer and commercialization. S&T demand and supply interactions can be hastened through appropriate policy interventions. These interventions include technology generation, technology absorption, provision of S&T services, and cooperation or linkages between the private sector and public R&D institutions including the academe (Kim 1995).

In this regard, Australia has been using the joint program/strategic research alliance between the academe and the private sector to transform research results into commercial products. The alliance is operationalized through the Cooperative Research Centres where the government and the private sector identify projects for industry that are to be jointly funded. Some areas funded in 1999-2000 by both sectors are photonics, biological control of pest animals, vaccine technology, and polymers (Science and Technology Budget Statement, 1999-2000, Department of Industry, Science and Resources, Canberra, Australia, 1999).

S&T policy experts agree that R&D commercialization should be developed based on: (i) demand-driven partnership between research institutions/university and industry; (ii) availability of R&D funds for small and medium-sized industries for product improvement, and new product and process development; and (iii) royalty from commercialization of R&D output (1995 International Workshop on Commercialization of Research and Development Output).

South Korea effectively uses cooperative research or joint R&D strategy to develop and use technologies. The government-funded research institutes play an important role as mediators between industry and universities. Cooperative R&D is an important mechanism that enhances national technological capabilities in high technology industry. The development projects of electronic switching systems (TDX-1, TDX-10) memory chips (4-Mega D-RAM and 16 Mega D-RAM), and microcomputers (TICOM1 and TICOM2) were successful cases that have used cooperative R&D projects (Young-Ho Nam and Jin Gyu Jang 1995).

The collaborative programs linking the universities with the RDIs of the DOST are operationalized in the consortia system organized and
coordinated by the sectoral councils particularly the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) and the Philippine Council for Health Research and Development (PCHRD). On the other hand, the S&T Volunteers’ Pool and the Manufacturing and Productivity Extension Programs (MPEX) which are current programs of DOST managed by TAPI, mobilize members of the academe in consultancy services. The faculty members and/or experts from the private sector are deployed to adopters who are extended technical assistance or grant-in-aid by DOST or its councils.

Gender Dimensions in Science and Technology

International and Regional Covenants

The Charter of the United Nations (UN) reaffirms “...faith in the fundamental human rights, in the dignity and worth of the human person, in the equal rights of men and women”. In 1948 the UN adopted the Universal Declaration of Human Rights which enshrines the principle of equality between women and men and prohibits discrimination against women. In 1967, the General Assembly adopted the Declaration on the Elimination of Discrimination against Women stating particularly in Article 1 that discrimination with regard to women is fundamentally unjust and constitutes an offense against human dignity. The Convention on the Elimination of All Forms of Discrimination Against Women binds the State Parties to the Convention to embody the principle of equality of men and women in their national constitutions or other appropriate legislation.

Subsequently three world conferences on women were held in various years. In 1975 the World Conference of the International Women’s Year was held in Mexico City. The Conference recommended that governments ensure the equality of women and men before the law and also equality of opportunities in education, training, and employment. The World Conference of the UN Decade for Women: Equality, Development, Peace was held in 1980 in Nairobi. It adopted a Programme of Action to attain the three objectives of the decade. The Fourth Women World Conference was held in 1995 in Beijing. The Beijing Platform of Action was adopted to accelerate the implementation of the strategies agreed upon in Nairobi. There were other related world conferences in the last decade such as the World Conference on Environment and
Development in Rio de Janeiro, the World Summit on Social Development in Copenhagen, and the various APEC fora.

The Beijing Platform for Action covers 12 areas of concern. Those relevant to science and technology are issues on feminization of poverty, inequality in access to and control over economic structures’ differential impact of policy on women, underrecording and undervaluing of women’s work, and gender inequalities in the management of natural resources and in the safeguarding of the environment (Ancog 1998).

The Chennai Declaration which is a major document emanating from a United Nations Development Program (UNDP), United Nations Fund for Women UNIFEM, and Swaminathan Foundation-sponsored conference of women S&T policy-makers, scientists, and researchers focused on addressing the impact of poverty on women. It established a resource group of women in S&T which will act as “facilitators in the task of bringing the benefits of modern Science and Technology to the service of women, particularly in priority areas like nutrition, health, education, and economic livelihood and security”.

Greater participation of women in S&T careers is hampered by many factors. Among these are gender-role stereotyping, legal impediments, sociocultural, and economic conditions. There is a mutually reinforcing relationship between gender-role stereotyping and lack of access to, and underachievement in the educational system. Within school curricula, content reveal stereotyping in textbook imaging and vocabulary. Depictions of men show them most frequently as leaders, assuming a range of interesting activities. Women are portrayed primarily as mothers, wives, and daughters (APEC HRD Working Group Network on Economic Development Management [NEDM] Conference on Gender Equity in Education and Training, 1994).

Beliefs, attitudes, and practices embedded in the culture of a country also influence openness to women’s participation in S&T. Malcolm, a woman scientist and policy expert states: “Many of us work long and hard to get more women into science and engineering careers. There are lots of reasons why we do this, reasons related to economics, equality of access, relative employment stability and utilization of talent, as well as personal satisfaction and intellectual challenge for the women involved. We also do this because science and technology are not as good as they could be when ‘other perspectives’ are missing. If women and minorities
are excluded, other viewpoints of the world are being lost” (World Science Report 1996).

McGregor and Harding aptly explain that gender relations are dynamic, historically changing ways of obtaining and distributing scarce resources. They analyzed the impact of strifes and colonization on the roles of men, women, and children. Describing the hierarchical relations arising from gender differences, they adds: “Most distressingly, we often think that the mark of a real man is the extent in which he has been able to define himself precisely against whatever his culture thinks of as womanly; he is a warrior, not a mother (heroically, actively choosing to risk death versus “naturally” passively delivering life); through his talents and skills, he provides the family income, not merely unskilled child care and domestic labor, or he is rigorously objective and dispassionate, not subjective and emotional. Hierarchical organized values are assigned in the meanings of manliness and womanliness.”

Two years ago, the international participants of the United Nations Educational, Scientific and Cultural Organization (UNESCO) Asia Pacific Conference on S&T discussed gender quite extensively. The conferees identified four areas as priority concerns in science, engineering, and technology (SET). These are: (i) the need to increase women’s access to and participation in all levels of education and training in SET; (ii) promotion of S&T research programs, development projects and access and implementation strategies aimed at improving the living conditions of women and their children; (iii) improvement of career opportunities for women scientists, engineers, and technologists so that women have participation in SET decision-making processes and structures and in directing the development and application of SET at all levels; and (iv) need for dedicated investigations of the dynamic intersections between the lives of women and new technologies, followed by the removal of barriers to women’s uptake of new technologies or the elimination of negative impacts of the new technologies(Alarcon and Dugsdale 1998). The UNDP’s gender program supports some of UNESCO’s gender initiatives including some projects agreed upon in the Chennai meeting.

The leaders of APEC adopted in 1999 the Integration of Gender in the APEC Framework. This was preceded by the APEC Ministerial Meeting on Women hosted by the Philippines. This meeting advocated recognition of gender as a cross-cutting theme and acceleration of gender integration in APEC’s programs, projects, and activities.
Trends in S&T Jobs

Gender equality and access is an important dimension of sustainable development. Science and technology studies show that the gender bias surfaces in terms of priority to promotions in key positions in the academe and research institutions. In most European countries for instance, and except for a few Central and European countries, gender imbalance and exclusion is also present. Women are less represented in the sciences and in general at higher institutions throughout Europe.

In the United States, in terms of employment in the academe, women are less likely than men to be in the science and engineering faculty. Forty-four percent of women are in non-science engineering fields and only 24 percent are in engineering. These include physical science, psychology, and mathematics, and only 6 percent are in the engineering faculty. As regards involvement in research, women are less likely than men to be engaged in funded research, or to be principal investigator, or to have published articles. Women are less likely to reach the highest ranks or to be tenured than men. They are less likely than men to be full professors and are more likely than men to be assistant professors and instructors (National Science Foundation 1996).

Women can often be effectively segregated or marginalized within scientific and technical fields, even when their aggregate percentages look reasonably good. It is quite common, for example, for a university to be a rather feminized sector, especially at the low ranks of instructor or lecturer. Possibly in an effort to create a niche for themselves in natural sciences women may have unintentionally segregated themselves into certain fields. In the United States, for instance, women attempted to make room for themselves by creating disciplines of home economics and nutrition in the late 19th and 20th centuries (Koblitz 1995). Women scientists found themselves largely restricted to those fields and had a difficult time securing employment outside them (Rossiter 1983).

Nebres and Mercado’s 1998 study on science education and gender difference in the Asia Pacific Region show that in all countries surveyed, males outnumber females in engineering. However, in Australia, New Zealand, and the Philippines, females outnumber the males in health sciences (UNESCO, Asia Pacific Conference for the 21st Century, 1998).

Focusing the analysis on S&T agencies in the Philippines, the situation is relatively better in terms of women’s participation in S&T
activities. The 1999 data from DOST indicate that 2,382 of 4,789 or 49.7 percent of the total personnel complement are women.

In the seven DOST RDIs, specifically Forest Products Research and Development Institute (FPRDI), Advance Science and Technology Institute (ASTI), Food and Nutrition Research Institute (FNRI), Industrial Technology Development Institute (ITDI), Metals Industry Research and Development Center (MIRDC), Philippine Nuclear Institute (PNRI), and Philippine Textile Research Institute (PTRI), five of the directors are men; only one is a woman. In the five service institutes, specifically Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), Philippine Volcanology and Seismological Institute (PHIVOLCS), Science Education Institute (SEI), Science and Technology Information Institute (STII), and TAPI, there are two female and four male directors. In the sectoral councils: Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), Philippine Council for Aquatic and Marine Resources Research and Development (PCAMRD), Philippine Council for Industry and Energy Research and Development (PCIERD), Philippine Council for Health Research and Development (PCHRD), and Philippine Council for Advance Science and Technology Research and Development (PCASTRD) there are two men and three women executive directors.

The total personnel complement of the RDIs is 1,688, of which 891 or 52 percent are women. On the other hand, the service institutes have 2,062 personnel, with 900 or 43 percent women. Sixty-one percent or of 444 personnel of the sectoral councils are women. The regional offices, whose mandate is technology delivery and coordination, have 395 personnel, of which 212 or 53 percent are women.

Thus while leadership in the various agencies of DOST is basically male dominated, the RDIs, sectoral councils, and regional offices have a larger number of women personnel. At the central office level, the Secretary or head of the department is a male, all are males, and two of the three assistant secretaries are women. The women officials are assigned to the legal and administrative services and the financial and management services. Three of the 12 regional directors are women (as of 31 December 1999).

The Philippines, in a sense, has better gender participation in S&T activities compared with other countries in the region. However, this does not imply that women have a greater role in major decision-making.
The women at the head office are cast in the stereotype “female” role by virtue of their assignment to the support services. In the sectoral councils though, two women scientists are the executive directors. It may be noted that the PCHRD’s networks with the Department of Health (DOH), the health science community, and the private sector have grown stronger through the years and that PCASTRD serves as secretariat to the Information Technology and E-Commerce Council.

Methodology
Selection of Technologies and Variables
The technologies which were selected for the study were food technology particularly canton noodle with squash, herbal medicine products, specifically lagundi and sambong, and forest products technology particularly tunnel drying and spray booth. The reasons for the choice are accessibility and willingness of the adopters to respond to the questionnaires and interviews, and the initiatives of both technology generator and technology adopter in the practical application of the technologies and commercialization.

For these technologies, the advice of the directors of FNRI, PCHRD, and FPRDI was sought. To obtain a region-wide perspective of technologies used in the countryside, two regional directors were interviewed intensively.

Region VI was selected since its director has had extensive experience in technology transfer, having served as deputy director of TAPI prior to her promotion as regional director. In addition, the various technologies applied in Region VI vary and typify the contribution of technologies to microenterprises and to those situated in other regions as well. Region III was also chosen because of the predominance of furniture manufacturers in Pampanga and surrounding areas.

The study is basically descriptive and presents the following: profile of the technology generators and adopters, the cost of research and technology development, the nature of the technology adopted, modification of technology, reasons for effective technology transfer, and factors which hinder the transfer processes. Where data are available volume of production is presented. The intellectual property rights (IPR) provisions on technology transfer are also discussed. The role of women as technology developers and generators and their functional role in the business are also assessed. Potential areas for policy reforms to enhance
technology transfer and the commercialization of research results are proposed.

Instruments

A short interview guide was used to obtain information on the background of the adopter, experience on the use of the technology, improvements done on the technology, gender distribution on functions and responsibilities, level of success in technology commercialization as indicated by sales volume, factors which contribute to or hinder the effective use of technology, and the distinct contributions of women and men in the proprietorship/firm. The guide was used to validate and enhance the information reflected on the questionnaire.

The questionnaire for the technology generator contains the following items: respondent’s profile, description of duties/responsibilities, research activities, initiator of research, description of the technology resulting from the research, source of fund, complement of research team, number of adopters, factors which facilitated/hindered technology transfer efforts, and the role of women in R&D commercialization. An open-ended item was included in the last part of the questionnaire for the respondent’s comments or suggestions.

For the technology adopter, the questionnaire covered these items: respondent’s profile, description of duties, description of technology used/applied, date of technology transfer, type of business organization, number of personnel employed, gender distribution vis-a-vis assignment of responsibilities, raw material requirements, volume of business, classification of industry as to total number of employees, total capital investment, technology transfer agreement, technology enhancement or modification, factors which contributed to and/or hindered the effectiveness of technology transfer, and the role of women in R&D and technology commercialization. An open-ended item was included in the last part of the questionnaire for additional comments or suggestions.

The instruments were pretested PTRI among selected adopters. Revisions were made as a result of the pretest.

Respondents

Eight directors and deputy directors, 2 regional directors, and 16 chief supervising specialists (division chiefs), senior research specialists, and researchers were interviewed.
This number included some of the division chiefs in FNRI, FPRDI, PTRI, and researchers involved in research and development and technology transfer. Field visits were made in the plants/offices of six adopters in Region VI, four in Region III, and two in the National Capital Region. Twenty-five adopters were interviewed. The regional directors, directors and/or deputy directors gave technical advice to adopters who were willing to be interviewed.

Sixty questionnaires were sent to adopters but only 35 responded. Some of the responses were minimal and/or vague. Thirty questionnaires were sent to technology generators; 12 were accomplished and returned.

Other sources of information were reports, documents, circulars, and policies of DOST, RDIs, the sectoral councils, and other relevant institutions.

Limitations

Majority of the adopters did not reveal information on volume of sales, revenues generated, and raw materials used. The information were deemed confidential by the adopters, who chose to leave these items unanswered in the questionnaire. A few did not state the number and assignment of personnel. This resulted in gaps in responses to the corresponding items in the questionnaire.

Due to pressing business schedules, several adopters could not be interviewed in the third quarter of 2000. When they were interviewed during the last quarter, many expressed anxiety over their expected sales. The prevailing economic and political developments at the time of data-gathering somehow dampened the optimistic outlook of the respondents.

On the technology generators’ side, specific information on the amount of investment in R&D was also not available for some technologies. Thus, the level of information is quite uneven.

DOST Technologies

DOST’s technology transfer and commercialization program is carried out by its RDIs, TAPI and regional offices. Technologies developed by MIRDC, one of the RDIs, include the following: wrought iron furniture making, gemstone processing, spin casting, spinning technology, lathe machine, bioreactor for accelerated degradation of solid municipal wastes, and a seriating machine.
FPRDI has developed these technologies: tunnel dryer, cement-bonded board, high pressure sap displacement system, cocolumber, ricehull ash cement hollow blocks, solid wood bending, handmade paper, and lumber stress grading, among others.

DOST technologies which were transferred in the regions include among others abaca fiber extraction processing, cocowood processing, essential oil processing, fine jewelry production, food processing, fortified salt production, tool and die, and production of fiber concrete roof tiles.

Technology transfer can be effected with the combined efforts of the technology generators/RDIs, which developed the technology and TAPI. Technology is promoted directly to potential adopters through demonstrations and/or training. Investments fora undertaken by TAPI periodically and during the celebration of the National Science and Technology Week attract technology adopters/entrepreneurs. The S&T Provincial Centers of DOST are also vehicles for technology transfer. Each Provincial Center has a technology promotion division, staffed by technical personnel who can handle technology transfer activities in collaboration with the RDI experts.

For entrepreneurs/firms that need technical assistance in their initial years of operation, the Technology Business Incubator (TBI) is an enabling mechanism, which nurtures a young entrepreneur/firm that uses a certain technology. The TBI can be located in the DOST compound or in places where the technology adopter operates the business.

The alliance among the technology adopters/private firms, RDIs and the academe is being strengthened by DOST. One of its flagship programs include among others, the transfer of clean technologies to SMEs so their products and services can meet world standards.
Herbal Medicine Technology

Amelia C. Ancog*

Background

In the last 15 years, reforms in the health sector were adopted by former Presidents Corazon Aquino and Fidel V. Ramos. These are the National Drug Policy (NDP), the Generics Act (Republic Act No. 6675) and the law establishing the Philippine Institute of Traditional and Alternate Care (PHITAC, Republic Act No. 8423). The first two reforms were reviewed 5 years ago by DOH through the UP College of Public Administration in collaboration with various sectors and stakeholders. The PHITAC, having been approved much later, has not yet been assessed in the same extent as the NDP and the Generics Law. Nevertheless, significant issues relative to herbal medicine were discussed during the review and recommendations were brought out by medical practitioners, pharmaceutical firms, local government officials, and stakeholders.

The issues raised during the review focused on how the four elements of the national drug policy, specifically quality assurance, self-reliance, tailored procurement, and people empowerment were addressed by the implementers and concerned institutions. Quality assurance means that the people are assured about the safety, quality, and effectiveness of all drug products in the market. Self-reliance is directed toward local and national pharmaceutical companies. Tailored procurement refers to the drug acquisition process in the public sector.

On self-reliance, it was pointed out that 65 percent of the market for pharmaceutical products is still dominated by multinational companies, with the national drug companies sharing the remaining 35

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percent. Part of the strategy toward self-reliance is the development of herbal medicine from indigenous plants in the country. The review expressed the need to increase the production of herbal plants, the establishment of more herbal processing plants, and public education on herbal medicine through promotion and advertisement.

It may be noted that the interest in herbal medicine is not so new. Even during the precolonial years, the “herbolarios” or traditional healers “prescribed” herbal-based preparations to patients. Dr. Ernesta Quintana of the University of the Philippines Los Baños (UPLB) had undertaken folkloric studies on herbal plants, which are being used to cure certain ailments. It is important to note that one of the projects of the National Integrated Research Program on Medicinal Plants (NIRPROMP) entails the study of cultural practices on producing medicinal plants.

**Technology Development**

The processes involved in developing technologies for pharmaceuticals can be time consuming and tedious. Technology development is preceded by research which requires not only financial resources but also the involvement and commitment of scientists and researchers. By its very nature, research on medicine is expensive; processes such as scientific validation of the efficacy of raw materials require dedication, love for the work, and financial support. Such support is very crucial particularly in countries where resources are limited and where competing priorities for national programs often result in niggardly allocation of resources for R&D.

In the early 70s, the National Institute of Science and Technology (reorganized in 1987 as the Industrial Science and Technology Institute under the DOST) undertook studies relating to preliminary screening of extracts of medicinal plants for medicinal purposes. Other studies were supported by the National Research Council of the Philippines (NRCP) and the PCHRD.

With the various studies on herbal medicine, a broader program was developed which integrated the various aspects of herbal medicine research. The PCHRD, a sectoral planning body of DOST, supported the funding of a program with six components for medicinal plants research. This DOST council is currently headed by a woman executive director, a physician and administrator, Dr. Pacita Zara—a career officer in science and technology who has established her name in health
research and development management. Her extensive linkages with national and international health institutions have enabled PCHRD to tap experts and resources for the Council’s various programs. A dedicated public servant, her zeal to commercialize health technologies brought a new dimension to technology transfer.

The PCHRD employs more women than men. Of the four supervisors, three are females and one is a male. Twenty-eight of the technical positions are occupied by women and seven by men. Administrative positions are equally distributed between males and females at 12 each.

**National Integrated Research Program on Medicinal Plants (NIRPROMP)**

A compelling reason for establishing NIRPROMP is the inadequacy and weaknesses of the local drug industry, particularly the absence of a truly Filipino research-based industry. A technical report revealed that “years of colonial and neocolonial control have distorted the development of the pharmaceutical industry.” The pharmaceutical industry is import-dependent, limited to formulating, and compounding with practically no basic material manufacturing (PCHRD-DOST 1991). In spite of the transfer of public governance to Filipinos, the industry remains dominated by multinational companies (Department of Health and College of Public Administration 1997).

To hasten the development of medicine from local/indigenous materials, PCHRD supported the National Integrated Research Program on Medicinal Plants in 1977. Preparatory to the development of specific research projects, scientists and researchers agreed to first analyze the leading causes of mortality and morbidity.

Based on available data from the Department of Health and other studies, respiratory diseases such as pneumonia, bronchitis, tuberculosis, and gastrointestinal diseases, cardiovascular diseases, and rheumatic heart disease were the leading causes of mortality. Moreover, bronchial asthma, diabetes, rheumatoid arthritis, and cancer were causes of significant debility among many Filipinos.

The scientists then tackled the issue of choosing the class of drugs to be developed: curatives (antipathogens) or symptomatics. Using the criteria of cost of research and length of time needed to screen hundreds of medicinal plants for antibacterial/antiviral activities, they decided on symptomatic medications that would reduce the expenses incurred by the government in the purchase of the drugs. Studies would focus on
medicinal plants with any of the following effects: antitussive, antiasthmatic, analgesic, antidiarrheal, antispasmodic, anti-diabetic, antihypertensive, and diuretic (Mission 1).

The next issue that the scientists addressed was the choice of medicinal plants which would be studied. A survey of the practices of herbolarios and hilots indicated that they used more than 1,500 plants. The scientists first identified the plants used by 40-60 percent of the herbolarios; then 120 plants which were abundant or can be sourced from the wild or by cultural management were selected. Ultimately, the four criteria used for selecting the plants were disease incidence in the country, the need for substitutes for imported symptomatic drugs, available technology, and folkloric knowledge.

The disciplines involved in the Program are medicine, pharmacy, agriculture, botany, veterinary medicine, and chemistry. Scientists and researchers in agriculture were responsible for cultivating plants and establishing a gene bank; those in botany took care of pharmacognosy; those in medicine, preclinical and clinical investigations; those in pharmacy, the preparation of dosage forms; those in veterinary medicine, breeding of experimental animals and pathologic evaluation for subacute, subchronic, and chronic toxicity studies in experimental animals; and those in chemistry, isolation and determination of structural formulae of plant principles, mutagenicity studies, and soil analysis.

NIRPROMP adopted a two-mission approach. Mission 1 was geared toward producing crude medicinal preparations against common diseases for distribution and use in rural areas. Mission 2 focused on the conduct of in-depth studies on purified drugs extracted from medicinal plants and the promotion of commercialization efforts for domestic and export purposes.

NIRPROMP developed scientific screening processes to determine the safety and efficacy of indigenous medicinal plants. This resulted in the enhanced interest of scientists, researchers, and policy-makers on herbal medicine as a supplement in the health care delivery system. For the period 1977 to 1982, the Program completed crude herbal preparations (decoction/infusion) for 102 plants used by herbolarios, and passed rapid clinical screening establishing their efficacy/safety for 27 common diseases (Mission 1). From 1982 to the present, it identified 10 priority plants that underwent pharmacologic/toxicologic, bioassay, mutagenicity dosage formulation and metal analysis, cultivation and propagation studies (Mission 2).
Figure 1

MISSION I

Folkloric use

Rapid clinical trial

- Oral
- LD₅₀, Animals
- Mutagenic
- Pharmacological screens
- Metals analysis

Drop

Pharmaceutical development

Agricultural studies plantation

Clinical phase II

Drop

Training manuals
- Phil. Formulary
- Phil. Pharmacopelia

DOH

DECS

DILG

Botika sa Baryo

Herbal gardens

Training for herbal usage
- Herbs
- Galenicals

To remedy the lack of inexpensive medicines

MISSION II
Figure 2

MISSION II

Clinically confirmed folkloric use

Chemical isolation

Chemical structure & characteristics

Initial bioassay

Animal pharmacology/toxicology

Agricultural studies

Pharmaceutical development

Clinical phase I

Clinical phase II

Clinical phase III

Marketing

Production

Plantation

Phase IV Clinical
Component Projects

Six projects on “Scientific Validation Studies to Determine Plants’ Efficacy, Safety and Adverse Reactions” were developed and headed by various experts from the University of the Philippines (UP). These include:

“Clinical Screening and Validation Studies of Medicinal Plant Products Used in Traditional Folk Medicine” led by Dr. Nelia Cortes Maramba of the Department of Pharmacology.

This project validates claimed the efficacy and safety of identified medicinal plant preparations through the conduct of scientific and ethical trials among volunteer subjects with close adherence to the Declaration of Helsinki and the World Health Organization (WHO) Good Clinical Practices Guidelines.

“Pharmacologic and Toxicologic Studies of Philippine Medicinal Plants” led by Dr. Horacio Estrada of the Department of Pharmacology.

This project encompasses batch testing services on priority plants, determines the lethal dose 50 (LD$_{50}$) of priority plants, covers behavioral studies focusing on neuroleptic and anti-depressant effect to verify folkloric claims on priority plants, and determines the effect of priority plants on isolated tissues.

“Establishment of Quality Control Bioassay Standard Procedures for Medicinal Plant Products” under Dr. Romeo Quijano of the Department of Pharmacology.

This study focuses on the establishment of bioassay quality control standard procedures for assessing adequate pharmacologic potencies of medicinal plant products, and determining the subchronic and chronic toxicity of priority medicinal plant products.

“Dosage Forms from Medicinal Plant Constituents” led by Dr. Natividad de Castro of the College of Pharmacy.

This project encompasses these objectives: formulate and prepare pharmaceutical dosage forms from medicinal plant materials, select and evaluate excipient for use in dosage formulations, set quality control specifications for raw materials and finished products; establish stability of raw materials and finished products from priority plants, carry out chemical/pharmaceutical tests and assays needed in preparing medicinal
plant monographs, design and prepare placebo formulations to be used in the clinical testing of pharmaceutical dosage forms, and improve existing dosage formulations.

“Mutagenicity, Clastogenicity, and Antimutagenicity Potential of Drug Preparations from Philippine Medicinal Plants” led by Dr. James Villanueva of the Institute of Chemistry.

This study covers the evaluation of the mutagenicity, clastogenicity, and antimutagenicity potential of raw materials/finished products from priority plants.

“Development of Appropriate Cultural Management Practices to Improve Yield and Quality of Selected Medicinal Plant Species” headed by Prof. Ernesta Quintana of the Department of Horticulture, UPLB.

The study covers the following objectives: commend solutions to current production problems of priority plants, generate data that will continue to determine the production cost of selected plants, supply NIRPROMP’s needs for raw material of priority plants, and maintain a medicinal plant garden that would serve as a source of mother plants for mass production.

Ten out of 102 plants had been initially selected for study: lagundi, sambong, tsang-gubat, niyug-niyugen, bayabas, ulasimangbato, bawang, ampalaya, akapulko, and luyang dilaw. Study results identified several plants with potential for medicine that can be commercialized at reasonable cost. Figures 1 and 2 show the charts of Mission 1 and Mission 2 Activities, respectively (PCHRD 1991).

Profile of the Program and Project Leaders

Dr. Horacio Estrada

Dr. Horacio Estrada is a Doctor of Medicine and was an Eli Lilly Fellow in Pharmacology for a year at the University of Pennsylvania. He is also a Professor Emeritus of the College of Medicine, UP. He held the positions of Vice Chancellor of Academic Affairs of UP Manila, Acting Dean of the College of Medicine, Secretary of the College, and was a member of the various important committees of UP. Thirty-five of his articles/research were published.
**Dr. Romeo Quijano**

Dr. Romeo Quijano is a medical doctor and is an associate professor of the Department of Pharmacology of UP. He obtained his master’s degree in Pharmacology from Mahidol University, Thailand and served as research fellow at Kobe University, Japan (1990) and visiting professor at the University of Pittsburgh, US (1993). In addition to his NIRPROMP project, he is also the project leader of the Drug Utilization Study, an RP-Ausaid National Drug Policy Coordination Project.

He has several articles on bioassay of medicinal plants and other scientific papers that were published in national and international journals. He received the Presidential Outstanding Civil Service Award (*Lingkod Bayan*) in 1988.

One of his interesting articles which was published in the Medical Action Group Journal (1989) is entitled *Paano kita gagamutan?* (How shall I heal thee?).

**Dr. Isidro Cabuyao Sia**

Dr. Isidro Cabuyao Sia is a Doctor of Medicine. He completed his degree in medicine in UP and his Doctor of Philosophy degree at the Kobe School of Medicine. He is currently a professor at the Department of Pharmacology, College of Medicine, and Vice Chancellor of UP Manila. He is likewise a project leader of the National Drug Information Center of the National Drug Policy Program of the DOH.

Several of his research studies, articles, and books are written in Pilipino such as *Manual sa paggamit ng halamang gamot* (1981) (Manual on the proper use of medicinal plants), and *Gabay sa wastong paggamit ng gamot: Para sa kapitan ng barangay* (Guide in rational use of drugs for village leaders) (1997). Some of his studies are ethnodocumentations of many cultural communities, which include the Dumagats of Aurora, Nueva Ecija, Quezon, and Bulacan; the Tagbanuas of Palawan; Bugkalots of Nueva Vizcaya and Quirino; and the Ibalois of Benguet.

He is a member of the Board of Trustees of Social Action Foundation for Urban and Rural Development and the Community Medicine Foundation. He was one of the Ten Outstanding Young Men (TOYM) awardees in 1992, in recognition of his work in pharmacology, and was the Outstanding Basic Science Teacher, UP College of Medicine in 1995.
**Dr. Nelia Cortes-Maramba**

Dr. Nelia Cortes-Maramba is a Doctor of Medicine, and a diplomate of the American Board of Pediatrics Society. She is currently a professor of Pharmacology and Toxicology at UP and Head of the National Poisons Control and Information Service of the Philippine General Hospital (PGH). She is also the Chair of the National Adverse Drug Reaction Advisory Committee of the Bureau of Food and Drugs of the DOH.

She has served in numerous national and international advisory panels/committees/organizations in the fields of research, pharmacology, drug dependence, toxicology, and medical curricula of national and international organizations including: Chair, Department of Pharmacology, College of Medicine, UP (1975-83); member of the Advisory Committee on Medical Research, Western Pacific Region, WHO (1981-84); and member of the Advisory Panel on Drug Dependence and Alcohol Problems, WHO, Geneva (1987 to present).

She has undertaken research on teratology, developmental pharmacology, medicinal plants, and occupational and clinical toxicology, many of which were published nationally and internationally.

She was voted by the United Nations Economic and Social Council as a member of the International Narcotics Control Board (INCB) (1997 to present) and was its 2nd Vice President in 1999.

She is a recipient of many awards, two of which are the Most Outstanding Researcher Life Achievement Award in Medical Research from the National Science Research Council of the Philippines (1992) and the Lingkod Bayan Award for outstanding public service from the President (1988).

**Dr. Ernesta Quintana**

Dr. Ernesta Quintana holds the degrees of Bachelor of Science and Master of Science in Botany from UP.

She is a professor at the Department of Horticulture in UPLB. For the past two decades she has been active in various committees involved in the study of medicinal and indigenous plants including the Philippine Committee on Standardization of ASEAN Herbal Medicine based in the Bureau of Food and Drugs of the DOH, and the Intergovernmental Advisory Committee on Bio-Search. She handled numerous research projects such as the establishment and maintenance of a gene bank on medicinal plants (1989-92) and production and mass propagation of
medicinal plants for primary health care (1992-95). She wrote many technical papers that were presented in national, regional, and international fora. She also presented several papers in national fora on topics such as Locality Sources of Medicinal Plants and Prescribing Pattern of Herbolarios in Region II. She also undertook similar studies for Regions I, IV, V, VI, IX, and XII. Among her published outputs are the Guidebook on the proper use of medicinal plants (1982), Herbal medicine technoguide (1983), and Monograph on lagundi (1986).

She is a recipient of the Presidential Lingkod Bayan Award in 1988. For her research, the DOST gave her an award for the Best in the Use of Indigenous Materials (together with other members of the NIRPROMP) in 1996.

**Dr. Natividad Feliciano-de Castro**

Dr. Natividad Feliciano-de Castro earned the degrees of Bachelor of Science in Pharmacy and Master of Science in Pharmaceutical Chemistry at UP. She has a Doctor of Philosophy degree, major in pharmaceutical chemistry from the University of Connecticut, USA. She is professor emeritus of industrial pharmacy at the College of Pharmacy in UP.

She is currently a member of the Technical Advisory Committee on ASEAN Technical Cooperation on Pharmaceuticals and Chair of the Advisory Committee of the DOH. She has written many scientific papers that were published as monographs/articles in professional journals and government publications. Among her articles/monographs are: "Pharmaceutical studies on lagundi" (with L.B.B. Gutierrez) (1989), and “Dosage formulation and manufacturing research in selection and scientific validation of medicinal plants for primary health care”.

She has received many awards for her achievements. Two of these are the Achievement Award for research activities in medicinal plants in 1991 from the National Research Council of the Philippines and the Tuklas Talino Award for akapulko lotion from DOST in 1996.

**Resources**

The Program has been receiving support from PCHRD since 1977 up to the present. As of 30 June 2000 the total project budget amounted to P30,319,636.00. These cover expenses for the salaries of various project teams, maintenance and operating expenses, and capital outlay.
Table 1. Budget Allocation

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Approved Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clinical Screening and Scientific Validation Studies of Phil. Medicinal Plant Products Used in Traditional Folk Medicine</td>
<td>P 8,545,081.00</td>
</tr>
<tr>
<td>2. Dosage Form from Medicinal Plants</td>
<td>6,750,290.00</td>
</tr>
<tr>
<td>3.1 Establishment and Maintenance of Medicinal Plant Production Farm, UPLB</td>
<td>1,460,458.00</td>
</tr>
<tr>
<td>3.2 Development of Appropriate Cultural Management Practices to Involve Yield and Quality of Selected Medicinal Plant Species</td>
<td>1,025,256.00</td>
</tr>
<tr>
<td>4. Pharmacologic/Toxicologic Studies of Philippine Medicinal Plants</td>
<td>4,258,051.00</td>
</tr>
<tr>
<td>5. Establishment of Quality Control Bioassay Standard Procedures for Medicinal Plant Products</td>
<td>6,103,955.00</td>
</tr>
<tr>
<td>6. Mutagenicity/Carcinogenicity and Antimutagenicity Potential of Drug Preparation of Phil. Medicinal Plants</td>
<td>2,186,516.00</td>
</tr>
<tr>
<td><strong>Total budget</strong></td>
<td><strong>P30,319,636.00</strong></td>
</tr>
</tbody>
</table>

Projects 1 and 2 were funded as early as 1977 and 1979, respectively. The rest of the projects were initiated in the early 80s. All of the six projects receive annual grants-in-aid from PCHRD. Collaborating institutions provided counterpart expenses for personnel, facilities, and utilities amounting to P6,958,713.00 for the past 5 years.

Project leadership was almost evenly distributed between males and females. The Program Manager was a male, while three project leaders each were male and female. In one male led project, the coleader was also a male; in another, the coresearcher was a female. All of the scientists/project leaders were well known in their fields and were involved in teaching and research and have published articles nationally and internationally. On the other hand, the research positions were dominated by women. Eleven women were science research specialists or research assistants. There were only three male science research
specialists or research assistants. The driver and laborer were males. The work of research specialists is technical and “sensitive” in nature, involving research activities in the laboratories, conducting tests and evaluations, and preparing reports for the review of the project leader. The level of patience, dedication, and care in handling chemicals and animals for experiments is high. Many project leaders assert that there are more women who apply for this type of work. Staff members have degrees in the sciences and have worked in the projects for long periods.

Of particular significance is the gender role in preparing and completing the Technology Transfer Document (TTDs) for *sambong* and *lagundi*. These are major outputs that include plant description, agriculture, preclinical studies, pharmaceutical studies and clinical studies, among others. The TTDs are the main instruments for technology transfer and commercialization.

The following table indicates the multidisciplinary nature of research and development of the above products and the gender participation in the completion of the TTDs.

Research teams for both *lagundi* and *sambong* were heavily female-dominated. Most of the women are industrial pharmacists, whereas there is only one female in agriculture. For both *lagundi* and *sambong*, females in the medical field occupy more positions; the male doctors constitute about 47 percent of the medical team.

<table>
<thead>
<tr>
<th>Discipline</th>
<th><em>Sambong</em></th>
<th><em>Lagundi</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td>Medicine</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Industrial Pharmacy</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>Chemistry</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Medical Technology</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Nursing</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Agriculture</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7</td>
<td>36</td>
</tr>
</tbody>
</table>

Table 2. Discipline and Gender Distribution in Herbal Medicine Technology R&D
Transfer of Knowledge and Technology

To ensure that research results and information on uses of herbal medicine are disseminated, the following activities were undertaken by the program implementors in collaboration with concerned agencies. The activities included the following:

1. Workshops and symposia for stakeholders in both government and nongovernment organizations in the regions.
2. Preparation of training materials and guidebooks on medicinal plants.
3. Distribution of planting materials and cultivation of herbal gardens in schools, rural health centers, and in backyards.
4. Human resource development on various aspects of medicinal plant research and development use.
5. Training projects for government personnel involved in cultivation, manufacture quality control, bioassay, and pharmacologic testing.

Many training programs, symposia, and seminars were implemented. In collaboration with the Ministry of Education (now DECS) a herbal garden program was initiated in public schools using priority plants such as lagundi, sambong, tsaaang gubat, and others. In 1985, the Ministry of Health (now the DOH) started the construction of formulating manufacturing plants for herbal medicine in Cotabato, Tuguegarao, and Tacloban. A plant had been constructed in Davao. At present, the Davao and Tuguegarao plants are operational. Their harvest is used by the DOH. However, they also sold plants and leaves to private individuals, enterprises, and others. The experts in the agricultural, pharmaceutical, and medical sectors of NIRPROM trained the personnel of the manufacturing plants.

In addition to the efforts of NIRPROMP, TAPI also conducts investment fora to encourage potential investors to undertake herbal medicine production. Other technologies are also “offered” to interested individuals and entrepreneurs to promote commercialization of Filipino technologies.

PCHRD’s Technology Transfer Guidelines

PCHRD adopted its technology transfer guidelines which embody provisions on guiding principles, including self-reliance in selected areas
between public and private sectors, the role of PCHRD as a broker for commercializable technology, division of income among several funding agencies, execution of a memo of agreement (MOA), capability of adopter, intellectual property rights, confidentiality, and ethical conduct of PCHRD staff. The guidelines also incorporated the provisions of DOST Memorandum Circular No. 002, Series of 1991, on the Guidelines on Technology Transfer Arrangements in the National Research and Development Systems (Detailed guidelines of PCHRD appear in Appendix 1). In 1998, the DOST updated its policies on intellectual property rights based on the Intellectual Property Code (R.A. No. 8293) and the Magna Carta for Scientists, Engineers, Researchers, and other Science and Technology Personnel in the Government (R.A. No. 8439). These are embodied in DOST Memorandum Circular No. 001, Series of 1998 (Appendix 3).

Technology Adopter

A Filipino-owned corporation, Pascual Laboratories, through its subsidiary, Altermed, courageously took on the adoption and commercialization of two products of NIRPROMP. These involve the production of lagundi and sambong tablets which are available in the market under the brand names Ascof (300 mg plain and 600 mg forte) and Releaf (250 mg plain and 500 mg forte), respectively. Lagundi is an anti-cough and anti-asthma medication, whereas sambong is useful as a diuretic and a remedy for urolithiasis. These herbal products bested 100 other products and inventions in the 25th International Exhibition of Inventions, New Techniques and Products in Geneva, Switzerland on 11-20 April 1997 where they were given silver medals.

Pascual Laboratories is headed by Abraham Pascual, who holds a bachelor’s degree in Chemistry (Fordham University, New York City) and a Doctor of Philosophy degree in Pharmaceutical Chemistry. His family is the owner of both Pascual Laboratory and Altermed. He has been a member of the Governing Board of PCHRD since 1989 and is active in other corporations.

He is a risk taker, has strong entrepreneurial skills, and is achievement oriented. Furthermore he is well-informed about indigenous pharmaceutical products and visits other countries to observe and learn about pharmaceutical developments. He supports the commercialization of Filipino technologies and is aware that the market will patronize high-quality medicines developed from local raw materials.
His consultant for herbal medicine is a well-known expert in traditional medicine, Dr. Francis Wade Gomez. He is a trustee of the Philippine Institute of Traditional and Alternate Care (PHITA), and was a founding program manager of the Traditional Medicine Program of the DOH. He contributed extensively in formulating the draft of the bill on PHITAC (Republic Act No. 8423) and worked in rural areas as a volunteer and medical care officer. In addition to his medical degree, he has a Master’s Degree in Primary Health Care Management from Mahidol University, Thailand. He likewise served as consultant to various countries.

Resources

The initial investment for each product is about P2 million. Depending on the season (planting and harvesting), the work force including farm hands and the sales force can reach 100. The corporation owns 7 hectares of land in Nueva Ecija, a great part of which is planted with lagundi and a certain portion with sambong. It has also contract farming arrangements in other areas to ensure the steady supply of raw materials. It hopes to increase its share in the market through the years.

Women personnel are responsible for quality assurance and product development. Manufacturing, marketing, and distribution are assigned to both men and women. Management positions were held by men (as of September 2000). As part of Altermed’s expansion activities for 2001, it hired a full-time farm manager effective 2 January 2001.

Intellectual Property Rights (IPR)

A technology transfer agreement was entered into between Pascual Laboratories, Inc. and its subsidiary, Altermed Corporation on 15 November 1995 for the production/commercialization of lagundi. The agreement stipulated that the adopter will pay a technology transfer fee of P50,000 and royalty payment of 2 percent for the first 3 years and 1.5 percent for the remaining 2 years. The license is nonexclusive and renewable upon mutual consent of both contracting parties. For sambong, the technology transfer fee is P70,000 and the royalty payment is 4 percent for the first 3 years and 3 percent for the succeeding 2 years. The license is likewise nonexclusive and renewable.

The company has about 20 office personnel involved in the herbal medicine business excluding the farmers who are attending to the farms for lagundi and sambong. Generally, management work is assigned to men,
while quality assurance and product development (R&D) are assigned to women. On the other hand, marketing responsibility is equally divided between men and women. This shows that activities requiring patience and attention to details particularly quality control is given to women (as of September 2000).

**Factors which Contribute to Successful Technology Transfer and Commercialization**

Pascual Laboratories is a successful Filipino pharmaceutical firm, which has commercialized Filipino research outputs. Its chief executive officer has a strong commitment to transform scientific studies into products that can compete with imported medicine. Since the signing of the memorandum of agreement with the PCHRD, Ascof and Releaf have reached many parts of the country. The company has enhanced the products by manufacturing the double dose caplet (forte). It is also producing another local indigenous product developed by NIRPROMP, the *akapulko* lotion.

The firm is amply assisted by a consultant who is known for his competence in traditional medicine, policy innovations, and service to the less privileged.

Women contribute to the success of the company through quality assurance and research and development activities.

As demand increases, there will be a need for the continuous supply of *lagundi* and *sambong* plants. It is essential to ensure the flow of supply not only from the existing farm-land but also from other potential areas for planting. Popularizing herbal products will require resources for marketing. Hence, there is a need for public dissemination of information on the usefulness of herbal plants through various means, including instruction in appropriate subjects.

Facilities for processing, regular training of manpower, quicker processing of license applications to operate, and issuance of the certificate of product registration had been identified by manufacturers and other stakeholders as areas for reform (1995 Workshops Program Review).

It will be noted that *Angat Pinoy 2000, A Report of the Accomplishments for Two Years* (July 1998 to July 2000) stated that “Through the Philippine Institute of Traditional and Alternate Care and its four herbal and pharmaceutical processing plants we have been
producing new medicinal plants. These medicinal plants include *lagundi* tablets for the treatment of cough and asthma; *sambong* tablets a remedy for kidney stone dissolution and an effective diuretic for those with edema; *tsaang gubat*, an antispasmodic remedy; and *akapulko*, an antifungal remedy which has benefited majority of poor Filipinos.” This confirms the importance of herbal products in the country.

**Analysis**

The research and development that led to the transfer of the technology for the production of herbal medicines from *lagundi* and *sambong* spanned almost one and a half decade. The financial resources that were used during the R&D phase, testing, and piloting were funded by PCHRD with a counterpart from the University of the Philippines (regular salaries of the project teams and utilities). Thus, the investment and risks were completely assumed by the government. The private sector in other countries in the region such as South Korea has bigger investment in R&D. From a low 22 percent share in 1976, the private sector share rose to 80 percent in 1991 (Young-Ho Nam 1995). The reverse is true in the Philippines where 90 percent of the R&D fund is government allocation.

The commercialization effected through a transfer of technology agreement between Pascual Laboratories and PCHRD was the outcome of the commitment of both contracting parties to use local technologies. The faith reposed in the results of the study of Filipino scientists by a Filipino entrepreneur was anchored on the knowledge that herbal products have a future in the Philippines.

Favoring the establishment of the relationship was the technical background of the entrepreneur, his experience in pharmaceutical production, and availability of a corporation that could produce the products. These factors minimized the risk in commercializing herbal products. *Lagundi* and *sambong* tablets have already been accepted in the market.

Similarly, the zeal of PCHRD’s lady executive director and the full support of the Governing Council to adopt and implement a viable commercialization strategy paved the way for other public-private sector collaboration in commercial ventures using local technologies. In addition, PCHRD’s technology transfer guidelines ensure the participation of appropriate stakeholders in intellectual property rights and transparency in activities relating to commercialization.
With the national policy framework in place, PHITAC has the mandate to pursue a vigorous program to develop indigenous medicine from local sources. It is essential that the initiatives undertaken by the adopter be encouraged so that other entrepreneurs will also be inspired in adopting and using Filipino technologies. Equally important is the funding support for PHITAC to ensure the continuous development and production of herbal medicine.

Gender plays a significant role in the development of herbal medicine technology. Prominent women scientists and researchers dominated the research and development activities on herbal technology including the preparation of the technology transfer document which described in detail the scientific processes that would enable an adopter to use the technology. The effective leadership of the executive director of PCHRD, a woman science administrator, contributed immensely to the commercialization of herbal technology by Filipino entrepreneurs. Undoubtedly, women’s participation in the development and transfer of this technology indicates that knowledge, expertise, and dedication enhance the opportunities for gender equity.
Nutritious Food Technology: Cantoon Noodles with Squash

A.C. Ancog and M.V. Capanzana*

Background

The 1993 and 1998 nutrition surveys conducted by the Food and Nutrition Institute (FNRI) showed that vitamin A deficiency, iron deficiency anemia, iodine deficiency disorders, and protein-energy malnutrition affect adversely the health of a substantial number of Filipinos. The problem is partly addressed by appropriate S&T programs of the DOST through the FNRI. The FNRI developed and continues to develop nutritional food products that address the aforementioned nutritional problems.

The research studies use indigenous/local materials and are designed such that the products resulting from the research do not significantly alter local food habits and beliefs. Noodles are popular among many Filipinos. It has taken many forms: flat or round noodles; white or yellow ones are favorite dishes. It can be cooked quickly, eaten in fastfood counters, or five-star restaurants. It is now available in many stores in “instant” or ready-to-eat form. In addition, noodles are often considered as a necessary part of the menu during birthday celebrations and other special occasions since it is associated with longevity of life.

Technology Development

The nutritious food/noodle technology was developed as part of the project “Commercialization of FNRI Technologies” of the Food Science and Technology Division of FNRI as early as 1981. Its budgetary allocation was not treated separately from the other activities of the project. Among the products, which were subsequently developed, were kroepeck from rice and mongo and other root crops. To enhance the

* The authors acknowledge with gratitude the advice of Dr. Corazon Barba, Director of FNRI and the assistance of the staff of the Food Science and Technology (FSTD) and the Technology and Promotion Group (TPG), FNRI
nutritive value of noodles, seven researchers plus a division chief, conducted the research incorporating vegetables particularly squash and *saluyot* to enhance the noodles’ nutritive content. In 1995 the team completed the formulation, piloting, and storage study.

The research team, which undertook the research and development of nutritious noodles, consisted of eight women, one of who is a Ph.D. holder. The current coordinator of the product development and technology transfer team is Dr. Mario Capanzana, also a holder of a Ph.D. in Food Science and Technology. His innovativeness in technology transfer has resulted in renewed interest in commercializing indigenous food. The project leader for the technology development is a woman; except for one man all the staff members are women and have strong technical background. The following table shows the team’s profile.

### Table 3. Gender Profile of FSTD and TTPG Staff Involved in Research and Production of Canton Noodle with Squash

<table>
<thead>
<tr>
<th>Name</th>
<th>Gender</th>
<th>Academic Background</th>
<th>Years of Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lydia Marrero</td>
<td>F</td>
<td>PhD Food Science</td>
<td>27</td>
</tr>
<tr>
<td>Emerina Eusebio</td>
<td>F</td>
<td>BS Pharmacy; Dip. in Food Science and Nutrition</td>
<td>42</td>
</tr>
<tr>
<td>Joyce Tobias</td>
<td>F</td>
<td>BS Chemistry; BS Food Technology</td>
<td>23</td>
</tr>
<tr>
<td>Pacita Reyes</td>
<td>F</td>
<td>BS Pharmacy</td>
<td>40</td>
</tr>
<tr>
<td>Ma. Elena Fernandez</td>
<td>F</td>
<td>M Applied Science; BS Chemistry</td>
<td>23</td>
</tr>
<tr>
<td>Alejandro Martin, Jr.</td>
<td>M</td>
<td>MBA; BS Chemical Engineering</td>
<td>23</td>
</tr>
<tr>
<td>Wenceslao Lainea</td>
<td>F</td>
<td>BS Chemistry; BS Food Technology</td>
<td>21</td>
</tr>
<tr>
<td>Marcela Sainez</td>
<td>F</td>
<td>BS Chem; BS Chemical Engineering</td>
<td>20</td>
</tr>
<tr>
<td>Mario Cabagbag</td>
<td>M</td>
<td>BS Chemical Engineering</td>
<td>18</td>
</tr>
<tr>
<td>Cecilia Quindara</td>
<td>F</td>
<td>BS Food &amp; Nutrition</td>
<td>23</td>
</tr>
</tbody>
</table>

FSTD – Food Science and Technology Division, TTPG – Technology Transfer and Promotion Group. *Also involved in technology transfer.
Description of the Technology

Raw Materials and Equipment Requirements

Squash canton noodles are nutritious and rich in β-carotene. The noodle is prepared from a blend of wheat flour, squash puree, salt, egg, and noodle improver. It is a fried product, golden yellow in color, and contains 13 g protein, 512 kcal, and 1.12 μg β-carotene per 100 g food. A 50-g serving will provide the 16 percent, 20 percent, and 24 percent recommended dietary allowance (RDA) for energy, protein, and vitamin A, respectively, of 4-6 year-old children.

The raw materials needed to produce 13,000 packs of 250-g packs are as follows: wheat flour 2,100 kg, squash 1000 kg, salt 40 kg, egg 40 kg, lye solution 20 kg, and vegetable oil 450 kg.

For this production volume, the following equipment were necessary: 1 noodle machine, 1 spike mixer, 1 grinder, 1 weighing scale of 100 kg capacity, 3 stoves with tank and regulator, 3 kettles (kawa), and 2 weighing scales 1 kg capacity.

Technology Transfer and Commercialization

The team responsible for technology transfer is currently under the leadership of Dr. Capanzana.

The technology transfer personnel are highly qualified for their responsibilities and majority of them have more than 20 years of experience in food technology and nutrition research, and technology promotion. The gender distribution is about equal.

The team ascertains the readiness of the adopter to undertake the production of the food products. An evaluation of the equipment/facilities (e.g., power and water supply), and raw material supply is done to ensure that the technology transfer will be successful. Likewise, actual production is observed during the initial stages.

In the early phase of the technology transfer, a lady food scientist, Dr. Lydia M. Marero, presented a paper on nutritious noodles during the investors’ forum conducted by TAPI at the Philippine Trade and Training Center in Manila in 1992. In the same year, she also conducted a demonstration on the processing of food products including kroepeck, catsup dry blends, and pasta noodles to a group of entrepreneurs and other interested individuals.

Mr. Casimiro Villacorte and his wife who attended the demonstration decided to set up the V-Sun Food Products and entered
into an agreement with FNRI to produce rice-mongo kroepeck, and rice-mongo weaning blend. Meanwhile, FNRI continued with its systematic product development on noodles with vegetables. In 1993, V-Sun Food Products adopted canton noodles with squash. The earlier production activities were done at Bicutan in a Technology Business Incubator. TAPI handled this arrangement, which partly subsidized the space. Subsequently, V-Sun transferred its operations to Cavite. The production of canton noodles with squash is now done on a per order basis.

From 1996 to the present, more intensive technology transfer activities were undertaken by FNRI. As of November 2000, there were 18 adopters of canton noodles with squash. Ten adopters were from Luzon, five from Mindanao, and three were from the Visayas. The adopters are shown in the following table.

The president/general manager of the adopters consisted of six men and five women in Luzon; two men and two women in Mindanao, and three women and one man in the Visayas.

Table 4. Adopters of Canton Noodles with Squash Technology

<table>
<thead>
<tr>
<th>Luzon</th>
<th>Mindanao</th>
<th>Visayas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kalilayan Multipurpose</td>
<td>Eagle Multi-purpose Cooperative</td>
<td>Jojo’s Noodle Center, Inc.</td>
</tr>
<tr>
<td>Cooperative</td>
<td>Southern Star Noodle Factory</td>
<td>Food Land Food Processing</td>
</tr>
<tr>
<td>BC Palma Enterprises</td>
<td>San Vicente Farmers Association</td>
<td>Family Noodle</td>
</tr>
<tr>
<td>Nutrifoods Specialists, Inc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmtec Foods, Inc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comaguiningking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women’s Association</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dayapan Multipurpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asper ENTERPRISES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pagsanguiran Multipurpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iloca Food Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V.Sun Food Products, Inc.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Role of the FNRI Director

One of the key players in the commercialization efforts of FNRI is its executive director, Dr. Corazon Barba, whose expertise in food and nutrition is known nationally and internationally. Before her appointment as director of the Institute she was a faculty member and director of the Institute of Human Nutrition and Food UPLB. She was visiting professor in the University of Indonesia, SEAMEO (Southeast Asia Ministers of Education Organization) Regional Center for Tropical Medicine TROPMED.

Her expertise, openness, and networking skills contributed to the remarkable “technology relationship” between Via Mare through Nutrifood Specialists and FNRI and other adopters. She showed her willingness to share the technology with as many adopters as are interested.

The MOA between the FNRI and the adopters stipulates a one-time transfer fee of P5,000.00 for 3 years of nonexclusive license. As a matter of policy, FNRI limits the entry of not more than one adopter for the duration of the agreement. This will enable the adopter to benefit from the use of technology.

Adopters

Many of the adopters are cottage industries and microenterprises. However, one adopter is a well-known entrepreneur who operates high quality restaurants and now exports food products to some countries abroad. This exciting development in the commercialization of canton noodles with squash is the transfer of the technology to Mrs. Glenda Baretto of Via Mare.

Her involvement in the production of noodles with squash came about after she visited FNRI to inquire about FNRI-developed ethnic products. During the visit, she expressed interest to adopt other products particularly canton noodles with vegetables. Aware that nutritious noodles can be transformed into a product, which her customers can appreciate and patronize, she signed an agreement through a subsidiary of Via Mare, Nutrifood Specialists with FNRI in 1998 to commercialize the technology on canton noodles with squash, saluyot, and seaweed. She also included the canton noodles with squash in the menu of her restaurants.

She hired food experts and tasters to improve the food products. Part of the enhancement activity was an evaluation of the taste of the
noodle to get a distinct taste that would give the product an excellent chance of capturing not only the local but also foreign markets. In November 1999 she launched her product and invited her affluent friends from business and social circles, members of the press, and the FNRI officials. Significantly, she asked Dr. Corazon Barba, FNRI Director, to brief the guests on the health benefits of the noodle. This activity was given wide publicity in newspapers; an event that elevated the “humble” canton noodle with squash into a “celebrity” food.

Mrs. Baretto has 35 years of experience in the food business. She learned cooking from her mother who is a very good cook. She is committed to her “craft”, is innovative, and is a risk taker. She believes in the marketability of ethnic food and has been exporting her nicely packaged cooked food products to the Middle East and Japan.

Examples of these are her “laing” and “kare-kare” which had been making waves among Filipino immigrants and overseas workers. She does not flinch from putting resources in a new product and had invested millions of pesos for world-class packaging materials for her products.

In La Castillanas, Negros Occidental, a wife and mother, Mrs. Delia Lumanas, learned about the canton noodle with squash when she participated in a Department of Trade and Industry (DTI)-sponsored study tour to various RDIs including FNRI. After the visit, she decided to adopt the canton noodles with squash technology, saying that she “fell in love” with. FNRI also provided technical assistance covering plant/factory layout, building structures, and equipment requirements. Mrs. Lumanas has a small bakery business, which supplied the bread and pastry in La Castillanas and surrounding towns. Realizing the potential of adopting the FNRI technology, she formed Jojo’s Noodle Center in 1998 with FNRI and DOST’s S&T Provincial Officer providing technical advice.

In a lot she owned near her home, she built a modest noodle factory. Her products are now sold to customers in adjoining provinces. Due to increasing demand, she decided to improve her equipment and applied for a grant from DOST’s Regional Office. To ensure that she will have a steady supply of squash, she established linkages with the mayor and barrio captains. The response of the local officials was enthusiastic and a number of farmers in her community and the adjoining areas planted squash for her needs.

She manages the business (proprietorship) and employs 11 personnel some of who are also part of the bakery operations. Her gross
sales in 1998 have gone beyond P1 million and she reinvested some of her profits in improving her factory. Her son helps her in some business activities, but she makes the major decisions. Her excellent networking skill is a significant asset, which enables her to mobilize resources. She expects to expand production once new equipment is purchased. The total investment which includes equipment upgrade is about P2.7 million.

Another technology adopter of canton noodles with squash is a group of women and men from the small barangay of Tanauan, Batangas known as Bgy. Bilog-bilog. The barangay is predominantly an agricultural community. Of its total land area, 68 percent is devoted to growing crops, like sugarcane, vegetables, corn, and coconut. Majority of the farmers are Agrarian Reform Beneficiaries (ARB) deriving their income from their farm produce. However, agricultural production was low due to high prices of farm inputs, lack of knowledge on appropriate and modern farm technology, and low soil fertility. Regardless of these constraints, farmers learned how to grow special varieties of squash, a major vegetable grown in the locality. Their squash are bigger in size and weight and have a better color and texture than those from other areas.

Because of the community’s desire to raise their standard of living, the residents in the area decided to pool their resources together to form the Dayapan Multi-purpose Cooperative. The Cooperative expanded their business operation taking advantage of the uniqueness of their squash varieties and engaged in producing canton noodles with squash. The Department of Agrarian Reform (DAR) of Batangas, through the Support and Service Office, assisted the Cooperative to get the technology on noodle production from FNRI. An MOA was entered into among DAR, FNRI-DOST, and Dayapan Multi-purpose Cooperative on the technology transfer and commercialization of the vitamin A-rich canton noodles.

The Cooperative initially rented FNRI’s facilities (pilot plant) in Bicutan, Taguig for market testing their product. The FNRI technology transfer team in production, quality control/assurance, and packaging first trained the farmers/beneficiaries. Once their competence was established, the group of women and men started commercial-scale production by bringing the fresh squash puree early in the morning from Bgy. Bilog-bilog to the FNRI pilot plant in Bicutan for processing. In the afternoon, the group brought back to Tanauan, Batangas one jeepload of the finished product for market testing and distribution to
local markets and DAR offices. The Cooperative rented the facilities for 2 months.

After they demonstrated the technical feasibility and marketability of the product, the Cooperative was able to acquire machines and equipment for squash canton production through a loan from the Technology and Livelihood Resource Center (TLRC). They set up their

Table 5. Status of Investment and Development Generated

<table>
<thead>
<tr>
<th>Name of Adopter</th>
<th>Value/Volume of Business</th>
<th>Investment Generated</th>
<th>Income Generated</th>
<th>Employment Generated</th>
<th>Other Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>18,900 packs (200 g) per month or 4,000 packs per day</td>
<td>P2.7 M</td>
<td>P1.7 M/year</td>
<td>10 workers</td>
<td>New bakery products with squash were developed after technology adoption</td>
</tr>
<tr>
<td></td>
<td>3,700 kg/mo</td>
<td>20,000 kg/mo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>On the initial stage of production</td>
<td>P232,994.00</td>
<td>-</td>
<td>-</td>
<td>The product was just launched in the market last July 2000</td>
</tr>
<tr>
<td>3.</td>
<td>P240,000/6 months</td>
<td>P4.45 M</td>
<td>-</td>
<td>20</td>
<td>Adopted 2 products from FNRI – Canton noodles with squash, noodles with saluyot</td>
</tr>
<tr>
<td></td>
<td>520 boxes/mo/variant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>312 bags/mo or 7,800 kg/mo</td>
<td>P2 M</td>
<td>-</td>
<td>12</td>
<td>1st technology adopter</td>
</tr>
<tr>
<td>5.</td>
<td>5,200 kg/mo or 10 t/mo</td>
<td>P500,000.00</td>
<td>P2000 – 390,000/y</td>
<td>10</td>
<td>Davao City market only</td>
</tr>
<tr>
<td>6.</td>
<td>200-300 packs/shift</td>
<td>P1.0 M</td>
<td>-</td>
<td>10</td>
<td>For launching</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>P10.883 M</td>
<td></td>
<td>62</td>
<td></td>
</tr>
</tbody>
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Based on a 30 June 2000 survey, the total investment of six adopters amounted to P11 million. Direct labor is about 62 workers. Due to the confidential nature of information on income generated, no data can be reported. The value/volume of business ranged from 3.7/mo to 10/mo.

Gender Distribution among Selected Adopters

The work assignments of the personnel of selected adopters as of 30 June 2000 are shown on table 6.

Some of the adopters are multiproduct producers and used their manpower for producing various food products. Nutrifoods Specialists, for instance is also producing ethnic food like “kare-kare” and “laing”. Eagle Multipurpose Cooperative also produces “bihon” or white thin noodles. Jojo’s Noodle Center has bakery products.

The functions of management/administration include services relating to supervision, human resource development, finance and other services; production includes quality assurance and control, whereas marketing includes distribution. While there are more men than women in management/administration, there are more women in production and quality assurance and marketing. Only one firm hired a full-time own processing facilities in Bgy. Bilog-bilog and started producing on their own, with some technical assistance from FNRI on the quality of the product. To date, DAR together with the local government of Batangas, assists the Cooperative in marketing and promoting the product in technology fairs, exhibits, and other venues where information on the novelty noodles can be disseminated.

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<td>2</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Nutrifood Specialists Inc.</td>
<td>5</td>
<td>4</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Farmtech Foods, Inc.</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Dagupan Multipurpose</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
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<td>4</td>
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<tr>
<td>Cooper.</td>
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<tr>
<td>Eagle Multipurpose</td>
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<tr>
<td>VSun Food Products, Inc.</td>
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<td>No information</td>
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food technologist but a number are consulting with the FNRI or the Provincial S&T Officer on technical matters. In several proprietorship/business firms, men do production activities such as kneading and transferring of ingredients to a cooking facility. On the other hand, wrapping of the products is generally assigned to women.

The data show that the management function is generally male dominated, while quality assurance is female dominated.

**Improvements on the Technology**

Some adopters initiated “improvements” in the technology such as changing the noodle improver, or redesigning the size and shape of the canton noodle. One adopter whose product is sold in big supermarkets patronized by affluent customers, packages her product using high quality materials. In this regard, many adopters are aware of the need to improve their equipment, maintain quality products, and establish goodwill in areas beyond their locality. They are continuing their consultations with FNRI to avail of technical advice.

Most of the adopters are eager to expand their markets and produce competitive canton noodle with squash that will stay in the markets for a long time. Given that squash is available and cheaper in the Mindanao area with relatively fewer adopters and increasing demand, the potential of increasing the number of adopters and transforming the current adopters to medium-size enterprises appears promising.

**Factors which Facilitate and Hinder Effective Technology Transfer**

Adopters find the technology for producing canton noodles with squash simple, and easy to adopt and implement. They are also keen on using indigenous raw materials to enhance the nutrient content of noodles. They find the FNRI and other DOST scientists and technologists helpful, concerned, and sincere in assisting them in their needs.

Among the difficulties confronting the adopters is the need for a continuous supply of squash of the right variety, particularly by those whose businesses are located in or near Metro Manila. The adopters in the South rarely face problems in squash supply.

Since majority of the adopters belong to the category of cottage industry (P150,000 to P1.5 million investments), financing their need for improved facility or equipment must be addressed. TAPI can provide assistance in upgrading equipment.
In addition, some adopters want to improve packaging quality; the cost of using better packaging materials will increase the selling price. A linkage needs to be established with the National Packaging Center of DOST. Package design and labeling with nutrition information must be incorporated to inform consumers of the nutritive value of the food products.

For the adopters whose markets are in the rural areas or relatively remote from the cities, this problem is not felt. However, in those operations in or near Metro Manila or other urban areas, good packaging is an important aspect of marketing.

Other FNRI Technologies

FNRI has developed many more nutritious/fortified food technologies. These include “laing” (mixed vegetable dish), rice crispy bars which are intended as emergency/disaster food, ready-to-eat snack food, instant kalamansi extract, instant lumpia sauce and egg-roll wrapper mix, guyabano-nata fruit drink, green mango-nata fruit drink, ripe mango-nata fruit drink, iron-fortified rice, vitamin A and iron-fortified sugar, and iodine-rich drinking water and “Water Plus + I$^2$”.

“Laing” is a popular Bicolano dish, which can be canned. It comes as a complete dish from taro (gabi) stalks and leaves slowly cooked in coconut milk and seasoned with ginger shrimp paste and Philippine chili. It is very spicy and creamy. Moonbake, Inc. of Las Piñas is already commercializing “laing” and now sells it in leading supermarkets in Metro Manila.

The rice crispy bar is made from combinations of expanded cereals and flour from legumes and oilseeds, which provide energy and adequate amount of protein. This product is ready-to-eat, appealing, and nutritious. The product is light, therefore, easy to handle and transport. FNRI developed this product as an emergency food to help nutritionally rehabilitate victims of armed conflicts, typhoons, floods, earthquakes, volcanic eruptions, and malnutrition. It comes in chocolate-coated, peanut-flavored, and tropical food variants that provide delicious and quick sources of calories, protein, carbohydrates, and fats.

Instant lumpia sauce is prepared from sugar and spices used for spring or egg rolls (crepe) which is a dish made of shrimps, pork, and vegetables such as carrots, potatoes, beans, and bean sprouts. Lumpia (egg roll) wrapper mix is a ready-to-cook wrapper for lumpia. Lumpia is a favorite side dish or snack brought in by the Chinese traders during
the precolonial era that was ingeniously adopted by the Filipinos using local ingredients.

Iron-fortified rice (IFR) is enriched rice made from a blend of premixed iron-fortified rice grains with ordinary rice. Premixed fortified rice grain is ordinary rice coated with iron in suitable solvent and binder. IFR contains 5 mg iron per 100-g rice. A day’s intake of approximately 4 to 6 cups of cooked IFR will meet the daily requirement of the body.

Iodine-rich drinking water or “Tubig Talino” is a refreshing health drink made from a blend of distilled or purified or ordinary drinking water and “Water plus + I₂” that could help prevent iodine deficiency disorders (IDD), one of the prevalent micronutrient deficiency in the Philippines responsible for goiter, mental and physical retardation, and birth defects. A 5-mL sachet or a 15-mL bottle of “Water plus + I₂” mixed with 20 L of water is enough to meet the required level of iodine in an iodine-rich drinking water. The taste, odor, and smell are very much similar to ordinary water.

With aggressive information dissemination and marketing, nutritious/fortified ethnic food can gain a strong market foothold. Collaboration with appropriate private sector organizations and other institutions will hasten the extensive commercialization of these products.

Analysis

Developing nutritious food products stemmed from the decision of women scientists in FNRI to contribute to the solution of vitamin deficiencies of many Filipinos. FNRI scientists and researchers responded to the challenge of developing food products, which will address health concerns and problems. Food technologies for the production of fruit drinks, rice-mongo kroepeck, weaning food (for babies), vitamin A-fortified coconut cooking oil and table sugar, and canton noodles with vegetables such as squash and “saluyot” are some of the products that had been transferred to adopters.

Technology transfer, however, cannot operate in a vacuum. It succeeds when these elements are present: (i) the availability of technical expertise of scientists and researchers who develop the technologies after research, piloting, and demonstration; (ii) existence of interested adopters/entrepreneurs; (iii) mechanism for transfer such as technology fora, investment fora, training, and seminars; (iv) availability of capital or assets/resources, raw materials supply, working capital, equipment
for the use/application of technology; (v) transparent and clear provisions for technology transfer duly embodied in a memorandum of agreement between the technology owner and the adopter; (vi) linkages with relevant individuals and/or institutions; and (vii) markets.

On the first element, FNRI has talented and dedicated scientists, most of whom are women who conducted and are still continuing research on food technologies. As regards the second, adopters of canton noodle with squash had been increasing since 1999. Other technologies are also being transferred in different parts of the country. The emergence of new adopters with adequate capital and experience as shown by Nutrifood Specialists, Inc., signifies that food technologies intended initially for enhancing nutritive value for malnourished individuals can be elevated into a “celebrity food.” Furthermore, the export potential of ethnic food produced from FNRI’s technologies had been tested.

The availability of resources such as equipment, raw materials, and working capital are crucial to the success of technology adoption. Since most of the adopters are cottage industry types, financing is crucial. The micro-lending facility, which was made possible through Republic Act No. 7882 (An Act Providing Assistance to Women Engaging in Micro and Cottage Business Enterprises, and for Other Purposes), provides an opportunity for women in rural areas or semi-urban areas to start a modest business using food technology. The extent to which credit is available to potential borrowers may be considered in tandem with the local government unit.

On the other hand, the technical assistance of DOST through TAPI and FNRI and the S&T provincial officers can be tapped by the adopters. However, the budget of DOST is also quite limited. Nevertheless for as long as government supports its technology transfer programs, DOST can provide appropriate assistance.

The memorandum of agreement with FNRI contains standard provisions on technology transfer. The technology transfer fee is a lump sum payment of P5,000 for 3 years without royalty payments and a nonexclusive arrangement. Under the agreement, FNRI commits to provide technical advice when necessary. The transfer fee is very modest and is not envisioned to cover the cost of R&D nor the cost of transfer activities involving the personnel of FNRI and field staff of DOST.

Networking or strategic alliances are important in the success of technology adoption/commercialization. The experiences of some adopters in developing raw materials supply and markets show that linking
up with local government units, local business leaders, prominent members of the community, and farmers’ groups provide dividends in many forms. Good public relations with these sectors contribute to nonformal advertisement of their products.

Access to opportunity in adopting and commercializing food technology is open to both men and women. Functions relating to management, production, and marketing are substantially available to men and women. Two adopters summed up the contribution of women on food technology as follows:

“Women are active in all R&D projects. Being women and mothers make them more familiar and aware of the nutritional needs of children” (Nutrifood Specialists, Inc.).

“Without the participation of women members of the Cooperative, the project will not materialize. Women have been active since the project was conceptualized” (Dagupan Multipurpose Cooperative).

The purpose of promoting nutritious food technology using indigenous materials is to improve health by enhancing food with nutrients. Popularizing such technology is a step toward enhancing the quality of life of our citizens. Thus, FNRI’s programs deserve continuous support from the national government and other sectors.

Identifying and developing local and foreign markets are essential for the long-term success of ethnic foods. Without strong commitment to use local technology under appropriate circumstances and the support of relevant government agencies and the private sector, patronage of ethnic foods will take a long time to take off. Nutrifood Specialists, Jojo’s Noodle Center, and Dayapan Multipurpose Cooperative have shown the way. Other adopters can benefit from their innovative approaches and experiences.
Forest Products Research
and Development Institute (FPRDI) Technology

Amelia C. Ancog *

**Background**

Furniture earns for the Philippines millions of foreign exchange. In 1993, furniture exports amounted to $203 million. In Region III, the export earnings from furniture were $41.7 million in 1998 and $39 million in 1999. The industry, though, is beset with problems of scarcity of raw materials and poor or even lack of production facilities.

To enhance their productivity, many cottage and small enterprises engaged in furniture manufacture need to upgrade their equipment using local technology since imported equipment is quite expensive. For instance, finishing equipment if procured abroad can drain the financial resources of firms. Such equipment enhance the quality and appearance of the furniture, consequently increasing their marketability. The quality of finish brings out the beauty of the design and carving which many foreign buyers desire.

Without appropriate facilities, finishing is done during the rainy season in poorly lighted areas that are often dusty. During the dry season finishing is done outside the factory or in open spaces with standard equipment that include compressors and spray guns. Imported finishing equipment is usually beyond the reach of the local entrepreneur. To assist local enterprises enhance their products, FPRDI developed two finishing equipment: the spray booth and drying tunnel.

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Technology Development

A well-designed spray booth and drying tunnel hasten the drying of furniture, shortening the production period. To develop the equipment, a team of scientists/researchers was organized in the late 80s by FPRDI. Researchers included Ruben Zamora, Arturo Capati, Felix Moredo, and Ma. Cecilia Zamora with the following responsibilities:

Ruben Zamora (an engineer) prepared the plans and specifications, bill of materials, and supervised the construction, installation, and commissioning of the facility.
Arturo Capati assisted in supervising the construction, installation, and commissioning of the facility.
Ma. Cecilia Zamora took care of technology transfer coordination.

The cost of development covering operating expenses for materials and supplies was about P42,000 (1988 figures) which was disbursed from the appropriations of FPRDI. It took less than 2 years to develop, test, and pilot the technology.

Spray booths are box-like enclosures used during finishing for removing overspray. They extract the varnish particles and solvents from the work areas, and prevent fogging and misting of surfaces, thus keeping the atmosphere free from fumes and improving the work environment.

There are two types of spray booths: the dry filter and the wash or wet filter. Both are made of GI sheets with steel framings. Each type is provided with an exhaust fan and a water filtering system.

The drying tunnel hastens the drying of finished furniture. It may either be a container van or a chamber made of steel framings. It is provided with a heat source, centrifugal blower, and air ducting. It can either be fixed or demountable. The drying process can be batch type or conveyorized.

The standard tunnel length is 6-12 meters. However, the length can be modified depending on the requirements of the adopter.

Furniture products can be dried either by batch (manual loading of furniture items inside the chamber) or conveyorized inside the chamber for continuous drying. With the use of a drying tunnel, an average of 25 minutes of drying time per charge of 50 to 55 dining chairs finished with nitrocellulose lacquer or aide-catalyzed lacquer can be attained. The facility can be operated by one person.
Adopters

Some of the adopters of the finishing/spray booth facility were: Calfurn Manufacturing Phil. Inc.; Asia Rattan Mfg. Co., Inc.; Hade Phil.; Weavercraft, Inc.; Don Q. Woodenwares; JB Woodcraft; Filipinas Furniture; Trebel Manufacturing Corporation; Q Designs Industries, Inc.; D’Or Designs, Inc.; Cruz Wood Industries; Betis House of Decor; A & R Interior; and Golden Cane. Most of the adopters are based in the province of Pampanga. On the other hand, several adopters of the drying tunnel facility were Asia Rattan Mfg. Co., Inc.; Calfurn Mfg. Phils. Inc.; JM Basket Bonanza, Inc.; Q Designs Industries, Inc.; and D’Or Designs, Inc., among others.

An adopter reported that before using the spray booth, his company’s average daily production was from 50 to 75 chairs. However, with the use of the equipment, his average daily production rose to 100 to 200 chairs. The technology also resulted in the improvement of staff attendance. Two adopters whose plants are situated in Pampanga are SMEs. Their furniture are sold in local and foreign markets. The businesses are owned and managed by the spouses.

**Adopter A** is a single proprietorship, which specializes in carved furniture and mixed-material furniture. In 1999, its local sale was P8 million and foreign sale was P12 million. The work force was divided as follows: management: 1 male, 5 females; production/quality: 67 males, 17 females; marketing: 5 males, 4 females.

The men outnumber women in production activities. Most activities in production involve lifting of heavy materials such as wrought iron and wood parts. On the other hand, accounting and financial services are performed by women (management).

The husband manages the business and the wife supervises the marketing operations. The spouses are both chemical engineers. In the production line, the husband oversees the workers. Men at the production level perform tasks related to cutting, sanding, joining parts of the furniture, spraying, and finishing. A lesser number of women do sanding activities. More are involved in packing, which entails careful wrapping of the furniture with layers of paper. However, when the furniture are fully wrapped, the men lift them into boxes.

The finishing spray booth (wet type) was adopted in 1998. Some improvements were added to the equipment such as the transfer of the drainage pipe from the middle portion to the lower portion and strengthening of the wire mesh stand. The adopter finds the technology simple and easy to use. It was transferred without a royalty fee.
Commenting on the role of men and women in the furniture production processes, the adopter stated: “Men are involved in welding, cutting of wood parts, varnishing, wrought iron parts assembly. Many of the activities are done by men while standing. Packing is a relatively light task since the furniture is wrapped tightly with brown paper to protect them from being damaged. This is manually done by female employees. The division of work in the factory is based on physical capacity, expertise, and skill.”

“Women are capable of implementing various activities in technology adoption. Many are educated and can occupy leadership roles. They are also good in marketing. They are persevering and patient.”

**Adopter B** started her business with a small store for imported goods in Pampanga. In 1962, the lady-entrepreneur was a mathematics teacher. A few years later, a friend requested her to display in her store space pieces of furniture that were sold quickly. Realizing the potential of the furniture business, she and her husband transformed their business into a cottage industry-level furniture enterprise.

To enhance the productivity of the enterprise, the UP Institute of Small Scale Industries extended technical assistance and assessed the enterprise’s layout, production system and processes, and human resources needs.

The staffing pattern of the firm was as follows: management: 3 males, 4 females; production/quality assurance: 46 males, 10 females; marketing: 8 females.

Men dominated the production jobs, while marketing was handled exclusively by women. The key positions were held by the husband, wife, and children, who all have degrees from universities. The accounting and financial services functions were assigned to women.

In 1986, the firm adopted the drying tunnel and spray booth technology after the FPRDI male technologist visited the factory and assessed the firm’s requirements. Business opportunities improved not only because of the adoption of the technology but also due to the entrepreneurial skills of the owners.

The firm subsequently became a corporation and expanded its business considerably. The corporation now has four outlets/display centers: two are in Pampanga, one in Quezon City, and one in San Juan, Mandaluyong City. Its products are described as furniture and furnishings made out of rattan, wicker, bamboo, wrought iron, wood, and their combinations.
Their products are exported to the Middle East, Europe, Singapore, Korea, Taiwan, and the United States. A few years ago, the firm acquired a new and bigger site for its factory. It has established its name for quality products that have successfully competed in the foreign market.

The spouses observed that the women are good in handling financial matters, whereas men are good in production activities. At the factory level, men are assigned to metal works and welding, whereas women perform sanding activities and packing.

They asserted that the drying tunnel and spray booth technology helped the company enhance its productivity by 60 percent. They said, “We gained confidence because the researchers provided and taught us the technology.” They acknowledged the accessibility of FPRDI and the DOST regional staff in providing advice when necessary. In addition, they mentioned that the funding support of other government agencies such as the Technology Resources and Livelihood Center is essential especially during the initial period of operation.

**Other Technologies**

FPRDI has developed other technologies, such as furnace-type lumber dryer; cement-bonded board; high pressure sap displacement system; cocolumber; ricehull ash cement hollow blocks; solid wood bending; handmade papermaking; almaciga resin varnish; bamboo collapsible packaging crates; pandan cocooning frames; thermal oil-heated lumber dryer; mechanized charcoal briquetting equipment; sawdust and ricehull carbonizer; fluidized bed combustor for steam generation, and many others.

The Institute actively promotes the technologies developed through investors’ fora, industry dialogues, technology exhibits, radio interviews, TV documentation, and publications.

**Analysis**

It is significant to note that adopters A and B are family owned corporations and managed successfully by husband-and-wife teams. Adopter B has mobilized the immediate members of his family to run the corporation. The spray booth and drying tunnel technology designed by FPRDI staff provided the firms with lower cost equipment, which enhanced their productivity and competitiveness. The willingness of the owners to adopt locally designed equipment resulted in bigger sales, at
the same time enabling FPRDI to extend its support on a periodic basis for potential upgrading.

The positive relationship between the technology generator and adopter demonstrates that Filipino technology is functional and contributes to the viability of the adopter’s business. At the same time, the technology generator maintains continuous links with the adopter. On the other hand, the Provincial S&T Officer and the regional personnel make themselves available for networking and advice.

The availability of the technical services of FPRDI and the DOST regional staff is essential to the long term success of the technology adopter’s business enterprise. Upgrading of technology is a continuing process that is one of the keys to competitiveness. The two adopters demonstrate the relevance of Filipino technology in successful businesses.

Access to opportunities for women and men are present in the furniture firms. However, gender differentiation of tasks depends on the physical strength needed in performing the various jobs. In terms of supervisory/managerial functions, both men and women occupy key positions. On the shop floor, tasks are delineated according to level of physical load and capability. Women are assigned less physically-strenuous work, whereas men are given work that requires strength.

This implies that there is a need to assess the design of equipment in the work situation along gender lines. The manner of performing the tasks, the weight of the materials, and the weight of the machine are some factors that can be considered in redesigning equipment.

On the financial services, both firms employ more women in finance and accounting activities. This may be due to the fact that the nature of this work requires close attention to details and women are perceived to be more patient or meticulous. This indicates that to a certain degree, work assignment is allocated along “suitability” lines—stereotypes that are reinforced by supply of professionals in certain fields of study, e.g., there are more female accounting graduates than male. Thus, one may infer that gender imbalance is influenced by the supply factor as it is by the perception (perseverance/patience) factor.
Region VI: Insights on Technology Adoption

Amelia C. Ancog*

Introduction

To assess the level of technology adoption in the regions, Region VI was selected as the focus of the survey. There were three reasons for this decision: first, the regional director was a former deputy director of TAPI and has a strong technical background (a chemical engineer); second, the networks with local officials were good; and third, the adopters were willing to accomplish the questionnaires.

The following 22 technology adopters returned responses to the questionnaires:

**Province of Aklan**
- Heritage Arts and Crafts
- Rentillo Enterprises
- Handicraft of Aklan MPCI
- Lida's Bricks and Pottery
- Papierus Arts and Crafts

**Province of Antique**
- Antique Federation of Cooperatives (AFCCUI)
- Bagollatri Gemstone Processing Assn.
- Mapatag Life Multipurpose Coop.

**Province of Capiz**
- Sunshine Agri-System, Inc.
- Capiz R Us

**Province of Guimaras**
- Our Lady of the Philippine Abbey

* The author acknowledges with gratitude the assistance of Director Zinnia Teruel, Engr. Ramon Teruel, Senior Science Research Specialist and the following Provincial Science and Technology Officers: Engr. Abraham Fabila, Antique; Mrs. Lea Tubigan, Aklan; Engr. Delia Tabanao, Guimaras; Engr. Ramon Galonga, Iloilo; and Mrs. Emelyn Flores, Negros Occidental.
The research team visited the offices/business sites of four adopters in Negros Occidental, interviewed some officers, and observed the personnel at work.

**Findings**

The adopters use simple technologies such as food processing for canton noodle with squash, banana and mango chips or puree, pickled vegetables, and other ethnic food (fish or shrimp paste) (9); drying of handicraft materials, gifts, housewares, bamboo for furniture, ceramics or pottery (3); plant culture for propagating orchids and ornamental plants (1); dyeing of clothing materials from indigenous material such raffia, abaca, and mats (2); candle making (1); soap making (1); vermicomposting (1); and gemstone processing (1).

The majority have small investments of below P1 million. Only six of the 17 adopters’ investments went beyond P1 million; the biggest was P3.4 million.

Very little information was obtained on revenues/income generated. Three of the six corporations export their products. Four adopters are cooperatives and the rest are individual proprietorships.

The adopters which are owned/operated by individuals generally have a relatively small number of personnel and also rather limited capital compared with those organized as corporations.
Table 7. Gender Distribution in Various Businesses

<table>
<thead>
<tr>
<th>Proprietor/Firm</th>
<th>Management/Adm./Finance</th>
<th>Prod./Quality Assurance</th>
<th>Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>M</td>
<td>F</td>
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<tr>
<td>Mapatag Life Multipurpose Coop</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Oton Straw Mats</td>
<td>3</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Handicraft of Aklan</td>
<td>5</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Far East Bamboo Exports Inc.</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Lida’s Brick and Pottery</td>
<td>2</td>
<td>3</td>
<td>No</td>
</tr>
<tr>
<td>Rentillo Enterprises</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Our Mother of Perpetual</td>
<td>1</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Help, MCPI</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Pio Fajardo</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Jojo’s Noodle Center</td>
<td>3</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Antique’s Fed. of Coop</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Intrax Industrial Sales</td>
<td>6</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Sunshine Agri System</td>
<td>35</td>
<td>22</td>
<td>55</td>
</tr>
</tbody>
</table>

Data obtained from 12 adopters show that 61 percent in management/administration including finance are women, 57 percent are in production/quality assurance, and 43 percent are in marketing (as of September 2000). The data are not comprehensive but nevertheless indicate the predominance of women’s involvement in microenterprises and small enterprises.

Technologies

Technologies were transferred in 1998 and 1999 except for two, which were transferred in 1992 and 1994. They are described by adopters as “easy to use and adopt”, “helpful”, and contributes to the success of the businesses. One company that exports its products asserted that the kiln dryer enhanced productivity since “it reduced the moisture content of the material and accelerated production by 120 days ahead of schedule”. Another stated that the drying technology created awareness of the importance of technology in increasing sales. One successful manufacturer of gifts and housewares stated that the shuttle kiln “lowered the production cost by 60 percent, whereas the handicraft drying chamber lowered the moisture content of the material (pandan leaves) to an appropriate level suitable for export requirements”.

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Technology Modification/Enhancement

Adopters undertook minimal modifications on the technology. These include substitution of syrup for sugar in a fruit juice formulation; use of alternative source of power for drying equipment; and increase in dimensions of equipment to accommodate bigger production volume. Modifications were often done after consulting with the technologists of DOST.

Factors which Facilitate and/or Constrain Effective Technology Transfer

One respondent asserted that the following contributed to successful technology transfer: the technology is simple, viable, easy to adopt; there is large demand for the products; the adopter has technical skills; and residents of the community can be tapped for employment. The factors that constrained effective technology transfer were: limited capital, lack and/or seasonality in the supply of raw materials, seasonality in the demand for products, limited access to markets, lack of trained manpower, absence of institutional markets (big buyers); and limited or unavailable good packaging materials.

Role of Women

About six of the businesses were managed by women, particularly under individual proprietorships. However, the husbands were actively involved in production and sourcing of raw materials. Women were generally responsible for financial management such as handling of funds particularly accounting, budgeting, and disbursement. Both men and women respondents perceived women to be creative, patient, persevering, committed, with a good appreciation for colors and color combinations, and reliable. One respondent stated that, “they are consistent in making decisions, good in targeting markets, and pay close attention to cleanliness”.

Analysis

The technologies adopted in Region VI were generally simple and viable. They were used by microenterprises and small enterprises, which had provided employment to the communities in adjoining areas. The businesses generated by the adopters contributed to countryside development and provided products to local residents and in some instances to adjoining areas. A few exported their products and were organized as corporations with the flexibility to mobilize resources such as financing support from formal lending institutions.
Adopters are change agents since in adopting technologies they introduce methods of manufacturing which enhance productivity and quality of products. They need encouragement to further enhance their capability to enter markets beyond their communities and adjoining areas.

It is significant to note that few adopters improved the technology that was adopted. This may be because the products are locally consumed and expectations are not high. Since only a small number of adopters export their products, efforts must be exerted to motivate other adopters to look beyond the markets in adjoining communities.

Closer interaction with business associations in proximate urban centers, linkages with the DTI, and exploring additional markets for the products will contribute to the success of the enterprises. Furthermore, credit facilities must be accessible to the adopters to enable them to expand their operations and aggressively market their products.

DOST needs to review the technologies that are adopted in the regions and identify niches that can be focused on. Depending on the resources in the communities such as raw materials, potential entrepreneurs, and personpower within and in the adjoining areas, more advanced technologies may have to be introduced in selected areas. Technologies appropriate for microenterprises need not be abandoned; at the same time new and modern technologies must also be considered especially where there are potential opportunities to introduce such technologies.
Findings on the research and development of technologies and technology transfer to entrepreneurs-adopters indicate that simple technologies are generally appropriate for microenterprises. In some instances, such technologies enable the adopters to transform their businesses to bigger enterprises. Adoption of technologies such as food processing of fruits, vegetables or production of canton noodles with squash, drying tunnel/chamber, spray booth, and similar technologies benefited the communities where the adopters are located. Employment was generated, use of tools and equipment for production was learned, formulation of nutritious products was applied, and other technology information and skills were shared by the adopters to their personnel and staff. These are learnings that contribute to an awareness and understanding of the role of technology in improving one’s life.

In the cases studied, technology transfer with the accompanying implicit or explicit knowledge in the technology or transfer agent was not adequate in hastening commercialization and economic development. As earlier pointed out by the policy writers, R&D commercialization is facilitated by the following: (i) demand-driven partnership between research institutions/universities and industry; (ii) availability of R&D funds for small and medium-sized enterprises for product improvement and new product and process development; and (iii) royalty from commercialization of output or other appropriate incentives which will encourage greater involvement in technology application and production activities.

The technologies transferred were generally supply driven; inspired by the mandate of the RDIs and expertise, inclination, and interest of the scientists. An exception was the drying tunnel/chamber, which was developed in close consultation between the client and the researcher. While it may be difficult to expect that scientists will readily and aggressively seek out the private sector to ascertain its technology needs, a mechanism needs to be worked out to allow the technology generators and potential adopters to meet at the research stage so that adopters can
articulate their expectations and scientists can plan their research accordingly.

Operationalizing this approach in enterprises can be done through the collaborative efforts of the RDI, the local/province-based academic institution, and the local government unit. To a certain extent, PCHRD’s annual planning system uses the multisectoral consultative processes. It involves key stakeholders in developing its research agenda.

Nevertheless, the consultation system of DOST’s sectoral councils in developing their research agenda may have to be reviewed so that in formulating the plans and programs, effective linkages can already be initiated between the technology generator and the technology adopter. Likewise, representatives from government financial institutions, which are mandated to provide credit facilities to technology-based enterprises must also be invited to participate in planning and program formulation. It is important that all sectors concerned are made aware of the requirements for credit assistance and loans of microenterprises or SMEs.

Techno-based microenterprises deserve much support from RDIs, government financial institutions, and big enterprises because they will ultimately grow into medium and big companies. Opportunities to enhance their capabilities with the right quantity and quality of resources, finance, technical information, and technical services must be considered a priority concern.

The Philippines can learn from the Cooperative Research Centres (CRCs) of Australia. The CRCs are institutions that undertake projects through the joint efforts of RDIs and the private sector. The R&D Start (Strategic Assistance for Research and Development) of Australia provides assistance of up to 50 percent of project costs for smaller Australian companies through grants for R&D projects and through loans, for the early commercialization of technological innovations (Core Start).

The extensive experience of Stanford University in commercializing research outputs is worth considering. At the initial phase of research, the University brings together the scientist and funding-manufacturing enterprise to collaborate on the successful conduct of R&D and commercialization of the process or products resulting from the research activities. Sharing of intellectual property rights and other terms of the relationships are agreed upon at the beginning of the research endeavor.

While there are incentives for investments in R&D on selected areas under the Investments Incentives Act (science parks, biotechnology,
information technology), the financing for product or process improvement for microenterprises or small industries is not readily available. In addition, assistance to microenterprises involved in the use or enhancement of technologies is not normally funded by lending institutions. Collateral requirements are difficult to comply with since only a few businesses own real estate (land and/or buildings).

Royalty payments are not generally expected by DOST for simple technologies that are transferred to adopters. To a large extent, DOST subsidizes the visits of technologists and experts to train, impart, and demonstrate the use of the technology. It will be noted that the royalty for the production of the canton noodle with squash is very minimal and consists merely of a lump sum payment. On the other hand, the royalty for producing herbal medicine products, particularly *lagundi* and *sambong*, is very modest with a very short period of payment of 3 to 4 years.

A salient dimension of the IPR policies of DOST is its transparency and clarity. The policies also include continuous advice when needed as well as the confidentiality of business data of the adopter. The IPR provisions serve as incentives to scientists and investors. Nevertheless, there is a need to disseminate these guidelines to a wider audience, specifically entrepreneurs to entice them to adopt technologies in their operations.

At the regional level the data indicate that generally, simple technologies are adopted by microenterprises and some small and medium enterprises. In terms of exports, two firms have been quite successful in finding foreign markets. Their products are of high quality and are much in demand in European markets. Both use indigenous materials and creative designs, which the buyers find unique and irresistible. These firms have corporate structures and are therefore able to mobilize financing and other resources for their business activities.

Microenterprises are good instruments for increasing the income levels of the owners and also as a source of learnings on the use of technology by community residents. The Chennai Declaration addresses the alleviation of the poverty of women through the use and application of technology. In this regard, microenterprises are good vehicles for addressing the problems of poverty. Most microenterprises are initiated by women, who are quite successful in raising capital, using indigenous materials, and mobilizing community members and resources. In addition to the qualities attributed to women such as perseverance, attention to
detail, and commitment, Filipino women in general are the holders of purse strings. As the data indicate, they serve as treasurers, budget officers, cashiers, and quality controllers of the firms/businesses where they work.

Technologies are easy to adopt and understand, respondents unanimously aver. Some respondents improved/enhanced the technologies to suit their business requirements. Some concerns that may require consultation with the technology generator involve redesigning simple equipment or substituting raw materials for processing food products. A monitoring system can be established by DOST so that appropriate enhancements and improvements can be undertaken quickly. This will enable the adopters, particularly those with limited resources, to avail of support services to strengthen their production capability.

The review group on the National Drug Policy expressly recommended that more areas be devoted to the cultivation of herbal plants, that additional herbal processing plants be established, and that information on the use of herbal medicine be disseminated. There are private firms, which are now successfully producing herbal products and others are waiting in the wings to commercialize additional products arising from the outputs of NIRPROMP. This Program should receive continuous support and encouragement. It showcases a multidisciplinary approach to drug development as well as the participation of women scientists, researchers, and technologists in R&D and technology transfer.

The R&D and technology development for nutritious food is female dominated. The entry of a well-known restaurateur in canton noodle (squash) commercialization indicates the potential of locally developed products from indigenous materials reaching wider markets. On the other hand, the entrepreneurial skills of a rural-based adopter, including her networking capability, show that a good technology can prosper in the hands of a committed and resourceful woman. The support system that DOST extended to both adopters is an important factor in the success of these entrepreneurs.

The firms using forest products technology likewise benefited from the collaborative efforts between the technology adopter and technology generator. Undoubtedly, accessibility of the scientist to the adopter enhances the technological capability of the latter.

Women as entrepreneurs coown the firms with their spouses. They handle the finance aspects of the business, while the husbands oversee
the production activities. At the shop level and production line, men outnumber women in work assignments which require the lifting of heavy equipment or materials. This has an implication on the future design of equipment or technology, which must be made more gender-friendly.

Women have participated actively and widely in R&D, technology transfer, and commercialization. Excellent research such as those pertaining to herbal medicine and nutritious food products were generally undertaken by women. Likewise, their role in enterprise management, production, and quality assurance particularly in the region is relatively high compared with men. The broad and active participation of women scientists and researchers in the NIRPROMP and nutritious food technology speaks well of the commitment of women to research which could result in successful commercialization activities.

Continuous monitoring and documentation of the participation of women in research, technology transfer, and commercialization are essential to ensure that the gains in gender equity are not eroded in the future.
Several policy initiatives may be considered to enhance technology commercialization. These are: (1) assessment of program and projects of RDIs vis-a-vis the private sector’s needs; (2) review of financing structures/mechanisms for technology adoption and commercialization; (3) continuous upgrading of entrepreneurial and technology use capability of technology adopters; (4) assessment of human resource development for scientists and researchers; and (5) review of conflict of interest principle in relation to participation of scientists in R&D commercialization.

The relationship between the private sector and RDIs must be assessed to ensure that the former’s needs are taken into consideration in developing R&D programs. More focused demand-driven R&D programs will facilitate the commercialization of research outputs. In this regard, the role of the private sector representative in the S&T sectoral councils needs to be reviewed to strengthen his/her role in advocating focused, responsive, and critical projects. Strategic alliances between the private sector, RDIs, and academic institutions, which in other countries are called R&D cooperative programs, need to be explored. Pooling of resources is vital specially in developing projects that are capital intensive.

The availability of financial support/credit facility for technology adopters especially those involved in microenterprises and small and medium enterprises must be assessed. The collateral requirements of financing institutions for loans of microenterprises need to be reviewed. Flexible and liberal lending policies for microenterprises that use technologies or improve or enhance technologies will enhance their capability to improve productivity and expand their markets. In addition, credit schemes that are creative and supportive of technology adoption and enhancement will go a long way toward ensuring the competitiveness of technology adopters.

Continuous upgrading of the entrepreneurial skills and use of technologies by microenterprises collaboratively undertaken by TAPI, DTI, appropriate private sector organizations/associations, and local
government units must be supported fully by the national government. The Manufacturing and Productivity Extension Program (MPEX involves consultancy services provided by a team hired by TAPI and a modest counterpart support from the firm to assist the enterprise improve its productivity) should be extended to a bigger number of microenterprises.

A practical human resource development program for scientists and researchers on entrepreneurship and intellectual property rights will broaden their perspectives on commercialization. Opportunities for interaction between scientists and businessmen should be created in joint fora and consultations and in an exciting arena of technology and enterprise development and commercialization.

Dialogues and informal discussions involving multisectoral representatives should be continued by the DOST in collaboration with industry associations, academic institutions, and policymakers. These productive exercises can help process ideas and proposals for cooperative endeavors.

A review of the conflict of interest principle as it applies to scientists in the public sector who invest in companies that commercialize their technology must be undertaken. Other countries in the region have liberal policies, which allow scientists to invest in the commercialization of their technologies. However, there is a need to balance ethical principles with the purpose of fostering greater technological creativity and rewarding the efforts of scientists.

On gender equality, women’s role in R&D technology generation and adoption may be enhanced by supporting associations/organizations that foster excellence in R&D and technology commercialization. Career paths for key and senior positions for women scientists may be improved by increasing the assignments/appointments to significant positions.

Continuing activities on data collection, segregation, and analysis on gender equality must be supported by both the public and the private sectors. Regular monitoring of compliance by government agencies in providing funds for gender programs will enhance the involvement of women scientists, researchers, technologists, and other women in technology transfer activities. The information generated by these activities will enable the country to continue with good practices on gender or initiate new ones that will be consistent with our commitment to gender equality and equity.
APEC has approved the integration of gender in its projects, processes, and activities. In addition, UNESCO recognizes that mainstreaming gender is one of its significant and major commitments. It further declares that mainstreaming a gender perspective is “the process of assessing the implications for women and men of any planned action including legislation, policies, and programmes, in any area and at all levels.” UNESCO further asserts that the “injustice created by inequalities based on gender/sex discrimination threatens in the long run not only the discriminated gender but the entire society.” Since the Philippines is a member of APEC and a Charter member of the United Nations, enhanced policy reforms and initiatives on gender will bring forward the creativity and support of the country to its commitments to APEC and UNESCO.

The efforts undertaken by our women scientists, researchers, technologists, and entrepreneurs and the roles they fulfill are inspiring. It is essential that these endeavors receive appropriate encouragement from the government and other sectors. Thus, the government and appropriate institutions should initiate and support with greater vigor significant innovations on gender equality in terms of gender-friendly legislation, policies, and programs.
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Books, Periodicals and Reports


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Other Sources of Information

Interviews with:
- Dr. Pacita Zara, Executive Director, PCHRD
- Dr. Corazon Barba, Director, FNRI
- Dr. Magdalena Cantoria, Academician, National Academy of Science & Technology (NAST)
- Dr. Horacio Estrada, Project Leader, NIRPROMP
- Dr. Francis Wade Gomez, Consultant, Altermed Corporation
- Dr. Conrado Oliveros, Director, Region III, DOST
- Dr. Quintin Quintanar, Academician, National Academy of Science & Technology (NAST)
- Dr. Isidro Sia, Program Coordinator, NIRPROMP
- Dr. Zinnia Teruel, Director VI, DOST
- Dr. Florentino Tesoro, Director, FPRDI, DOST
- Dr. Carlos Tomboc, Director, PTRI
- Engr. Rolando Viloria, Director, MIRDC

Interviews with: Supervisors and Staff of FNRI, FPRDI, PTRI, Region III, Region VI, technology adopters, selected numbers of NIRPOMP, S&T Planning Officers of DOST, and selected customers.

Interviews with adopters or their representatives: Glenda Baretto, Delia Lumanas, Violeta Tubil, Abel Tanhueco, Andres Torres, Rosita Torres, Salustiano Enriquez, Anita Feria, Nora Lamata, Liambert Tongson, Crispina Lachica, Jose Henares, Pamela Henares, Leslie Roldan, Javier Legaspi, Ronces Ababao, Teresita Zayco, Ferlina Gawan, Rex Galero, Felix Galero, Joyce Tobias, Lerma Huelar, Casimiro Villacorta, Celia Peralta, and Peter Patiño.
Appendix 1
Technology Transfer Guidelines of PCHRD

1. Coverage
1.1. These principles will be used for product-based technologies ready for commercialization, generated from DOST and PCHRD-assisted projects.

2. Guiding Principles
2.1. PCHRD’s overriding role in technology transfer is that of a broker or a facilitator. It shall consider returns on project investment when the technology is already commercially viable.

2.2. As a matter of principle, technology transfer provisions should be incorporated in the MOA drawn up at the start of any project.

2.3. In cases of multiple donors/funding agencies, any income accruing from the project shall be divided among donor agencies based on agreed upon sharing formula.

2.4. Selection of adopter will be determined by all parties who had a hand in the project conceptualization to its implementation based on a previous agreement.

In the absence of a previous agreement, the deciding body will be composed of individuals who had substantial exposure to the project. Business and legal inputs will be given primary consideration.

Should the inventor be among the parties interested to commercialize the technology, all things being equal, he will be given first preference.

2.5. Selection of the adopter is on a negotiated contract basis.

2.6. All of the following shall guide the selection of business entity as adopter.

2.6.1 Formal written intent to commercialize technology Enclosure should include the company profile, SEC Registration and corporation papers.

2.6.2 Entrepreneurs who uphold ethical manufacturing practices.
2.6.3 Entrepreneurs who are financially capable of commercializing the technology.

2.6.4 Entrepreneurs with technical expertise on the transferred technology.

2.6.5 Entrepreneurs with proven track record and good management skills.

3. Guidelines in the Selection of Technology Adopters (PCHRD)

3.1. Basic principles and policies. The State, through the Department of Science and Technology shall support, encourage and promote the following:

a. application and utilization of results of scientific and technological activities that contribute to national development;

b. regulatory mechanism(s) for technology transfer arrangements for national benefit. It shall encourage the greatest participation and initiative of the private sector in the utilization of science and technology;

c. public and private sector partnership(s) aimed at accelerating self-reliance in selected areas;

d. recognition and implementation of intellectual property rights for S&T innovations, and;

e. confidentiality of all technology transfer arrangements subject to national interest.

3.2. In carrying out its technology transfer activities, the PCHRD staff are bound by the Code of Conduct and Ethical Standards for Public Officials and Employees as embodied in RA 6713.

3.3. In addition to the provisions of DOST Memorandum Circular No.002, Series of 1991, on Guidelines on Technology Transfer Arrangements in the National Research and Development systems, the PCHRD also subscribes to the Guiding Principles in the Selection of Technology Adopter which was approved by the PCHRD Governing Council.
Appendix 2.
DOST MEMORANDUM CIRCULAR NO. 002
Series of 1992

SUBJECT: GUIDELINES ON TECHNOLOGY TRANSFER ARRANGEMENTS IN THE NATIONAL RESEARCH AND DEVELOPMENT SYSTEM

Pursuant to Executive Order No. 128, dated 30 January 1987, the Department of Science and Technology hereby promulgates these guidelines on technology transfer arrangements in the National Research and Development System (NRDS). This is in response to the need to strengthen technology commercialization and utilization especially in the countryside.

PART I
TITLE AND COVERAGE

Section 1. Title – These guidelines shall be known as the “Guidelines on Technology Transfer Arrangements in the National Research and Development System.”

Section 2. Coverage – These shall cover all technology transfer arrangements entered into by member agencies and institutes of the National Research and Development System with public or private clients whether domestic or foreign. These shall involve transfer of technologies where premium for private worship exists. Technology transfer arrangements, singly or in combination, shall include:

Sale – There is sale when the owner transfers ownership and delivers a technology or any copyrightable work to another in consideration of a price certain in money or its equivalent. The legal act for this arrangement shall be evidenced in the form of a legal document referred to as “Contract of Sale”.

Assignment – There is assignment when the entire right, title or interest in and to the patent and invention covered thereby
or of an undivided share of the entire patent and the
invention or of the entire copyright and the work covered
thereby are transferred to another. The assignment may be
onerous or gratuitous and may be limited to a specified
territory only. The legal act for this arrangement shall be
evidenced in the form of a legal document referred to as a
“Deed of Assignment”.

Licensing – Involves the granting or permission to a client to
perform in a country and for a limited period, one or more
acts which are covered by the exclusive right of the owner of
the intellectual property. The legal document showing the
permission granted by the owner of the intellectual property
is referred to as a “License Contract.” License is granted
subject to the terms and conditions set out in the contract by
which the license is granted.

Know-how Agreements – Know-how refers to all manufacturing
knowledge as communicated in writing or a comment that is
either separate from or may be included in license contract by
the owner or holder of the know-how to the client or recipient
of the know-how. Know-how may take the following forms:

(a) Technical information or data – tangible know-how which
could be transmitted in such forms as documents,
photographs, blueprints, computer cards, microfilms, plans
of factory buildings, diagrams of the layout of equipment,
diagrams or blueprints of machines, lists and specifications
of spare parts, operating or assembly manuals or
instructions, process flow charts, and other similar tangible
forms. Provisions concerning transmittal of this know-how
shall be the subject of a “Technical Information Contract”.

(b) Technical services – intangible know-how relating to the
demonstration of, or advice on manufacturing and other
operations, which is the subject of a “Technical Services
Contract”.

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(c) Technical assistance – intangible know-how relating to training, which is the subject of a “Technical Assistance Contract”.

(d) Management services – intangible know-how consisting of the actual direction or management of manufacturing or other operations over a certain period, which is the subject of a “Management Services Contract”.

PART II
BASIC PRINCIPLES AND POLICIES

Section 3. Basic Principles and Policies – The State, through the Department of Science and Technology, shall support, encourage and promote the following:

3.1 Application and utilization of results of scientific and technological research and development activities that contribute to national development;

3.2 Regulatory mechanism(s) for technology transfer arrangements for national benefit. It shall encourage the greatest participation and initiative of the private sector in the utilization of science and technology;

3.3 Public and private sector partnership(s) aimed at accelerating self-reliance in selected areas;

3.4 Recognition and implementation of intellectual property rights for S&T innovations;

3.5 Confidentiality of all technology transfer arrangements subject to national interest.
PART III
DEFINITION OF TERMS

Section 4. Meaning of Terms – For purposes of these guidelines, the following definition of terms shall be adopted:

4.1 National Research and Development System (NRDS) – Refers to the Department of Science and Technology and its agencies and other government agencies including the academe which are acknowledged by DOST as members of such and take active part in identifying, formulating, implementing, and monitoring the major thrusts, programs and projects of DOST as reflected in the Science and Technology Master Plan (STMP) and National Technology Agenda.

4.2 DOST – Refers to the Department of Science and Technology and all its agencies and institutes pursuant to Executive Order No. 128.

4.3 Technology Transfer Arrangement – Contract or agreement involving the systematic transfer of knowledge for the manufacture of a product, application of a process or rendering of a technical service, including the sale, assignment, or licensing of all forms of intellectual property rights.

4.4 Intellectual Property – Legal rights resulting from intellectual activity in the industrial, scientific, literary, or artistic fields. Intellectual property includes Industrial Property and Copyright.

4.5 Industrial Property – Includes inventions, utility models, industrial designs, trademarks, trade names, and service marks as defined under the Philippine Patent Law.

4.6 Copyright – The exclusive and legally secured right to the matter and form of literacy, scholarly, scientific, and artistic works resulting from intellectual creation, as provided for under applicable laws in the country.
4.7 Owner/Licensor – The NRDS agency to which the technology, intellectual property or services belong or is assigned and which undertakes technology transfer arrangement with the client/licensee.

4.8 Client/Licensee – Any person or legal entity undertaking technology transfer arrangement with the NRDS.

4.9 Strategic Technologies – technologies or intellectual properties classified by DOST as such relative to the thrusts, priorities, and programs as reflected in the STMP and National Technology Agenda.

PART IV
MECHANISMS FOR TECHNOLOGY TRANSFER ARRANGEMENTS

Section 5. Mechanism – All technology transfer arrangements shall be effected through a Memorandum of Agreement or Contract which shall embody the terms and conditions of the arrangement. As much as possible, sale or licensing contracts shall be secured through Bidding. However, Negotiated Contracts shall be allowed for projects involving “strategic technologies” as defined by DOST. Technology transfer arrangements shall follow the procedures and criteria specified in Annex A of this Circular.

5.1 Technology transfer arrangement proposals covering sale, assignment or licensing contracts shall be submitted to the DOST Executive Committee for evaluation and approval, taking into account the technical, economic, and legal aspects of the arrangement.

5.2 The DOST Execom shall designate a central processing unit which will maintain all records/transactions involving technology transfer arrangements.
5.3 Technology ownership and its proprietary considerations shall be governed by the appropriate provisions of existing DOST guidelines on intellectual property rights.

5.4 Any changes in the agreement or contract shall be upon mutual agreement of each party, either for project modification, expansion or termination with corresponding amendments or supplements in the agreement or contract as may be necessary.

5.5 Either party shall be liable for failure to observe or perform any provision of the agreement or contract, provided that such failure is not caused by any law, rule or regulation of any constituted public authority or beyond the control of the party in default.

Section 6. Official Authorized to Enter into a Memorandum of Agreement/Contract. The following are authorized to enter into a technology transfer arrangement with a client:

(a) The Department Secretary or his designated representative
(b) Director of the Institute
(c) Executive Director of DOST Council

Section 7. Provisions of the MOA/Contract. The following shall be included in the agreement or contract:

7.1 Definition – The agreement or contract shall define the technology, know-how or intellectual property to be transferred/utilized, the particulars or technical assistance and services to be rendered by the owners/licensors, as well as the manner in which the technology and technical services would be provided. The manner in which the technology is utilized by the client/licensee shall also be spelled out in the agreement or contract.

7.2 Responsibilities of Parties – It shall embody the specific responsibilities and obligations/contributions of the
owner/licensor and the client/licensee. This shall cover provisions on considerations, warranties, improvements, and developments, disclosures, infringement, arbitration, and termination.

7.3 Remuneration – To help determine the “price” or “cost” of transferring the technology, the NRDS agency may be guided by the following:

- scope, complexity and pioneering nature of the technology;
- importance of the technology in relation to the technology recipient’s overall activity;
- degree of mastery of the technology by the technology supplier;
- stage of the licensed product in the product life cycle;
- use of indigenous raw materials and services, energy savings, level of priority of the licensed activity;
- employment generation;
- export earnings and its effect on the balance of payments;
- spill-over of technology to local industry;
- technology supplier’s share in the technology recipient’s profit; and
- royalty approved for the industry under which the licensed product is classified.

The compensation for technology transfer arrangements shall take the form of:

7.3.1. Direct monetary compensation which may be singly or combined.

(a) Lump-sum payment – a precalculated amount to be paid once or in installments depending on the mode of payment agreed upon between the parties for the outright acquisition of intellectual property rights.
(b) Royalties – recurring payments, determined as a function of economic use or result (e.g., volume of production, sales price of the product, or profits of the client/licensee) of technology utilization. In general, the royalty base is determined either in terms of net sales, i.e., invoice value based on actual sales minus trade, quantity, or cash discounts and broker’s or agent’s commission, if any; return credits and allowance; tax or other government charges; and freight, insurance, and packaging cost or in terms of gross sales as may be agreed upon by both parties. The royalties shall be ascertained either on a percentage basis or as a fixed value.

(c) Fees – compensation for services or assistance rendered by technical or professional experts of an NRDS agency, fixed at a specified amount or calculated per person and per period of service. These may be combined or incorporated in a technology transfer arrangement.

7.4 Duration and Renewal - The duration of the agreement or contract shall be based on the adequacy of period for full absorption of the acquired technology, know-how or intellectual property by the client/licensee. For licensing contracts, it shall be from a minimum of 5 years to a maximum of 10 years, renewable for another period as the parties may deem necessary until the full absorption of the technology, know-how or intellectual property could be realized. If the life of the patent extends beyond the duration of the agreement or contract, an appropriate arrangement must be clearly provided for.

7.5 Training – In cases of training or technical assistance, the number of personnel to be trained, the areas of training and its duration, the facilities needed as well as the expenses to be incurred shall also be defined and made part of the agreement or contract.
7.6 Patents/Copyrights – In case the intellectual property is patented or copyrighted, the rights of the client/licensee over the intellectual property shall be explicitly defined in the agreement or contract.

7.7 Confidentiality/Secrecy – A clause relating to confidentiality of information shall be incorporated in the agreement or contract. It shall, however, be confined to the duration of the agreement or contract. A sample of a Contract of Non-Disclosure which can be used during the negotiation stage is shown in Annex B of this Circular.

7.8 Exclusivity – A clause relating to the exclusive use of the technology may be incorporated in the agreement or contract but not restrictive clauses as defined by the Bureau of Patents, Trademarks and Technology Transfer. The extent of exclusivity may be determined by the following factors:

(1) whether the development of the technology or intellectual property was solely funded by the DOST or subsidized by interested client/licensee;

(2) the client/licensee’s resources, e.g., organization, capital, and logistics to support the technology transfer process and its marketing network to distribute the product;

(3) the demand and need for the product; and

(4) nature of the product.

7.9 Utilization of Income – Utilization of revenue generated from technology transfer arrangements shall be governed by existing AOs on intellectual property, honoraria and fees, and accounting and auditing rules and regulations.
PART V
MONITORING AND COORDINATION

Section 8. To ensure the systematic coordination and monitoring of technology transfer arrangements, the NRDS agency undertaking the activity in the region shall inform the Regional Office and furnish them copy of the agreement or contract. The NRDS shall also submit copy of the approved agreement or contract to the appropriate DOST Council or the DOST and shall submit progress reports of the arrangement(s) when necessary.

PART VI. FINAL PROVISIONS

Section 9. Retroactivity – Agreements or contracts entered into before the effectively of this Memorandum Circular shall remain in force unless revised or amended.

Section 10. Effectivity – This Circular shall take effect and shall supersede Administrative Order No. 86-05 and all previous orders and issuances inconsistent with this Memorandum Circular.
SUBJECT: ESTABLISHING ADMINISTRATIVE MECHANISMS FOR ACQUISITION, TRANSFER AND ENFORCEMENT OF INTELLECTUAL PROPERTY RIGHTS IN THE NATIONAL R AND D SYSTEM

I. RATIONALE

With the increasing number of R&D intellectual properties, expanded technology transfer and commercialization activities and implications of worldwide developments particularly the GATT-TRIPS agreement, there is an urgent need to provide appropriate administrative mechanism for the acquisition, transfer and enforcement of intellectual property rights for DOST-generated/supported technologies.

Administrative Order No. 85-11 earlier prescribed guidelines governing intellectual properties resulting from research and development projects in the DOST system. However, changes in the IPR system in the country as well as the nature and scope of private sector involvement in R&D activities necessitate that amendments be introduced so that a responsive and relevant IPR system can be in place at DOST. Hence, this Memorandum Circular amends/supersedes Administrative Order No. 85-11 dated September 1985.

II. SCOPE

This Memorandum Circular shall govern the intellectual property rights (IPR) protection of discoveries, inventions/innovations, utility models, industrial designs, copyrights and other related IPR resulting from DOST-directed, DOST-assisted and contract R&D projects of DOST and its agencies and councils.

III. GUIDING PRINCIPLES

1. Intellectual properties resulting from research undertaken through DOST and supported with government funds belong as a matter of right, to the Government of the Republic of the Philippines.
2. Staff member(s) who achieve or produce intellectual properties are entitled to financial or other awards, bonuses and/or prizes from the DOST in accordance with pertinent provisions of the Science Act of 1958, Executive Order No.784 of 1982, Executive Order No 128 of 1987, and RA No. 8439 or the Magna Carta for Scientists, Engineers, Researchers and other Science and Technology Personnel in the Government.

3. Intellectual properties belonging to the DOST and its attached agencies may be used by the public and private sectors subject to the provisions of this Memorandum Circular.

4. The DOST shall, in undertaking contract research and development projects, with the private sector, treat results thereof as confidential for a specific time frame as provided for in the individual contracts covering the research activities.

5. DOST-assisted research and development projects shall be governed by a MEMORANDUM OF AGREEMENT between the DOST and the Proponent embodying therein, among other things, pertinent provisions of this Memorandum Circular as part thereof.

6. Contract research and development projects shall be governed by contracts between the DOST and the Client/Cooperator embodying therein, among other things, pertinent provisions of this Memorandum Circular as part thereof.


**IV. DEFINITION OF TERMS**

For the purpose of these guidelines:

1. DOST refers to the Department of Science and Technology and/or its agencies pursuant to Executive Order No.128.

3. Copyrights means the exclusive and legally secured right to reproduce, publish and sell the matter and form of literary, scholarly, scientific and artistic work. (Part IV, RA No. 8293)

4. Invention means any technical solution of a problem in any field of human activity that is new, involves an inventive step and is industrially applicable. It may be, or may relate to a product, or process, or any of the foregoing. (Sec. 21, RA No. 8293)

5. Utility model means any technical solution of a problem in any field of human activity and which is new and industrially applicable within the contemplation of the above statute. (Sec. 109, RA No. 8293)

6. Industrial design means any composition or lines or colors or any of three-dimensional form whether or not associated with lines or colors: provided, that such composition or form gives a special appearance to and can serve as pattern for an industrial product, or handicraft within the contemplation of the above statute. (Sec. 112, RA No. 8293)

7. Patent means a grant issued by the Philippine Government giving an inventor, maker or designer the right to exclude others from making, using or selling his invention, utility model or design within the Philippines during the term of the patent. (Sec. 71, RA No. 8293)

8. DOST-directed research means any research and development activity undertaken by staff members of DOST using DOST funds and resources.
9. DOST-assisted research means any research and development activity supported financially and/or in kind, wholly or partly by the DOST and undertaken by any person, or entity, private or public other than the DOST.

10. Contract research means any research and development activity undertaken by DOST which is fully or partly financed by any person or entity, private or government, other than DOST.

11. Full contract research shall mean any research and development activity undertaken and totally funded by the client.

12. Technical staff members means technical or scientific staff of DOST-directed, DOST-assisted, or contract research projects.

13. Research or Research and Development shall refer to scientific investigations or activities whether DOST-directed, DOST-assisted, or contracted.

14. Proponent means any institution-public or private undertaking a DOST-assisted research and development project.

15. Client shall refer to the individual or entity providing full funding for a research and development project.

16. Cooperator shall refer to the person or entity providing partial support in the form of funds, man-hour, building and equipment for a research and development project including the DOST as such.

V. INTELLECTUAL PROPERTY RIGHTS COMMITTEE

An Intellectual Property Rights Committee (IPRC) shall be established in each DOST agency. This committee shall consist of at least five (5) members with the Director/Executive Director of the R&D
Institute (RDI) /Council as Chairman. Other members of the IPRC shall be selected from among the technical division chiefs of the council/institute by the Chairman. In cases where the R&D project was funded by a DOST council but implemented by the R&D Institute (RDI) the IPRC of the Council which will include as an additional member the Director/Executive Director of the RDI, will oversee compliance with IPR guidelines and manage intellectual properties.

The IPRC shall:

1. Require technical staff members undertaking research projects to:

1.1 Bind himself/herself, his/her heirs, successors and assignees THAT all intellectual properties pertaining to or resulting from or suggested by:

(a) any work which he/she has conceived or made or may conceive or make with respect to the project, or
(b) any of the matters which has been or may be the subject of experimentation or investigation during the period or in connection with his/her employment at DOST, or contract with the Proponent and/or Client/Cooperator, shall be the property of DOST, Proponent and/or Client in accordance with Section IX. hereof.

1.2 Assign to the DOST, Proponent and/or Client/Cooperator all his rights, titles and interests in any and all such intellectual properties and to that end, shall sign any and all instrument of undertaking, assignment, waiver or transfer which the DOST, Proponent or Client/Cooperator may cause to be done from time to time in order that the interest hereof may be fully carried into effect.

1.3 Not cause the filing of application for patent, publish, disclose, or deliver to any person or
any entity present in conferences whether local or foreign, any information and data in his/her possession by virtue of his/her membership in the Technical Staff, without prior written authorization from the DOST, Proponent, and/or Client/Cooperator.

1.4 Submit a sworn statement to the DOST, prior to his/her assumption of duties, a list of patents or patent rights, discoveries, inventions, innovations, and industrial designs belonging to him/her, so that he/she cannot later on claim to own a project or rights thereto in case a similar or related project is conceived and made by the DOST, Proponent and/or Client/Cooperator.

1.5 Not directly or indirectly engage himself in another research project based on substantially the same work as the DOST-directed, assisted and/or contract research and development projects, during his/her employment in such project.

1.6 Assist the DOST, Proponent and/or Client/Cooperator in obtaining and enforcing patents and copyright for the benefit of the DOST, Proponent and/or Client/Cooperator covering the discovery, invention, innovation (utility model), industrial design and other scientific works in the Philippines and selected foreign countries, and to that end, execute and deliver to the DOST, Proponent and/or Client/Cooperator any and all instruments and documents which may be requested of him, and to continue this obligation as well as any service needed with the prosecution of any application or patents, and any interferences and/or litigation involving the same or any patent or
patents issued therefrom even beyond the termination of his/her employment with the DOST, Proponent and/or Client/Cooperator.

2. Maintain a data base on IPR applications, patents/copyrights obtained and technology transfer transactions completed by the agency

3. Provide the agency designated as depository for IPR, copies of patents, copyrights, deeds of assignment, licensing agreements, etc. For this purpose, TAPI which is the implementing arm of RA 7459 is designated as DOST depository of IPR.

4. Evaluate the invention as disclosed in the disclosure form (Annex 1) and accordingly make recommendations as to the desirability of seeking IPR protection.

5. Check authenticity of inventorship in the patent application papers of the technical staff members prior to the filing of the patent application.

6. Coordinate with TAPI with regard to the identification of clients/possible adopters, promotion and other matters pertaining to technology transfer and commercialization.

7. Provide assistance in the negotiation and preparation of technology transfer documents.

8. Ensure that the incentives provided for in the IPR guidelines are given to the right persons.

9. Ensure that the mission of the council/agency take precedence over patent consideration or personal financial interest.

VI. PROCEDURES IN OBTAINING AN IPR PROTECTION

1. Whenever any staff member makes a discovery or an invention, a report must be made using disclosure form indicated in Annex
1 and submitted to the IPR Committee. The disclosure form may also be used to report a technology that may no longer be patentable but may be protected by other means.

2. The IPR Committee evaluates the disclosure and makes recommendations.

VII. RULES OF NEGOTIATION AND LICENSING

1. Any technology/invention ready for transfer and commercialization may be offered to prospective buyers/adopters through publications, investors for among others.

2. Initially, the owner/seller should not provide detailed information or enabling disclosure to the prospective buyers.


4. Nonexclusive licenses which allow several adopters/companies to commercially exploit the technology/invention are encouraged but in some cases, an exclusive license may be necessary to provide an incentive for a company to undertake commercial development and production.

VIII. RIGHTS OF STAFF MEMBERS

A. DOST-directed Research Projects

1. Staff members, who are directly involved in bringing about the discovery, invention, innovation (utility model) or industrial design and who are listed as inventors, makers or designers in the letters patent shall be entitled to receive forty percent (40%) of all royalties and other benefits resulting from the licensing of IPR from such activities.

2. The implementing agency shall be entitled to 25% of royalties while the funding agency receive 35% of the royalties.
3. The staff member shall receive the incentive and/or financial award only upon receipt of the funding DOST Agency of the royalties and all other above benefits PROVIDED that such member has not violated and has religiously complied with all the obligations imposed on him/her by provisions of Item V hereof, PROVIDED FURTHER patents and copyrights of all DOST-directed research projects and all interests or rights that may arise thereto shall be assigned to the funding DOST agency.

B. DOST-assisted Research Projects
   B.1. Fully Funded
      B.1.1. Staff members shall be entitled to 40% of the royalties resulting from the commercialization of the IPR from the above projects.
      
      B.1.2. DOST shall be entitled to 45% and the proponent entitled to 15% of royalties.

   B.2. Partially funded
      B.2.1 Staff members shall be entitled to 40% of the royalties and the remaining royalty shared proportionally between DOST and the proponent based on actual investments made on the research project.

C. Contract Research
   The client, cooperator, DOST and staff members shall share royalties as indicated in the contract.

IX. STIPULATIONS TO BE EMBODIED IN THE MEORANDUM OF AGREEMENT
   1. Intellectual properties of DOST-directed research projects shall be exclusively owned by DOST.
   
   2. Intellectual properties of contract research projects shall be jointly owned by DOST and the Cooperator.
   
   3. Intellectual properties of DOST-assisted project shall be owned by DOST if full funding was extended. For DOST-assisted research
with cost-sharing arrangement, the intellectual property shall be jointly owned by DOST and the Cooperator.

4. The Proponent shall undertake the research and development project and devote as much time effort to it as is reasonably required and within the limits of the funds allotted for the purpose.

5. The Proponent shall make available to the DOST, cooperator and/or the client all significant information obtained through work on the research and development project and communicate promptly and without request, all information which he or she deems pertinent to the project through progress reports as required.

6. The Proponent shall keep complete and systematic logbooks, including notes on all experimental work, descriptions, diagrams and other data made while working on the said project. These log books shall be available for inspection by the DOST cooperator and/or client at any reasonable time.

7. The Proponent shall ensure that each of the staff members of the project enter into a contract of employment embodying therein, among other things, pertinent provisions of this Order.

8. The Proponent shall make known to the DOST cooperator and/or client of any discovery, invention innovation (utility model) and industrial design relating to or arising from work on the research project made by any of his staff members. Upon the request of the DOST, cause his or its staff members to execute all necessary papers to facilitate patent applications in the Philippines and/or foreign countries whenever applicable.

9. The Proponent shall submit to the DOST all contract concerning the sale of his/her or its patents/other intellectual properties or concessions of license arising from the research project and not to enter into any contract without obtaining the written consent of DOST.

10. The Proponent shall incorporate the provisions of the Memorandum Circular in any contract he/she may enter into,
be it sale of patents or concessions of license of all nature and to stipulate that the buyers and concessionaires shall pay directly to the DOST the aforesaid royalties.

11. The Proponent shall refrain from conducting for any other person or entity during the term of the research and development project, investigation within the specific scope of such research unless specifically authorized in writing by the DOST.

12. The Proponent shall refrain from publishing or making known to others the result of the research information without prior written approval of the DOST.

X. DEPOSITORY FOR THE IPR DOCUMENTS

The Technology Application and Promotion Institute (TAPI) as the implementing arm of the Department of Science and Technology (DOST) in promoting the transfer and commercialization of technologies is hereby designated as the depository of DOST IPR documents. In this designation, TAPI shall establish and maintain appropriate information system for use by clientele.

XI. EFFECTIVITY

Provisions of previous administrative orders and other administrative issuance inconsistent with this Circular are hereby modified or repealed or superseded as the case may be.

This Order shall take effect immediately.

(Sgd) WILLIAM G. PADOLINA
Secretary
Appendix 4.
QUESTIONNAIRE FOR TECHNOLOGY GENERATOR

1. Respondent Profile

1.1 Name ______________________________________________

1.2. Address ______________________________________________

1.3 . Gender    ☐ male    ☐ female

1.4. Civil Status ☐ single    ☐ married    ☐ widowed

1.5. Agency/Employer ___________________________
     _______________________________________
     _______________________________________

1.6. Address _______________________________________
     _______________________________________

1.7. Position _______________________________________

2. Brief Description of Responsibilities/Duties of Respondents:
3. Research Activities

Instructions:

1. Use additional sheets if more than three research programs/projects are being implemented by your Institution.

2. Use entire column per program/project for answering questions 3.1 to 3.10.

Part A - BASIC RESEARCH

<table>
<thead>
<tr>
<th>Specific Questions</th>
<th>Program/Project</th>
<th>Program/Project</th>
<th>Program/Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Title of Program/Project</td>
<td>[ ] Client</td>
<td>[ ] Client</td>
<td>[ ] Client</td>
</tr>
<tr>
<td>3.2 Who initiated research or inspired</td>
<td>[ ] Customer</td>
<td>[ ] Customer</td>
<td>[ ] Customer</td>
</tr>
<tr>
<td>research idea?</td>
<td>[ ] Supervisor</td>
<td>[ ] Supervisor</td>
<td>[ ] Supervisor</td>
</tr>
<tr>
<td></td>
<td>[ ] Mandate</td>
<td>[ ] Mandate</td>
<td>[ ] Mandate</td>
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<tr>
<td></td>
<td>[ ] Others</td>
<td>[ ] Others</td>
<td>[ ] Others</td>
</tr>
<tr>
<td></td>
<td>(specify)</td>
<td>(specify)</td>
<td>(specify)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3.1 How was the research funded?</td>
<td>[ ] Local fund</td>
<td>[ ] Local fund</td>
<td>[ ] Local fund</td>
</tr>
<tr>
<td></td>
<td>[ ] Foreign fund</td>
<td>[ ] Foreign fund</td>
<td>[ ] Foreign fund</td>
</tr>
<tr>
<td></td>
<td>[ ] Both</td>
<td>[ ] Both</td>
<td>[ ] Both</td>
</tr>
<tr>
<td>3.3.2 Source of local research fund</td>
<td>[ ] Philippine government</td>
<td>[ ] GAA/GF</td>
<td>[ ] GAA/GF</td>
</tr>
<tr>
<td></td>
<td>[ ] CIA</td>
<td>[ ] CIA</td>
<td>[ ] CIA</td>
</tr>
<tr>
<td></td>
<td>[ ] Research fund from other gov't Institution (e.g., DA, etc.)</td>
<td>[ ] Research fund from other gov't Institution (e.g., DA, etc.)</td>
<td>[ ] Research fund from other gov't Institution (e.g., DA, etc.)</td>
</tr>
</tbody>
</table>
### Specific Questions

<table>
<thead>
<tr>
<th>Program/Project</th>
<th>Program/Project</th>
<th>Program/Project</th>
</tr>
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<tbody>
<tr>
<td>[ ] Others, (specify)</td>
<td>[ ] Others, (specify)</td>
<td>[ ] Others, (specify)</td>
</tr>
<tr>
<td>[ ] Industry</td>
<td>[ ] Industry</td>
<td>[ ] Industry</td>
</tr>
<tr>
<td>[ ] NGO</td>
<td>[ ] NGO</td>
<td>[ ] NGO</td>
</tr>
<tr>
<td>[ ] Others (specify)</td>
<td>[ ] Others (specify)</td>
<td>[ ] Others (specify)</td>
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</tbody>
</table>

### 3.3.3 Source of foreign research fund

<table>
<thead>
<tr>
<th>Institutional organization (e.g., APEC, FAO, UNICEF, etc.)</th>
<th>Institutional organization (e.g., APEC, FAO, UNICEF, etc.)</th>
<th>Institutional organization (e.g., APEC, FAO, UNICEF, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Private/foreign industry</td>
<td>[ ] Private/foreign industry</td>
<td>[ ] Private/foreign industry</td>
</tr>
<tr>
<td>[ ] Others (specify)</td>
<td>[ ] Others (specify)</td>
<td>[ ] Others (specify)</td>
</tr>
</tbody>
</table>

### 3.4 How many individuals participated in the research?

<table>
<thead>
<tr>
<th>No. of males</th>
<th>No. of males</th>
<th>No. of males</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of females</td>
<td>No. of females</td>
<td>No. of females</td>
</tr>
<tr>
<td>Total</td>
<td>Total</td>
<td>Total</td>
</tr>
</tbody>
</table>

### 3.5 How many institutions participated in the research?

<table>
<thead>
<tr>
<th>No. of govt. institution</th>
<th>No. of govt. institution</th>
<th>No. of govt. institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of private institution</td>
<td>No. of private institution</td>
<td>No. of private institution</td>
</tr>
</tbody>
</table>

### 3.6 How long was the research project?

<table>
<thead>
<tr>
<th>Less than 1 yr</th>
<th>Less than 1 yr</th>
<th>Less than 1 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 2 years</td>
<td>1 to 2 years</td>
<td>1 to 2 years</td>
</tr>
</tbody>
</table>
### Appendices

<table>
<thead>
<tr>
<th>Specific Questions</th>
<th>Program/Project</th>
<th>Program/Project</th>
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</tr>
</thead>
<tbody>
<tr>
<td>8.7 How much was spent for the research program/project?</td>
<td>[ ] 3 to 4 years</td>
<td>[ ] 1 to 2 years</td>
<td>[ ] 1 to 2 years</td>
</tr>
<tr>
<td></td>
<td>[ ] more than 5 years</td>
<td>[ ] 3 to 4 years</td>
<td>[ ] 3 to 4 years</td>
</tr>
<tr>
<td></td>
<td>PS _________</td>
<td>PS _______</td>
<td>PS _______</td>
</tr>
<tr>
<td></td>
<td>EO _______</td>
<td>EO _______</td>
<td>EO _______</td>
</tr>
<tr>
<td>8.8 Are the research results or technologies developed transferred and commercialized?</td>
<td>[ ] Yes</td>
<td>[ ] Yes</td>
<td>[ ] Yes</td>
</tr>
<tr>
<td></td>
<td>[ ] No</td>
<td>[ ] No</td>
<td>[ ] No</td>
</tr>
<tr>
<td>8.9 If yes, number of technology adopters per technology</td>
<td>[ ] Technology Business</td>
<td>[ ] Technology Business</td>
<td>[ ] Technology Business</td>
</tr>
<tr>
<td></td>
<td>Incubator</td>
<td>Incubator</td>
<td>Incubator</td>
</tr>
<tr>
<td></td>
<td>[ ] Communal Service Facilities</td>
<td>[ ] Communal Service Facilities</td>
<td>[ ] Communal Service Facilities</td>
</tr>
<tr>
<td></td>
<td>[ ] Direct Transfer to Industry</td>
<td>[ ] Direct Transfer to Industry</td>
<td>[ ] Direct Transfer to Industry</td>
</tr>
<tr>
<td></td>
<td>[ ] Others, specify</td>
<td>[ ] Others, specify</td>
<td>[ ] Others, specify</td>
</tr>
</tbody>
</table>


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<td>[ ] Client</td>
<td>[ ] Client</td>
<td>[ ] Client</td>
</tr>
<tr>
<td>[ ] Consumer</td>
<td>[ ] Consumer</td>
<td>[ ] Consumer</td>
<td></td>
</tr>
<tr>
<td>(Multiple answer)</td>
<td>[ ] Supervisor</td>
<td>[ ] Supervisor</td>
<td>[ ] Supervisor</td>
</tr>
<tr>
<td>[ ] Mandate</td>
<td>[ ] Mandate</td>
<td>[ ] Mandate</td>
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<tr>
<td>[ ] Others (specify)</td>
<td>[ ] Others (specify)</td>
<td>[ ] Others (specify)</td>
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<td>[ ] GAA/GF</td>
<td>[ ] GAA/GF</td>
<td>[ ] GAA/GF</td>
</tr>
<tr>
<td>[ ] GIA</td>
<td>[ ] GIA</td>
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<tr>
<td>[ ] Others, (specify)</td>
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<td></td>
</tr>
<tr>
<td>[ ] Industry</td>
<td>[ ] Industry</td>
<td>[ ] Industry</td>
<td></td>
</tr>
</tbody>
</table>
4. Factors that contributed to technology transfer effectiveness

☐ Management (specify) ________________________________

☐ Nature of technology (e.g., simple, viable, etc.) (specify) ________________________________

☐ Market demand (specify) ________________________________

☐ Others (specify) ________________________________

5. Factors that hindered/adversely affected technology transfer effort

☐ Management (specify) ________________________________

☐ Technology (specify) ________________________________

☐ Market (specify) ________________________________

☐ Other (specify) ________________________________
6. **Assessment of the role of women in various activities for R&D and technology transfer in communities**

7. **Other comments/observations** (e.g., changes in policies, support system, etc.)

**LEGENDS:**
1. GAA = General Appropriations Act
2. GF = General Fund
3. GIA = Grants-In-Aid
4. DA = Department of Agriculture
5. NGO = Nongovernment Organization
6. APEC = Asia Pacific Economic Cooperation
7. FAO = Food and Agriculture Organization
8. UNICEF = United Nations International Children’s Educational Fund
9. PS = Personnel Services
10. MOOE = Maintenance and Other Operating Expenses
11. EO = Equipment Outlay
12. CO = Capital Outlay
Appendix 5

QUESTIONNAIRE FOR TECHNOLOGY ADOPTER

1. Respondent Profile

1.1 Name _________________________________________

1.2 Address _________________________________________

1.3 Gender  □ male  □ female

1.4 Civil Status  □ single  □ married  □ widowed

1.5 Agency/Employer _________________________________________

1.6 Address _________________________________________

1.7 Position _________________________________________

2. Brief Description of Responsibilities/Duties of Respondents

3. Technology Transfer (Instruction: One set of questionnaire for every technology adopted)

3.1 Describe the technology adopted

3.2 Date of technology transfer

            Year _____  Month_____  Day _____
3.3 Type of Business business organization

- Single Proprietorship
- Partnership
- Corporation
- Foundations
- Cooperative
- Others (specify)

3.4 Technical information

3.4.1 Personnel involved

Management

No. of males ___  No. of females ___

Functions of males Functions of females

(pls. indicate no. of staff)  (pls. indicate no. of staff)
[ ] Supervisor/manager  [ ] Supervisor/manager
[ ] Cashier  [ ] Cashier
[ ] Assistant  [ ] Assistant
[ ] Maintenance/Engineer  [ ] Maintenance/Engineer
[ ] Purchasing/Buyer  [ ] Purchasing/Buyer
[ ] Budget  [ ] Budget
[ ] Auditor  [ ] Auditor
[ ] Clerk/Support  [ ] Clerk/Support
[ ] Janitorial Services  [ ] Janitorial Services
[ ] Others (specify) _____  [ ] Others (specify) _____
Remarks: _____________  Remarks: _____________

Production/Quality Assurance/Control

No. of males ___  No. of females ___

Functions of males Functions of females

(pls. indicate no. of staff)  (pls. indicate no. of staff)
[ ] Production Supervisor  [ ] Production Supervisor
3.4.2 Raw Material Requirement

Major raw material requirement /month _____kg (specify) ____

Other raw material requirement /month _____kg (specify) ____
(please specify)

3.4.3 Volume of business

Income generated/year

Export P _______ Local P _______

Total employment generated

No. of male ___ No. of female ___

3.4.3 Classification of the industry as to total number of employees

Less than 5 workers (micro industry)

6 to 9 workers (cottage industry)
3.4.5. Total project cost/capital investment/assets? P_________

3.4.6. Classification of the industry/company as to capital investment/assets:

- ☐ micro (P150,000 and below)
- ☐ cottage (above P150,000 to P1.5 M)
- ☐ small (above P1.5 M to P15 M)
- ☐ medium (above P15 M to P 60 M)
- ☐ large (P61 M and above)

3.5 Technology Transfer Agreement

- ☐ With Royalty
  - ☐ Fixed lump sum
  - ☐ Based on net/gross sales
  - ☐ Both
  - ☐ Special arrangement (specify) ________________

- ☐ Without Royalty
3.6 Did you do technology improvement/modification on the adopted technology?

☐ Yes    ☐ No

If yes, please specify: __________________________
___________________________
___________________________

3.7 Exclusivity Arrangement

☐ Applicable (specify) __________

☐ Not applicable

☐ Others (specify) __________

4. Factors that contributed to technology transfer effectiveness

☐ Management (Specify) _________________________________

☐ Nature of technology (e.g., simple, viable, etc.)
(specify) _________________________________

☐ Market demand (specify) ______________________________

☐ Others (specify) ________________________________

5. Factors that hindered/adversely affected technology transfer effort

☐ Management (specify) _________________________________

☐ Technology (specify) _________________________________

☐ Market (specify) _________________________________

☐ Other (specify) _________________________________
6. Assessment of the role of women in various activities for R&D and technology transfer in communities

7. Other comments/observations
   (e.g., changes in policies, support system, etc.)
About the PASCN

The Philippine APEC Study Center Network (PASCN) was established on November 23, 1996 by virtue of Administrative Order No. 303, as the Philippines’ response to the APEC Leaders’ Education Initiative. Among the goals of the PASCN are to promote collaborative research on APEC-related issues; facilitate the exchange of information between or among government and nongovernment organizations, academic or research institutions, business sector and the public in general; encourage faculty and students of higher education to undertake graduate studies, theses and dissertation on APEC issues; undertake capacity-building programs for government agencies on matters related to APEC; and provide technical assistance to government agencies and private organizations on APEC-related initiatives.

The Network is composed of the Asian Institute of Management, Ateneo de Manila University, Central Luzon State University, De La Salle University, Foreign Service Institute, Mindanao State University, Silliman University, University of Asia and the Pacific, University of the Philippines, University of San Carlos, Xavier University, and the Philippine Institute for Development Studies as Lead Agency and Secretariat.