

PASCN Discussion Paper No. 2001-04

## **Gender and Technology**

*Amelia C. Ancog*



The *PASCN Discussion Paper Series* constitutes studies that are preliminary and subject to further revisions and review. They are being circulated in a limited number of copies only for purposes of soliciting comments and suggestions for further refinements.

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*Amelia C. Ancog*

University of the Philippines

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September 2001

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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!

Finally, to my husband Edmundo Ancog and my son Raymond, my thanks for the editorial work. Diana M. Figueras deserves special appreciation for her encoding work and support services.

## 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. It describes selected researches 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 adoptors face as they commercialize 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) technology for the manufacture of furniture (spray booth and tunnel drying). Data were elicited from respondents including scientists, and adoptors from Metro Manila, Region III and Region VI and key officials, supervisors and researchers of the RDIs, DOST and the University of the Philippines.

The data reveal that, generally, the 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 adoptors, tapping in the process the technical advice and services of the 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, absence of institutional buyers were among the factors pinpointed by the adoptors which hindered the effective commercialization of the technologies. Nevertheless, adoptors 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 adoptors.

Women scientists and researchers fulfill key roles in R&D and technology adoption and in managing microenterprises and small and medium enterprises. In R&D, women as well as men held the positions of project leaders. Men and women who are technology adoptors 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 which 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 adoptors to enhance their skills can hasten the growth of techno-based enterprises. An entrepreneurship-training program including intellectual property rights will broaden the horizon of scientists and researchers.

Continuing activities on data collection, segregation and analysis on gender equality and access must be supported by the public and the private sectors. The 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 APEC's policy and program development on gender in science and technology.

## EXECUTIVE SUMMARY

### Introduction

The Asia Pacific Economic Cooperation (APEC), UNESCO, and other multilateral agencies encourage the adoption and implementation of gender friendly policies and programs and documentation of good practices. An area of significance is the study and analysis of the extent of contribution of women in research and development and technology adoption. Such 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: (1) demand-driven partnership between research institutions/university and industry; (2) availability of funds for small and medium-sized industry for product improvement and new product and process development, and (3) 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 available technologies, a substantial number of which had been transferred to adoptors. 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 adoptors, as proprietors or owners of microenterprises and small and medium enterprises. 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 forest product technology particularly 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 on the background of the adoptor, 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 or hinder the effective utilization of technology and the distinct contributions of women and men in the firm.

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 adoptors, 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 adoptor, the questionnaire has this items: respondent's profile, description of duties, description of technology used, date of transfer of technology, 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 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 adoptor.

The instruments were pre-tested in the Philippine Textile Research Institute and selected adoptors. 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 6 adoptors in Region 6, 4 in Region 3 and 2 in the National Capital Region. Twenty-five adoptors were interviewed. Sixty questionnaires were sent to adoptors; thirty-five responded. A number 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 adoptors.

## **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.

NIRPROMP adopted two-mission approach. Mission 1 is geared towards the production of crude medicinal preparations against common diseases for distribution and utilization in rural areas. Mission II 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, passed rapid clinical screening establishing their efficacy/safety for common diseases. From 1982 to the present, it identified ten priority plants which underwent toxicologic, bioassay, mutagenicity, dosage formulation, metal analysis, cultivation and propagation studies.

The leadership of the projects is almost evenly distributed between male and female. The Program Manager is a male, while 3 project leaders are male and 3 are 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 adoptors since they contain the plant description, agriculture, pre-clinical studies, pharmaceutical studies and clinical studies, among others. They are the main instruments for technology transfer and commercialization.

The adoptor 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 Care.

The license for the manufacture of *lagundi* and *sambong* will subsist for five years which is non-exclusive and renewable. A technology transfer fee and royalty payments for five years are stipulated in the Technology Transfer Agreement. *Lagundi* 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 anti-cough and anti-asthma while *sambong* is useful as diuretic and a remedy for urolithiasis. These herbal products bested 100 other

products and inventions and received silver medals in the 25<sup>th</sup> International Exhibition of Inventions, New Techniques and Products in Geneva, Switzerland on 11-20, 1977.

The support of the past administrators and the present Executive Director of the Philippine Council for Health Research and Development (PCHRD), the positive relationship between the University of the Philippines and its scientists in pursuing the 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 the scientists, researchers, funding institution and technology adopter. 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 identify 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 affect adversely the health of a substantial number of Filipinos.

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

One of the nutritious products is the 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 kropeck from rice, mungo and other rootcrops. 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 8 researchers (including the project leader) in the team and only one person was a male. The technology transfer team, on the other hand, was led by a male who also completed the degree of PH.D in Food Science.

Three of the five team members were female and one was a male.

Squash canton noodle is rich in B-carotene and 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 1.12mg b-carotene per 100g food. A 50g

serving will provide 16%, 20%, and 24% Recommended Dietary Allowance (RDA) for energy, protein and Vitamin A, respectively of 4-6 year old children.

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

As of November 2000, there are 19 adoptors of canton noodles with squash. Eleven adoptors are from Luzon, 5 from Mindanao and 3 are from the Visayas. The President/General Managers – adoptors consist of 6 men and 5 women in Luzon, 2 men and 2 women in Mindanao and 3 women and 1 man in the Visayas. Based on the June 30, 2000 survey, the total investment of 6 adoptors 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.

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 micro-entrepreneur 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 the acquisition of equipment, technical advice/services from FNRI and effective networking skills of the adoptor with the local communities and nearby provinces, the business is thriving.

The adoptors find the technology simple and easy to implement. They recognize the important role of FNRI and TAPI in increasing their business opportunities. One of the problems encountered by the adoptors in Metro Manila is the lack of continuous supply of the right variety of squash, a problem that is not generally faced by adoptors in the southern provinces. Credit facility is also perceived as important as raw material supply. For the adoptors who intend to expand their operations, availability of funds to upgrade their equipment and improve the quality of packaging materials are essential.

The adoptors who are effective in their enterprises do not hesitate to aggressively use their networks 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, the 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 Product Research and Development Institute (FPRDI) developed two technologies: 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 the removal of overspray. They extract the varnish particles and solvents from the work areas, prevent fogging and misting of surfaces thereby keeping the atmosphere free from fumes and improving the work environment. There are two types of spray booth: 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 adoptors of the technologies are based in Pampanga, some of whom are exporting the furniture to Europe, United States, Middle East, Singapore, Korea and Taiwan. Two of the adoptors whose products are in foreign markets started as family enterprises with 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 are more men than women. Men are assigned to metal works and welding while women perform sanding activities and packing. Support services are also generally handled by women.

The adoptors assert that the technologies are easy to use and modify. Productivity increased by 60% because of the technologies. They also recognize the availability of the scientists from FPRDI who provide technical advice and services upon request. They however point to the need for sources of financing for expansion and product improvement.

#### Region VI: Insights on Technology Adoption

Technology adoptors in Region VI use food processing technology for canton noodles with squash, banana and mango chips or puree, pickled vegetables, fish and shrimp paste, (9 adoptors); drying of handicraft materials, production of gifts, housewares and decorative items, bamboo furniture, ceramics (3 adoptors); plant culture for propagation of orchids and ornamental plants (1 adoptor) dyeing of clothing materials from indigenous material such as raffia and abaca (2 adoptors); candle making (1 adoptor); vermicomposting (1 adoptor); and gemstone processing (1 adoptor). Majority have small investments or below P1million. Only six of the adoptors invested beyond P1million, the biggest was P3.4 million. Very minimal information was obtained on the revenues/income generated. Three of the 6 corporations export their products. Four are cooperatives and the rest are individual proprietorships.

Data obtained from 12 adoptors show that 61% in management/administration/finance are women; 57% are in production/quality assurance

and 43% are in marketing. The data are not comprehensive but nevertheless indicate the strong involvement of women in microenterprises and small enterprises.

The technologies adopted are perceived as “easy to use and adopt,” helpful, and contribute to the increase of productivity or lower the cost of production. Women are seen to good in appreciating colors and color combination, a quality which is useful in producing handicrafts, decorative items, gifts, toys and housewares. They are 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, the capability of the adoptors and demand for the products. The constraints identified by the adoptors are 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 which were transferred, adopted and commercialized are 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 which was completed due to 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 Technology Application and Promotion Institute (TAPI-DOST). In the Regional Office, 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 adoptor. 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 the Forest Product Research and Development Institute (FPRDI). The proprietorships or firms which adopted the technologies are also dominated by women who are recognized for their ability to handle finance and for their creativity and reliability. Men are generally involved in production activities in most firms. There appears 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 adoptors' enterprises. Thus, collateral requirements usually imposed by financial institutions for loans to microenterprises must be reviewed. Flexible and liberal lending policies for microenterprises which utilize technologies or enhance technologies will upgrade their capability and productivity. In addition, credit schemes which are forward looking, supportive of technology adoption and enhancement will go a long way towards ensuring the competitiveness of technology adoptors.

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 which are capital intensive.

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

A practical and brief human resource development program for scientists and researchers on entrepreneurship and intellectual property rights should be fostered in joint fora and consultations. Constant dialogues and interactions involving multisectoral representatives such as industry associations, academic institutions and policy makers, 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 which commercialize their technologies may be looked into. Other countries in the region have liberal policies which allow scientists in public service to invest in the commercialization of their technologies. However, there is a need to balance ethical principles with the purpose of fostering greater creativity and rewarding the efforts of scientists.

On gender equality, the women's role in research and development, technology generation and commercialization may be enhanced by supporting associations/organizations which 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. The 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 on gender equality. Furthermore, studies on gender must be encouraged and funded to build the basis for policy formulation at the national and APEC levels.

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## **Gender and Technology**

**Amelia C. Ancog\***

### **Introduction**

Technology transfer is a major goal of the Department of Science and Technology (DOST). Its mandate comprehends not only the coordination of the researches of various government research institutions but technology transfer as well. To carry out its mandate the Research and Development Institutes (RDIs), the Regional Offices and the Technology Application and Promotion Institute (TAPI) and the Councils are involved in various degrees in transfer of technologies.

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

It may be noted that the acceptance by investors from the private sector of locally developed or “indigenous” technologies take a long time. Unless technologies are promoted with advertisement or unless subsidy is given by government or foundations, adoption becomes quite problematical. Since the product demand has not yet been proven, it becomes the responsibility of the RDI to entice the private sector to adopt the technology and invest its resources to commercialize the products.

The documentation of the experiences of scientists, researchers, technology transfer personnel and adoptors 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 role of gender is also important since often in past studies on technology transfer, gender is not seen as an integral part of analysis. Thus, highlighting two technologies which have exhibited various levels of successes will yield insights on the interplay of factors that will hasten commercialization.

In this regard, there are technologies that are suitable for micro and small enterprises which will bring 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.

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## **Purpose and Significance of the Study**

This study aims to discuss the processes involved in the technology transfer of selected RDIs of the DOST, the role of women in research and development (R & D) 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. The extent of analysis 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 a number of studies on gender in science and technology in the Philippines, there is still a need to document the processes of technology transfer which has shown considerable success or which failed. The lessons from the practical experiences are useful in developing best practices for gender in S & T. In addition, the role of women scientists and researchers when documented will provide insights on the opportunities and constraints to gender access and equality.

Consequently it is hoped that the study will contribute to the knowledge on the commercialization of research results and provide insights on enhancing the participation of women in S & T activities including technology adoption and commercialization. Likewise, it will offer recommendations to foster closer linkages between RDIs and the private sector or other adoptors; 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 APEC's efforts in building the lessons and literature on gender in science and technology and in micro, cottage, small and medium enterprises.

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 which 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 the 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 technology and mobilize resources for production. Likewise there must be technology transfer structure, mechanism and policies which are transparent and understandable to technology adoptors. In addition, location, raw materials and markets must be present or potentially available in anticipation of increase in demand for the products and services. Similarly, financial assistance or credit facilities must be available to enable technology adoptors to operate their enterprises and expand their markets.

### Research and Development and Technology Transfer

Yap 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 (1986). The coupling model likewise integrates the R & D activities with the market demand and the private sector's aggressive use of research outputs to meet market pressures (Beijing, 1998). Other writers emphasize the importance of the presence of pro-active 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 which are to be jointly funded. Some areas which are 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: (1) demand-driven partnership between research institutions/university and industry; (2) availability of R & D funds for small and medium-sized industries for product improvement and new product and process development; and (3) 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 utilize technologies. The research institutes, which are government-funded, 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 micro-computers (TICOM1 and TICOM2) were successful cases that have utilized cooperative R&D projects (Young-Ho Nam & 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 Research and Development and the Philippine Council for Health Research and Development. On the other hand, the S & T Volunteers' Pool and the Manufacturing and Productivity Extension Programs (MPEX) which are current programs of DOST and managed by the Technology Application and Promotion Institute mobilizes members of the academe in consultancy services. The faculty members and/or experts from the private sector are deployed to adoptors 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 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 offence 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.” (Symonides and Volodin, 1999)

Subsequently four 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 fora of the Asia Pacific Economic Cooperation.,

The Beijing Platform for Action covers twelve 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 UNDP, UNIFEM and Swaminathan Foundation-sponsored conference of women S & T policy makers, scientists and researchers focused on addressing the impact of poverty of 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 on women, particularly in priority areas like nutrition, health, education and economic livelihood and security”.

Greater participation of women in S & T careers are hampered by many factors. Among these are gender-role stereotyping, legal impediments, socio-cultural 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 scientists 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).

Harding aptly explains that gender relations are dynamic, historically changing ways of obtaining and distributing scarce resources. She analyzes the impact of strifes and colonization on the roles of men, women and children. Describing the hierarchical relations arising from gender differences, she 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 labour, 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 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: (1) the need to increase women’s access to and participation in all levels of education and training in SET; (2) the promotion of S & T research programs, development projects and access and implementation strategies aimed at improving the living conditions of women and their children; (3) the 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 (4) the 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 & Dugdale, 1998) The UNDP's gender program supports some of UNESCO's gender initiatives including a number of the projects agreed upon in the Chennai meeting.

The Leaders of the Asia Pacific Economic Cooperation 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 program, 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. (Nash, 1998)

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 per cent (44%) of women are in non- science engineering fields and only 24% are in engineering. These include physical science, psychology, and mathematics, and only 6% 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 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 nineteenth and twentieth 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 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 21<sup>st</sup> 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 of the DOST indicate that 2,382 of 4,789 or 49.7% of the total personnel complement are women.

In the six RDIs specifically Forest Products Research Institute, Advance Science and Technology Institute, Food Nutrition and Research Institute, Industrial Technology Development Institute, Metals Research and Development Center, and Philippine Textile Research Institute, five Directors are men; only one is a woman. Again, in the five Services Institutes, specifically Philippine Geophysical Atmospheric Administration, Philippine Volcanology and Seismological Institute, Science Education Institute, Technology Application and Promotion Institute are evenly divided between two female and two male directors. The Executive Directors jobs of the 4 Sectoral Councils: PCARRD, PCAMRD, PCIERD and PCASTRD are evenly divided between men and women.

The total personnel complement of the RDIs is 1,688, of which 891 or 52 % are women. On the other hand, the Services Institutes have 2,062 personnel, 900 or 43 % are women. Sixty one per cent (61%) or 272 of 444 personnel of the Sectoral Councils are women. The Regional Offices, whose mandate is technology, delivery, and coordination, has 395 personnel, of which 212 or 86% are women.

Thus while leadership in the various agencies of DOST is basically male-dominated, the RDIs, the 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 of 3 Undersecretaries are males, and 2 of the 3 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.

The Philippines, in a sense, has better gender participation in S&T activities compared to 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, the health science community and the private sector have grown stronger through the years and the Philippine Council for Advance Science and Technology Research and Development (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 of the adoptors and willingness of the adoptors to respond to the questionnaires and interviews and the initiatives of both

technology generator and technology adoptor in the practical application of the technologies and commercialization.

For these technologies, advice of the Directors of the Food Nutrition Research Institute, the Philippine Council for Health Research and Development and the Forest Products Research Institute 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 extensive experience in technology transfer, having served as Deputy Director of the Technology Promotion and Application Institute prior to her promotion as Regional Director. In addition, the various technologies applied in Region VI are varied and typify the contribution of technologies to micro enterprises 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: the profile of the technology generators and adoptors, 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 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 the information on the background of the adoptor, experience on the use of the technology, improvements undertaken on the technology, gender distribution on functions and responsibilities, level of success in technology commercialization as indicated in volume of sales, factors which contribute or hinder the effective utilization 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 adoptors, 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 or suggestions.

For the technology adoptor, the questionnaire has these items: respondent's profile, description of duties, description of technology used/applied, date of transfer of technology, 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 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 from the adoptor.

The instruments were pre-tested in the Philippine Textile Research Institute and selected adoptors. Revisions were undertaken as a result of the pretest.

### Respondents

Eight Directors and Deputy Directors, two Regional Directors, and 16 chief supervising specialists (division chiefs), senior research specialists and researchers were interviewed .

This includes some of the division chiefs in the Food Nutrition Research Institute, the Forest Products Research Institute, the Philippine Textile Research Institute and researchers involved in research and development and technology transfer. Field visits were made in the plants/offices of 6 adoptors in Region VI, 4 in Region III and 2 in the National Capital Region. Interviews were undertaken with 25 adoptors. The Regional Directors, the Directors and/or Deputy Directors gave advice on the adoptors who would be willing to be interviewed.

Sixty questionnaires were sent to adoptors but only thirty-five responded. Some questionnaires had minimal and/or vague data. Thirty questionnaires were sent to technology generators; twelve were accomplished.

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

### Limitations

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

Due to pressing business schedules a number of the adoptors could not be interviewed in the third quarter of year 2000. When they were interviewed during the last quarter of the year 2000, many expressed their anxiety about their expected sales. The economic and political developments which were prevailing at the time of data-gathering somehow dampened what otherwise would have been an 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.

## **Technologies of DOST**

DOST's technology transfer and commercialization program is carried out by its RDIs, TAPI and Regional Offices. Illustrative of the technologies developed by the Metals Research and Development Center (MIRDC one of the RDIs) include the following: wrought iron furniture making, gemstone processing, spin casting, spinning technology, local CNC lathe machine, bio-reactor for accelerated degradation of solid municipal wastes and seriating machine.

The Forest Products Research and Development Institute (FPRDI) has these technologies: tunnel dryer, cement-bonded board, high pressure sap displacement system, cocolumber, ricehull ash cement hollow blocks, solid wood bending, handmade paper, ricehull cement hollow blocks and solid wood bending, among others.

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 slat production, tool and die and production of fiber concrete rooftiles.

Technology transfer can be effected with the combined efforts of the technology generator/RDIs, which developed the technology and TAPI. Technology is promoted directly to potential adoptors through demonstrations and/or training. Investments for undertaken by TAPI periodically and during the celebration of the National Science and Technology Week attract technology adoptors/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 and/or in collaboration with the RDI's 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 technology. The TBI can be located in the compound of DOST or in other places where the technology adoptor operates his business.

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

## **Herbal Medicine Technology**

**Amelia C. Ancog\***

### **Background**

In the last one and one-half decades, reforms in the health sector were adopted by former Presidents Corazon Aquino and Fidel V. Ramos. These are the National Drug Policy (NDP, 1987), 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 five years ago by the Department of Health through the College of Public Administration of U.P. 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 forward 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 implementors 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 drug acquisition process in the public sector.

On self-reliance, it was pointed out that sixty-five (65) per cent of the market for pharmaceutical products is still dominated by multinational companies, with the national drug companies sharing the remaining thirty-five (35) per cent. Part of the strategy towards 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 pre-colonial years, the “herbolarios” or traditional healers “prescribed” herbal-based preparations to patients. Dr. Natividad de Leon Quintana from the University of the Philippines Los Baños 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 (NIRPROM) entails the study of cultural practices on the production of medicinal plants.

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## **Development of Technology**

The processes involved in the development of technology for pharmaceuticals can be time consuming and tedious. It is preceded by researches which require not only financial resources but also the involvement and commitment of scientists and researchers. By its very nature, researches on medicine are expensive undertakings; the 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 so limited and where competing priorities for national programs often result in niggardly allocation of resources for R & D.

In the early seventies, the National Institute of Science and Technology (reorganized in 1987 as the Industrial Science and Technology Institute under the Department of Science and Technology) undertook studies relating to preliminary screening of extracts of medicinal plants for medicinal purposes. There were other studies which were supported by the National Research Council of the Philippines and the Philippine Council for Health Research and Development.

With the various studies on herbal medicine on hand, a broader program was developed which integrated the various aspects of herbal medicine researches. The Philippine Council for Health Research and Development (PCHRD), a sectoral planning body of DOST, supported the funding of a program with 6 components for medicinal plants research. It 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 has 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 towards the transfer of technologies.

The PCHRD employs more women than men. Of the four supervisors, 3 are females and 1 is a male. Twenty-eight (28) of the technical positions are occupied by women and seven (7) by men. Administrative positions are equally distributed between males and females at twelve each.

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

A compelling reason for the establishment of 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 neo-colonial control have distorted the development of the pharmaceutical industry." The pharmaceutical industry is import-dependent, limited to formulating, compounding and with practically no basic material manufacturing. (Technical Report Series No. 12, PCHRD-DOST, 1991) In spite of the transfer of public governance to Filipinos, the industry remains dominated by multinational companies (The Policy Review and Program Evaluation of the Generics Law and of the National Drug Policy, 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 (NIRPROMP) in 1977. Preparatory to the development of specific research projects the scientists and researchers agreed to first analyse 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 gastro-intestinal diseases, cardiovascular diseases and rheumatic heart disease were 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 (anti-pathogens) or the 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 which would reduce the expenses incurred by government in the purchase of the drugs. Studies would focus on medicinal plants with any of the following effects: antitusive, antiasthmatic, analgencics, antidiarrheals, antispasmodics, anti-diabetics, antihypertensives and diuretics (Mission 1)

The next issue which 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 to 60 % of the *herbolarios*; then 120 plants which were in abundance 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 the cultivation of plants and the establishment of gene bank; those in botany took care of pharmacognosy; those in medicine, pre-clinical 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 I is geared towards the production of crude medicinal preparations against common diseases for distribution and utilization in rural areas. Mission II 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.

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 in herbal medicine as 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*, passed rapid clinical screening establishing their efficacy/safety for 27 common diseases (Mission 1). From

1982 to the present, it identified ten priority plants which underwent pharmacologic/toxicologic, bioassay, mutagenicity dosage formulation and metal analysis, cultivation and propagation studies (Mission II).

### **Component Projects**

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

***“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 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 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 service on priority plants; determines lethal dose 50(LD50) on priority plants; performs behavioural studies such as neuroleptic and anti-depressant effect in order to verify folkloric claims on priority plants and determines the effect of priority plants on isolated tissue studies.

***“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 studying the subchronic and chronic toxicity on priority medicinal plant products.

***“Dosage Forms from Medicinal Plant’s 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 the preparations of medicinal plant monograph; 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 on 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.

The study covers the following objectives: produce results which will solve the current production problems of priority plants; generate data that will continue towards the determination of cost of production of selected plants; supply NIRPROMP’s needs for raw material of priority plants and maintain the medicinal plant’s garden that would serve as mother plant for mass production.

Ten plants out of 102 had been prioritized specifically the following: *lagundi*, *sambong*, *tsaang-gubat*, *niyug-niyugan*, *bayabas*, *ulasimangbato*, *bawang*, *ampalaya*, *akapulko*, *luyang dilaw*. The results of the studies identified a number of plants with potential for medicine that can be commercialized at reasonable costs. Figures 1 and 2 show the Flow Charts of Mission 1 and Mission II Activities, respectively. (PCHRD Technical Report Series No. 12, 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, U.P. 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 U.P. Thirty five of his articles/researches were published.

#### ***Dr. Romeo Quijano***

Dr. Romeo Quijano is a Doctor of Medicine and is an associate professor of the Department of Pharmacology of the University of the Philippines. He obtained his Masters 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 U.S. (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 a number of articles on bioassay of medicinal plants and other scientific papers which were published in national and international journals. He received the Presidential Outstanding Civil Service Award (Lingkod Bayan) in 1988.

One interesting article which was published in the Medical Action Group Journal (1989) is entitled *Paano Kita Gagamutin?* (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 U.P. 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 U.P. Manila. He is likewise a project leader of the National Drug Information Center of the National Drug Policy Program of the Department of Health

A number of his researches, articles and books are written in Pilipino such as *Manual sa Paggamit ng mga Halamang Gamot* (1981) (Manual on the Proper Use of Medicinal Plants), *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 cover the ethnodocumentation of many cultural communities some of which are the Dumagats of Aurora, Nueva Ecija, Quezon and Bulacan, of 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 Outstanding Basic Science Teacher, UPM 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. She is also the Chairman of the National Adverse Drug Reaction Advisory Committee of Bureau of Food and Drugs of the Department of Health.

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: Chairman, Department of Pharmacology, College of Medicine, U.P.(1975-83); member of the Advisory Committee on Medical Research, Western Pacific Region, World Health Organization (1981-84); and member of the Advisory Panel on Drug Dependence and Alcohol Problems, World Health Organization, Geneva (1987 to present).

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

She was voted by the United Nation Economic and Social Council as member of the International Narcotics Control Board (INCB) (1997 to present) and 2<sup>nd</sup> Vice President of INCB 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 country's President (1988).

***Dr. Ernesta Quintana***

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

She is a professor at the Department of Horticulture, UP. 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 Department of Health 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 which were presented in national, regional and international fora. She also presented a number of papers in national fora on topics such as Locality Sources of Medicinal Plants and Prescribing Pattern of Herbalorias 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 Department of Science and Technology 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 the University of the Philippines. She has a Doctor of Philosophy degree, major in pharmaceutical chemistry from the University of Connecticut, U.S.A. She is professor emeritus of industrial pharmacy at the College of Pharmacy, U.P.

She is currently a member of the Technical Advisory Committee on ASEAN Technical Cooperation on Pharmaceuticals and Chairman of the Advisory Committee of the Advisory Committee of the Department of Health. She has written a number of scientific papers which 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 achievement. Two of these are 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 the Department of Science and Technology in 1996.

**Resources**

The Program has been receiving support from PCHRD since 1977 up to the present. As of June 30, 2000 the total budget utilized by the projects amounted to P30, 319,642.00. These cover expenses for the various project teams salaries, maintenance and operating expenses and capital outlay.

**Table 1. Budget Allocation**

<b>Project Title</b>	<b>Approved Budget</b>
1. Clinical Screening and Scientific Validation Studies of Phil. Medicinal Plant Products Used in Traditional Folk Medicine	P 8,545,081.00
2. Dosage Form from Medicinal Plants	6,750,290.00
3.1 Establishment and Maintenance of Medicinal Plants Production Farm, Los Baños, U.P.	1,450,458.00
3.2 Development of Appropriate Cultural Management Practices to Involve Yield and Quality of Selected Medicinal Plant Species	1,025,285.00
4. Pharmacologic/Toxicologic Studies of Philippine Medicinal Plants	4,258,051.00
5. Establishment of Quality Control Bioassay Standard Procedures for Medicinal Plant Products	6,103,955.00
6. Mutagenicity/Clastogenicity and Antimutagenicity Potential of Drug preparation of Phil. Medicinal Plants	2,186,516.00
<b>TOTAL BUDGET</b>	<b>P30,319,642.00</b>

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

The leadership of the projects is almost evenly distributed between male and female. The Program Manager is a male, while 3 project leaders are male and 3 are female. In one male- led project, the co-leader is also a male; in another, the co-researcher is a female. All of the scientists/project leaders are well known in their fields and are involved in teaching and research and have published articles nationally and internationally. On the other hand, the research positions are dominated by women. Eleven female are science research specialists or research assistant. There are only 3 male science research specialists or research assistant. Two males serve as driver and laborer.

**Table No. 2. Gender Distribution of Responsibilities in Herbal Medicine Technology**

<b>Gender</b>	<b>Project Leader/ Co-Researcher</b>	<b>Technical/Research Specialist</b>	<b>Administrative/Support Services</b>
Male	5	3	2
Female	4	11	

The work of the research specialists are technical and “sensitive” in nature involving research activities in the laboratories, conducting tests and evaluation, and preparing reports for the review of the project leader. The level of patience, dedication

and care in handling chemicals and animals for the experiments are high. A number of project leaders assert that there are more women who apply for this type of work. The staff members have degrees in the sciences and have stayed with the projects for long periods.

Of particular significance is the gender role in the preparation and completion of the Technology Transfer Document (TTDs) for *sambong* and *lagundi*. These are major outputs that include plant description, agriculture, pre-clinical 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.

**Table No. 3. Discipline & Gender Distribution in Herbal Medicine Technology**

Discipline	<i>Sambong</i>		<i>Lagundi</i>	
	M	F	M	F
Medicine	3	6	4	9
Pharmacy	-	1	-	2
Industrial Pharmacy	2	18	1	19
Chemistry	1	8	1	8
Medical Technology	1	1	1	1
Nursing	-	2	-	4
Agriculture	-	-	1	1
<b>TOTAL</b>	<b>7</b>	<b>36</b>	<b>8</b>	<b>34</b>

It will be noted that the research team for both *lagundi* and *sambong* are heavily female-dominated. The highest number of female are industrial pharmacists, while there is only one female in the agriculture. For both *lagundi* and *sambong*, females in the medical field occupy a bigger a number of the positions; the males doctors constitute about 47% of the medical team.

### **Transfer of Knowledge and Technology**

To ensure that the results of the research and 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 addressed to both government and non-government 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 in various aspects of medicinal plant research and development utilization.
5. Training projects for government personnel involved in the cultivation, manufacture quality control, bioassay and pharmacologic testing.

A number of training programs, symposia and seminars were implemented along the aforesaid activities. In collaboration with the Ministry of Education (now DECS) a herbal garden program was initiated in public schools using the priority plants such as *lagundi*, *sambong*, tsaang gubat and others. In 1985, the Ministry of Health (now Department of Health) 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 Department of Health. However, private individuals, enterprises and others can also purchase plants and leaves from them. The experts of the agricultural, pharmaceutical and medical sectors of NIRPROM trained the personnel of the plants.

In addition to the efforts of NIRPROMP, the Technology Application and Promotion Institute (TAPI) of DOST also conducts investment fora, to encourage potential investors undertake the production of herbal medicine. Other technologies are also “offered” to interested individuals and entrepreneurs to foster commercialization of Filipino technologies.

### **PCHRD’s Technology Transfer Guidelines**

PCHRD adopted its technology transfer guidelines which embodied provisions on guiding principles, including self reliance in selected areas between public and private sectors, the role of PCHRD as broker for commercializable technology, division of income among several funding agencies, execution of a MOA, capability of adoptor, 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 appears in Appendix 1.)

### **Technology Adoptor**

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

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 achievement-oriented. Furthermore he is well-informed on indigenous pharmaceutical products and visits other countries to observe and learn about pharmaceutical developments. He supports the commercialization of Filipino technologies, 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 for Traditional and Alternative Health Care (PITAHC); and was a founding program manager of the Traditional Medicine Program of the Department of Health. He contributed extensively in the formulation of the draft of the bill on the Philippine Institute of Traditional and Alternate Care (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 at Mahidol University, Thailand. He likewise served as consultant to various countries.

## **Resources**

The initial investment for each product is about P2 million pesos. Depending on the season, (planting and harvesting) the personnel including farm hand can reach about 100 including the sales force. The corporation owns 7 hectares of land in Nueva Ecija, a great part of which are planted with *lagundi* and a certain portion with *sambong*. It has also contract farming arrangement 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 are held by men (as of September 2000). As part of Altermed's expansion activities for 2001, it hired a full time farm manager effective January 2, 2001.

## **Intellectual Property Rights**

A technology transfer agreement was entered into between Pascual Laboratories, Inc. and its subsidiary, Altermed Corporation 15 November 1995 for the production/commercialization of *lagundi*. It stipulated that the adoptor will pay a technology transfer fee of P50,000 and royalty payment of 2% for the first three (3) years and 1.5% for the remaining two (2) years. The license is non-exclusive and renewable upon mutual consent of both contracting parties. For *sambong*, the technology transfer fee is P70,000 and the royalty payment is 4% for the first three (3) years and 3% for the succeeding two (2) years. The license is likewise non-exclusive 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 man and woman. This seems to imply that activities requiring patience, 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 producing another local indigenous product developed by NIRPROMP, akapulito lotion.

It 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 in quality assurance and research and development activities.

As demand increases, there will be a need for 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 the usefulness of herbal plants through classroom information in appropriate subjects.

Facilities for processing, regular training of manpower, quicker processing of application of license to operate and issuance of 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 "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 effective diuretic for those with edema; *tsaang gubat*, an antispasmodic remedy; and *akapulko*, an antifungal remedy which as benefited majority of poor Filipinos." This confirms the importance of herbal products in the country.

### **Analysis**

The research and development which led to the transfer of the technology for the production of herbal medicines *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 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. It may be mentioned that the private sector in other countries in the region such as South Korea has bigger investment in R & D. From a low 22% share in 1976, the private sector share rose to 80% in 1991 (Young- Ho Nam, 1995). The reverse is true in the Philippines where 90% of 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 which could produce the products. These factors minimized the risk in the commercialization of 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 to 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.

The national policy framework is 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 adoptor be encouraged so that other entrepreneurs will also be inspired in adopting and utilizing 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 describes in detail the scientific processes that will enable an adoptor 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, the women's participation in the development and transfer of this technology indicates that knowledge, expertise and dedication enhance the opportunities for gender equity. (Revised as of 1/14/01)

**Nutritious Food Technology**  
**A. C. Ancog & M. V. Capanzana\***

**Canton Noodles with Squash**

**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 Department of Science and Technology through the FNRI. The FNRI developed and continues to develop nutritional food products that address the aforementioned nutritional problems.

The researches use indigenous/local materials and are designed in such a manner that the products resulting from such researches do not significantly alter local food habits and beliefs. It is commonly accepted that noodles are popular with 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 fast food 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 since it is associated with longevity of the celebrant.

**Development of the Technology**

The nutritious food/noodle technology as early as 1981 was developed as part of the project “Commercialization of FNRI Technologies” of the Food Science Division of FNRI. Its budgetary allocation was not treated separately from the other activities of said project. Among the products, which were subsequently developed, are kroepack from rice and mungo and other rootcrops. To enhance the nutritive value of noodles, seven researchers plus a division chief conducted the research incorporating vegetables particularly squash and saluyot to enhance the noodles’ nutrients. In 1995 the team completed the formulation, the piloting and storage study.

The research team, which undertook the research and development of nutritious noodles, consisted of 8 women, one of whom is a holder of Doctor of Philosophy. The current coordinator of the product development and technology transfer team is headed by a man, Dr. Mario Capanzana holder of Doctor of Philosophy in Food, Science and Technology. His innovativeness in technology transfer has resulted in renewed interest in the commercialization of indigenous food. The project leader 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:

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\* The authors acknowledge with gratitude the advice of Dr. Corazon Barba, Director of FNRI and the assistance of the staffs of the Food Science and Technology Division (FSTD) and the Technology and Promotion Group (TPG), FNRI.

**Table 4.**  
**Gender Profile of the Staff of the FSTD Involved in Canton Noodles with Squash**

<b>Name</b>	<b>Gender</b>	<b>Academic Background</b>	<b>Years of Experience</b>
Lydia Marrero	F	Ph D Fd Sc	27
Emerina Eusebio	F	BS Phar.; Dip. In FSN	42
Joyce Tobias	F	BS Chem; BS Food Tech	23
Pacita Reyes	F	BS Phar	40
Ma. Elena Fernandez	F	M Applied Science; B.S.Chem	23
Alejandro Martin, Jr.	M	MBA; B.S. ChE	23
Wenefreda Lainez	F	BS Chem; BS Food	21
Marcelo Saises	F	BS Chem	20

### **Description of the Technology**

#### **Raw Materials and Equipment Requirements**

Squash canton noodles is a nutritious noodle which is rich in B-carotene and 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 13g protein, 512kcal and 1.12mg b-carotene per 100g food. A 50g serving will provide 16%, 20%, and 24% 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 250g/pack 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 the abovementioned volume of production the following equipment are necessary: 1 noodle machine, 1 spike mixer, 1 grinder and 1 weighing scale at 100 kg capacity 3 stoves with tank and regulator, 3 kettles (kawa), and 2 weighing scales at 1 kg. capacity.

### **Technology Transfer**

The team responsible for technology transfer is currently under the leadership of Dr. Capanzana and is composed of the following personnel:

**Table 5.**  
**Gender Profile of the Staff of the TTPG Involved in Canton Noodles with Squash**

<b>Name</b>	<b>Gender</b>	<b>Academic Background</b>	<b>Years of Experience</b>
Alejandro Martin	M	MBA, BS ChE	23
Mario Cabagbag	M	BS ChE	18
Cecilia Quindara	F	BS Food & Nutrition	23
Joyce Tobias	F	BS Chem, BS Food Tech	23
Wenefreda Lainez	F	BS Chem, BS Food Tech	21

It will be noted that the technology transfer personnel are highly qualified for their responsibilities and majority have more than 20 years of experience in food

technology and nutrition research and technology promotion. The gender distribution is equal.

The team ascertains the readiness of the adoptor to undertake the production of the food products. An evaluation of the equipment, water supply, power and raw materials 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 technology transfer, a lady food scientist, Dr. Lydia Marrero presented a paper on nutritious noodles during the investors' forum conducted by the Technology Application and Promotion Institute at the Philippine Trade and Training Center in Manila in 1992. In the same year, she also conducted a demonstration of the processing of food products including kroepck, 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 kroepck, and rice-mongo weaning blend. Meanwhile, FNRI continues with its systematic product development on noodles with vegetables. In 1993, canton noodles with squash was adopted by V-sun Food Products. The earlier production activities were done at Bicutan in a Technology Business Incubator. This arrangement is handled by the Technology Promotion Institute (TAPI), where the space is partly subsidized by TAPI. 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 are 19 adoptors of canton noodles with squash. Eleven adoptors are from Luzon, 5 from Mindanao and 3 are from the Visayas. The names of the adoptors are shown in the following table:

**Table 6. Adoptors of Canton Noodles with Squash Technology**

<b>Luzon</b>	<b>Mindanao</b>	<b>Visayas</b>
Kalilayan Multi-purpose Cooperative	Eagle Multi-purpose Cooperative	Jojo's Foods, Inc
BC Palma Enterprises	Southern Star Noodle Factory	Food Land Food Processing.
Nutrifoods Specialists, Inc.	San Vicente Farmers Association	Family Noodle
Farmtec Foods, Inc.	Gillamac Food Industries	
Comaguingking Women's Association	Triple D Enterprises	
Dayapan Multi-purpose Cooperative		
Asprer Enterprises		
Pagsanguiran Multi-Purpose Cooperative		
Ilocos Food Products		
V-Sun Food Products, Inc.		

The president/general manager of the adoptors consist of 6 men and 5 women in Luzon; 2 men and 2 women in Mindanao and 3 women and 1 man in the Visayas.

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 connected with the University of the Philippines, Los Baños as faculty member and Director of the Institute of Human Nutrition and Food. She was visiting professor in the University of Indonesia, SEMEO, TROPMED.

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

The Memorandum of Agreement between the FNRI and the adoptors stipulates a one time transfer fee of P5,000.00 for 3 years of non-exclusive license. As a matter of policy, FNRI limits the entry of not more than one adoptor for the duration of the agreement. This will enable the adoptor to benefit from the use of technology.

Many of the adoptors are cottage and micro enterprises. However, one adoptor is a well-known entrepreneur who operates high quality restaurants and now exports food products to some foreign countries. 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 thru 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 arrive at a distinct taste profile to give the product an excellent chance of capturing not only 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 officials of FNRI. Significantly, she asked Dr. Corazon Barba, Director of FNRI 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. (See Annex 1. Panorama. December 26, 1999)

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 a risk taker. She believes in the marketability of ethnic food and has been exporting her nicely packaged cooked food products in the Middle East and Japan.

Examples of these are her “laing” and “kare-kare” which had been making waves among the 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 Castellanas, Negros Occidental, a wife and mother, Mrs. Delia Lumanas learned about the canton noodle with squash when she participated in a DTI-sponsored study tour to various Research and Development Institutes including FNRI. After the visit, she decided to adopt the technology, saying that she “fell in love” with the technology on canton noodles with squash. 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 Castellanas 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 is the manager of her business (proprietorship) and employs 11 personnel some of whom 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 her production once her new equipment is purchased. The total investment will be about P2.7 million which includes equipment upgrade.

**Table 7. Status of Investment and Development Generated**

<i>Name of Adoptor</i>	<i>Value/Volume of Business</i>	<i>Investment Generated</i>	<i>Income Generated</i>	<i>Employment Generated</i>	<i>Other Information</i>
A.	18,900 packs (200 g) per month or 4,000 packs per day  3,700 kg/mo 20,000 kg/mo	P2.7 M	P1.7 M per year	10 workers	New bakery products with squash were developed after technology adoption
B.	On the initial stage of production	P232,994	-	-	The product was just launched in the market last July 2000
C.	P240,000/6 mos.	P4.45 M	-	20	Adopted 2 products from FNRI –

<i>Name of Adoptor</i>	<i>Value/Volume of Business</i>	<i>Investment Generated</i>	<i>Income Generated</i>	<i>Employment Generated</i>	<i>Other Information</i>
	520 boxes/mo/variant				Canton noodles with squash, noodles with saluyot
D.	312 bag/mo or 7,800 kg/mo	P2 M	-	12	1 <sup>st</sup> technology adoptor
E.	5,200 kg/mo 10 tons/mo.	P500,000	2000 – P390,000/y	10	Davao City market only
F.	200-300 packs/shift	P1.0 M	-	10	For launching
	<b>Total ---</b>	<b>P10.883 M</b>		<b>62</b>	
-					

Based on June 30, 2000 survey, the total investment of 6 adoptors 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 kg/mo to 10 tons/mo.

### **Gender Distribution in Selected Adoptors**

The work assignments of the personnel of selected adoptors as of June 30, 2000 are shown hereunder:

**Table 8. Gender Distribution in Selected Adoptors**

Name	Management / Administration		Production / Quality Assurance		Marketing	
	Male	Female	Male	Female	Male	Female
Jojo's Noodle Center	2	1	2	5	1	1
Nutrifood Specialists Inc.	5	4	-	1	2	1
Farmtech Foods, Inc	1	2	1	1	3	2
Dagupan Multipurpose Coop.	1	-	2	5	-	1
Eagle Multipurpose Coop.	2	3	-	1	9	-
V-Sun Food Products, Inc	1	1	No information		-	1

Some of the adoptors are multiproducts producers and utilized the man power for production of 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 includes services relating to supervision, human resource development, finance and other services; production includes quality assurance and control while 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 food

technologist but a number are consulting with the FNRI or the Provincial S & T Officer on technical matters. In a number of proprietorship/business firms, production activities such as kneading and transferring of ingredients to cooking facility are done by men. On the other hand, wrapping of the products is generally assigned to women.

The data implies that management function is generally male dominated; while quality assurance is female dominated.

### **Improvements on the Technology**

Some adoptors initiated "improvements" on the technology such as by changing the noodle improver, redesigning the size and shape of the canton noodle. One adoptor whose product is sold in big supermarkets patronized by affluent customers, packages her product in high quality materials. In this regard, many adoptors 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 adoptors 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 adoptors and increasing demand, the potential of increasing the number of adoptors and transforming the current adoptors to medium enterprises appears promising.

### **Factors which Contribute and Hinder Effective Technology Transfer**

The adoptors find the technology for the production of canton noodle with squash simple, easy to adopt and implement, They are also keen on the use of indigenous raw materials to enhance the nutritious content of noodles. They find the FNRI and other DOST's scientists and technologists helpful, concerned and sincere in assisting them in their needs.

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

Since majority of the adoptors belong to the category of cottage industry (P150,000 to P1.5 million investment), financing their need for improvement of facility or equipment must be addressed. The Technology Application and Promotion Institute (TAPI) can provide assistance for equipment upgrading.

In addition, some adoptors want to improve the quality of packaging; however, the cost of using better packaging materials will result in the increase of 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 adoptors whose markets are in the rural areas or relatively remote from the cities, this problem is not felt. However, those whose operations are in or near Metro Manila or other urban areas, good packaging is seen as an important aspect of marketing.

## **Other FNRI Technologies**

FNRI has developed many more nutritious/fortified food technologies. These are “laing” (mix vegetable dish), rice crispy bars which intended as food for emergency/disaster, 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 Table Sugar, and Iodine-Rich Drinking Water and “Water Plus” + I<sub>2</sub>

“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. Nutrifood Specialists is already commercializing “laing”.

Rice Crispy Bar is made from combinations of expanded cereals, 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 from 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 like 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 pre-colonial era that was ingeniously adopted by the Filipinos using local ingredients.

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

## **Analysis**

The development of nutritious food products stemmed from the decision of women scientists in FNRI to contribute to the solution of vitamin deficiencies of many Filipinos. Its scientists and researchers responded to the challenge of developing food products which will address the aforementioned problems. Food technologies for the production of fruit drinks, rice mungo kroepack, weaning food (for babies), and canton noodles with vegetables such as squash and “saluyot” are some of their products which had been transferred to adoptors.

Technology transfer however, can not operate in a vacuum. It succeeds when these elements are present: (1) the availability of expertise evidenced by the scientists and researchers who develop the technologies after research, piloting and demonstration; (2) existence of interested adoptors/entrepreneurs; (3) mechanism for transfer such as technology fairs investment fairs, training and seminars; (4) availability of capital or assets/resources, raw materials supply, working capital, equipment for the use/application of technology; (5) transparent and clear provisions for technology transfer duly embodied

in a Memorandum of Agreement between the technology owner and the adoptor; (6) the linkages with relevant individuals and/or institutions; and (7) markets.

On the first element, FNRI has talented and dedicated scientists most of whom are women who conducted and are still continuing researches on food technologies. As regards the second, adoptors for canton noodle with squash has since 1999 been increasing. Other technologies are also being transferred in different parts of the country. The emergence of new adoptors with adequate capital and experience as shown by Nutrifood Specialists, Inc., signify that food technologies intended initially for enhancing nutritive value for malnourished individuals can be elevated to “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 adoptors are cottage industry types, financing becomes crucial. The micro-lending facility which 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 this 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 adoptors. However, the budget of DOST is also quite limited. Nevertheless for as long as government supports its technology transfer programs, DOST provides appropriate assistance.

The Memorandum of Agreement of FNRI contains standard provisions on technology transfer. The technology transfer fee is a lump sum payment of P5,000 for three years without royalty payments and a non-exclusive 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 is important in the success of technology adoption/commercialization. The experiences of some adoptors in developing raw materials supply and markets show that linking up with the local government units, the local business leaders, prominent members of the community, farmers’ groups provide dividends in many forms. Good public relations with these sectors contribute to non-formal 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 adoptors 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 Multi-Purpose Cooperative)

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

The identification and development of markets both local and foreign are essential for the long-term success of ethnic foods. Without strong commitment to use local technology in appropriate circumstances and with the support of relevant government agencies and the private sector, patronage of ethnic foods will take a long time to take off. Nutrifood Specialists and Jojo Noodle Center have shown the way. Other adoptors 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. Thus, as early as 1993, furniture exports amounted to \$203 million. In Region 3, the export earnings on furniture was \$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 equipments using local technology since imported equipment is quite expensive. For instance, finishing equipments if procured abroad can drain the financial resources of the firms. The importance of such equipments lie in the fact that they enhance quality and appearance of the furniture consequently increasing their marketability. The quality of finishing brings out the beauty of the design and carving which many foreign buyers desire.

Without appropriate facility, finishing is done during the rainy season in poorly-lighted areas which are often dusty. During the dry season finishing is done outside the factory or in open spaces with standard equipment which include compressors and spray guns. Imported finishing equipment is usually beyond the reach of the entrepreneur/enterprise. In the light of the need to assist them enhance their products, the Forest Products Research and Development Institute developed two equipments. These are the spray booth and drying tunnel.

### **Development of Technology**

Well designed spray booth and drying tunnel hasten the drying of the furniture thereby reducing the production period. To develop the equipments, a team of scientists/researchers was organized in the late eighties by the Forest Products Research and Development Institute (FPRDI). They are composed of Ruben Zamora, Arturo Capati, Felix Horedo and Ma. Cecilia Zamora with the following responsibilities:

Ruben Zamora (an engineer) worked on the preparation of plans and specifications, bill of materials, supervision of the construction, installation, and commissioning the facility.

Arturo Capati assisted in the supervision of the construction, installation and commissioning of the facility.

Ma. Cecilia Zamora took care of technology transfer coordination.

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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 two years to develop, test and pilot the technology.

Spray booths are box-like enclosures used during finishing for the removal of overspray. They extract the varnish particles and solvents from the work areas, prevent fogging and misting of surfaces thereby 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.

Standard length of the tunnels is 6 meters to 12 meters. However, the length can be modified depending on the requirements of the adoptor.

Furniture products can be dried either by batch (manual loading of furniture items for inside the chamber) or conveyorized inside the chamber for continuous drying. With the use of a drying tunnel, an average of 25 minutes 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.

## **Adoptors**

Some of the adoptors of finishing/spray booth facility are: 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, Inc., D'Or Designs, Inc., Cruz Wood Industries, Betis House of Decor, A & R Interior and Golden Cane. Most of the adoptors are based in the province of Pampanga. On the other hand, a number of the adoptors of the drying tunnel facility are 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 adoptor 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 attendance of his staff. Two adoptors whose plants are situated in Pampanga are small and medium enterprises. Their furniture which are sold in local and foreign markets are owned and managed by the owners/spouses.

**Adaptor 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 assignment of their employees are as follows:

**Table 9. Gender Distribution: Adoptor A**

<b>Gender</b>	<b>Management</b>	<b>Production/Quality Assurance</b>	<b>Marketing</b>
Male	1	67	5
Female	5	17	4

It will be noted that 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 chemical engineers. At the production lines, the husband oversees the workers. Men in the production level perform tasks relating to cutting, sanding, joining parts of the furniture, spraying and finishing. A lesser number of women are doing sanding activities. A higher number 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 was strengthened. The adoptor finds the technology simple and easy to use. It was transferred without royalty fee.

Commenting on the role of men and women in the furniture production processes, the adoptor 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 in technology adoption. Many are educated and can occupy leadership roles. They are also good in marketing. They are persevering and patient.”

**Adoptor B** started her business with a small store for PX 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 which 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 its lay out, production system and processes and human resources needs.

The staffing pattern of the firm is as follows:

**Table 10. Gender Distribution: Adoptor B**

<b>Gender</b>	<b>Management</b>	<b>Production/Quality Assurance</b>	<b>Marketing</b>
Male	3	46	
Female	4	10	8

Men dominate the production jobs while marketing is handled exclusively by women. The key positions are held by the husband, wife and children, all of whom have degrees from universities. The accounting and financial services functions are assigned to women. Majority of the workers in the production line are men.

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 has four outlets/display centers: two are in Pampanga and the other two in Quezon City and 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 which have successfully competed in the foreign market.

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

They asserted that the drying tunnel and spray booth technology helped the company enhance its productivity by 60%. They said "Lumalakas ang loob namin dahil tumutulong sila sa pagturo ng technology." They acknowledged the accessibility of FPRDI and the DOST regional staff to provide advice when necessary. In addition, they mentioned that the funding support of other government agencies like the Technology Resources and Livelihood Center is essential especially during the initial period of operation.

### **Other Technologies**

FPRDI has developed other technologies developed, 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, etc.

FPRDI 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 adoptors A and B are family-owned companies and managed successfully by husband and wife teams. Adoptor B has mobilized the immediate members of his family to run the corporation. The spray booth and drying tunnel technology designed by male technologists of FPRDI 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 adoptor demonstrates that Filipino technology is functional and contributes to the viability of the adoptor's business. At the same time, the technology generator maintains continuous linkage with the adoptor. On the other hand, the Provincial S&T Officer and the regional personnel, make themselves available for networking and advice.

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

Access to opportunities to women and men are present in the furniture firms. However, gender differentiation of tasks is dependent on the physical strength needed in performing the work. 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 while 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 which can be considered in the redesign of 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: firstly, the Regional Director was a former Deputy Director of TAPI and has a strong technical background (a chemical engineer) secondly, the networks with local officials were good and thirdly, the adoptors were willing to accomplish the questionnaires.

Twenty-two (22) technology adoptors favorably responded to the questionnaires as shown in the following list:

#### Province of Aklan:

Heritage Arts and Crafts  
Rentillo Enterprises  
Handicraft of Aklan MPC  
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

#### Province of Iloilo:

Ideal Home Foods  
Vital Clean Marketing  
Oton Straw Mats  
Our Mother of Perpetual Help MPC

#### ***Province of Negros Occidental***

Buro-buro Spring Black pepper, Flower and Vermi Farm  
Jojo's Noodle Center  
Cruzayco Corp.  
T-Flavors/Food Processors  
Far East Bamboo Export, Inc.  
Anawares Venture Corp.  
Hacienda Crafts Company, Inc.  
Intrax Industrial Sales

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The research team visited the offices/business site of four adoptors in Negros Occidental, interviewed some officers and observed the personnel in their work.

## Findings

The adoptors 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 propagation of 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).

Majority have small investments or below P1 million. Only six of the 17 adoptors' investments was beyond P1 million, the biggest was P3.4 million.

Very little information was obtained on revenues/income generated. Three of the 6 corporations export their products. Four adoptors are cooperatives and the rest are individual proprietorships.

The adoptors 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 11. Gender Distribution in Various Businesses**

<i>Proprietor/Firm</i>	<i>Management/Adm./Finance</i>		<i>Prod./Quality Assurance</i>		<i>Marketing</i>	
	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>
Mapatag Multipurpose Coop	3	4	6	-	1	-
Oton Straw Mats	3	-	6	2	1	-
Handicraft of Aklan Multipurpose Coop.	5	-	1	-	1	-
Far East Bamboo Exports Inc.	4	6	2	3	3	1
Lida's Brick & Pottery	2	3	No data	No data	-	2
Rentillo Enterprises	5	2	7	2	1	2
Our Mother of Perpetual Help, MCP	1	2	13	2	1	2
Pio Fajardo	1	1	4	1	5	10
Jojo's Noodle	1	2	5	2	1	1
Antique's of Fed. Coop	3	1	-	2	-	1
Intrax Industrial Sales	1	1	4	2	-	1
Sunshine Agri System	6	-	5	23	8	10
<b>Total</b>	<b>35</b>	<b>22</b>	<b>53</b>	<b>39</b>	<b>22</b>	<b>29</b>

Data obtained from 12 adoptors show that 61% in management/administration including finance are women; 57% are in production/quality assurance and 43% are in

marketing. (as of September 3000) 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 adoptors as "easy to use and adopt", "helpful" and contributory to the success of the businesses. One company which 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 "lower the cost of production by 60% while the handicraft drying chamber lower the moisture content of the material (pandan leaves) at appropriate level suitable for export requirements".

### **Modifications/Enhancement of Technology**

Minimal modification of the technology was undertaken by the adoptors. These are 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 volume of production. Modifications are often done after consulting with the technologists of DOST.

### **Factors which Contribute and/or Constrain Effective Technology Transfer**

The 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; and The adoptor has technical skills and residents of the community can be tapped for employment. The factors that contribute to/or constrain effective technology transfer are: limited capital, lack and/or seasonality in the supply of raw materials, seasonality in the demand for the products, limited access to markets, lack of trained manpower, absence of institutional markets (big buyers) limited or unavailable good packaging materials.

### **Role of Women**

About six of the businesses are managed by women particularly in proprietorships. However, the husbands are actively involved in production and sourcing of raw materials. Women are generally responsible for financial management such as handling of funds particularly accounting, budgeting and disbursement. Both men and women respondents perceive women to be creative, patient, persevering, committed, has a good appreciation of colors and color combination and reliable. One respondent stated

that “they are constant in making decisions, good in targetting markets, and pay close attention to cleanliness”.

## **Analysis**

The technologies adopted in Region VI are generally simple and viable. They are used by microenterprises and small enterprises which have provided employment to the communities in adjoining areas. The businesses generated by the adoptors contributed to countryside development and provide products to local residents and in some instances to adjoining areas. Only few export their products and they are organized as corporations with flexibility to mobilize resources such as financing support from formal lending institutions.

Adoptors 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 adoptors improved the technology that was adopted. This may be due to the fact that the products are locally consumed and expectations are not high. Since there is a relatively small number of adoptors who export their products efforts must be exerted to motivate other adoptors to look beyond the markets in adjoining communities.

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

DOST needs to review the technologies, which are adopted in the Regions and identify niches that can be focused on. Depending on the resources of the communities such as raw materials, potential entrepreneurs, manpower within and in the adjoining areas, higher types of 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 technology.

## **Integrated Analysis**

The findings on the research and development of technologies and technology transfer to entrepreneurs-adoptors indicate that simple technologies are generally appropriate for microenterprises. In some instances, such technologies enable the adoptors to transform their businesses to bigger enterprises. There are beneficial effects on the use of the technologies such as food processing of fruits, vegetables or production of canton noodle with squash, drying tunnel/chamber, spray booth, and similar technologies to the communities where the adoptors are located. Employment is generated, use of tools and equipment for production is learned, formulation of nutritious products is applied and other technology information and skills are shared by the adoptors to their personnel and staff. These are learnings which somehow contribute to an awareness and understanding of the role of technology in improving one's life.

Nevertheless, transfer of technology with the embedded implicit or explicit knowledge in the technology or transfer agent is not adequate to hasten commercialization and economic development. As earlier pointed out by policy writers, R & D commercialization are facilitated by the following: (1) by demand driven partnership between research institutions/university and industry; (2) availability of R & D funds for small and medium-sized enterprises for product improvement and new product and process development; and (3) 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 scientist. 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 so that the technology generator and potential adoptor can meet together even as early as the research stage so that the adoptor can articulate his expectations and the scientists can plan his research accordingly.

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

Nevertheless, the consultation system of DOST's Sectoral Councils in developing its research agenda may have to be reviewed so that in the process of the formulation of the plans and programs, one-on-one relationships are already initiated between the technology generator and the technology adoptor. Likewise, representatives from government financial institutions which are mandated to provide credit facilities to technology-based enterprises must also be invited to participate in the planning and program formulation processes so that all sectors concerned will be 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 since some of them can ultimately grow and become medium and big companies. While most of the technology adoptors are categorized as microenterprises 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 Centers (CRCs) of Australia. The CRCs are institutions which undertake projects through the joint efforts of RDI and private sector. The R & D Start (Strategic Assistance for Research and Development) of Australia provides assistance of up to 50% of project costs for smaller Australian companies through grants for R&D projects and through loans, for the early commercialization of technological innovation(*Core Start*).

The extensive experience of Stanford University in commercializing research outputs is worth considering. At the initial phase of research activities, 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 technology is not normally fundable by lending institutions. Collateral requirements are difficult to comply with since only a few own real estate (land and/or buildings).

Royalty payments are not generally expected by DOST for simple technologies which are transferred to adoptors. 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 the production of herbal medicine products, particularly *lagundi* and *sambong*, is very modest with very short period of payment of three to four years of royalty fees.

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 the business data of the adoptor. 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 success in exports, two firms have been quite successful in finding foreign markets. Their products are of high quality and are much in demand in markets in Europe. Both use indigenous materials and creative designs which the buyers find unique and irresistible.

These firms have corporate structures and 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 source of “learnings” on the use of technology by community residents. One may recall that 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. One notes that most microenterprises are initiated by women, who are quite successful in raising capital, using indigenous materials and mobilizing community members. It may be assumed that in addition to the qualities attributed to women such as perseverance, attention to details and commitment, Filipino women in general are the holders of the purse. They serve as the data indicate, as treasurers, budget officers, cashiers and quality controllers of the firms/businesses where they work.

Technologies are easy to adopt and understand, the respondents unanimously aver. Some of them improved/enhanced the technologies to suit the requirements of their firms. Some problems which may require consultations with the technology generator involve redesigning simple equipment or substituting raw materials for the processing of food products. A monitoring system can be established by in the DOST so that appropriate enhancements and improvements can be undertaken quickly. This will enable the adoptors, 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 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 medical products arising from the outputs of NIRPROMP. This Program should receive continuous support and encouragement. It is a showcase of 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 is female-dominated. The entry of a well-known restaurateur in the canton noodle (squash) commercialization indicates that locally developed products from indigenous materials can reach wider markets. On the other hand, the entrepreneurial skills of a rural based adoptor, including her networking capability, show that a good technology can prosper in the hands of a committed and resourceful woman. The support system which DOST extended to both adoptors is an important factor in the success of these entrepreneurs.

The firms utilizing forest products technology likewise benefit from the collaborative efforts between technology adoptor and technology generator. Undoubtedly, accessibility of the scientist to the adoptor enhances the technological capability of the latter. As regards gender, women as entrepreneurs co-own the firms with their spouses. They handle the finance aspects of the business, while the husbands oversee the production activities. At the shop level, men outnumber women in work

assignments which require lifting of heavy equipment or materials. This has implication in the future design of equipment to make them more gender-friendly.

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

Women as a whole have participated reasonably well in R & D, technology transfer and adoption in the areas covered by the research. This situation, however, should not lead to complaisance as regards gender equity. Continuous monitoring and documentation of the participation of women is essential to ensure that the gains are not eroded in the future.

## **Recommendations and Conclusions**

A number of 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 utilization capability of technology adoptors; (4) assessment of human resource development for scientists and researchers; and (5) review of conflict of interest principle in relation to the participation of scientists in R & D commercialization.

The relationships between private sector and RDIs must be assessed to ensure that the latter's needs are taken into consideration in developing R & D programs. A more focused demand driven R & D programs will hasten the commercialization of research outputs. In this regard, a review of the role of the private sector representative in the S&T Sectoral Councils may be undertaken 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 needs 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 adoptors specially 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 which utilize technologies or improve or enhance technologies will upgrade the capability of such enterprises to improve productivity and expand their markets. In addition, credit schemes which are creative, supportive of technology adoption and enhancement will go a long way towards ensuring the competitiveness of technology adoptors.

Continuous upgrading of the entrepreneurial skills and use of technologies by microenterprises collaboratively undertaken by the Technology Application and Promotion Institute (TAPI) the Department of Trade and Industry, appropriate private sector organizations/associations and the local government units where the microenterprises are located 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) is worth extending to a bigger number of microenterprises .

A practical and brief human resource development program for scientists and researchers on entrepreneurship and intellectual property rights will broaden their perspective. 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 policy makers. These can be very productive exercises which will 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 which commercialize their technology may be looked into. 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, the women's role in R&D technology generation and adoption may be enhanced by supporting associations/organizations which 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. The 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 in gender equality and equity.

The 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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## 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 adoptor 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 adoptor is on a negotiated contract basis.
- 2.6. All of the following shall guide the selection of business entity as adoptor.
  - 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 Adoptors (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 Principle in the Selection of Technology Adoptor 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”.
- (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 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, tradenames, and services 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 such 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 HOA/Contract. The following shall 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 t 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:

- (a) scope, complexity and pioneering nature of the technology;
- (b) importance of the technology in relation to the technology recipient’s overall activity;
- (c) degree of mastery of the technology by the technology supplier;
- (d) stage of the licensed product in the product life cycle;
  
- (e) use of indigenous raw materials and services, energy savings, level of priority of the licensed activity;
- (f) employment generation;
- (g) export earnings and its effect on the balance of payments;
- (h) spill-over of technology to local industry;
- (i) technology supplier’s share in the technology recipient’s profit; and
- (j) 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 pre-calculated 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 A.O.'s 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 effectivity 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.

**Appendix 3.**  
**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 RESEARCHES**

Specific Questions	Program/ Project	Program/ Project	Program/ Project
3.1 Title of Program/Project			
3.2 Who initiated research/or inspired research idea?	<input type="checkbox"/> Client <input type="checkbox"/> Customer <input type="checkbox"/> Supervisor <input type="checkbox"/> Mandate <input type="checkbox"/> Other (specify) _____ _____ _____	<input type="checkbox"/> Client <input type="checkbox"/> Customer <input type="checkbox"/> Supervisor <input type="checkbox"/> Mandate <input type="checkbox"/> Other (specify) _____ _____ _____	<input type="checkbox"/> Client <input type="checkbox"/> Customer <input type="checkbox"/> Supervisor <input type="checkbox"/> Mandate <input type="checkbox"/> Other (specify) _____ _____ _____
3.3.1 How was the research funded?	<input type="checkbox"/> Local fund <input type="checkbox"/> Foreign fund <input type="checkbox"/> Both	<input type="checkbox"/> Local fund <input type="checkbox"/> Foreign fund <input type="checkbox"/> Both	<input type="checkbox"/> Local fund <input type="checkbox"/> Foreign fund <input type="checkbox"/> Both
3.3.2 Source of local research fund <input type="checkbox"/> Philippine government	<input type="checkbox"/> GAA/GF <input type="checkbox"/> GIA <input type="checkbox"/> Research fund from other gov't. Institution (e.g. DA, etc.) <input type="checkbox"/> Others, (specify) _____ _____ _____ <input type="checkbox"/> Private	<input type="checkbox"/> GAA/GF <input type="checkbox"/> GIA <input type="checkbox"/> Research fund from other gov't. Institution (e.g. DA, etc.) <input type="checkbox"/> Others, (specify) _____ _____ _____ <input type="checkbox"/> Industry <input type="checkbox"/> NGO	<input type="checkbox"/> GAA/GF <input type="checkbox"/> GIA <input type="checkbox"/> Research fund from other gov't. Institution (e.g. DA, etc.) <input type="checkbox"/> Others, (specify) _____ _____ _____ <input type="checkbox"/> Industry <input type="checkbox"/> NGO

Specific Questions	Program/ Project	Program/ Project	Program/ Project
	<input type="checkbox"/> Others, (specify) _____ _____ _____	<input type="checkbox"/> Others, (specify) _____ _____ _____	<input type="checkbox"/> Others, (specify) _____ _____ _____
3.3.3 Source of foreign research fund	<input type="checkbox"/> Institutional Organization (e.g. APEC, FAO, UNICEF, etc.)  <input type="checkbox"/> Private/foreign industry  <input type="checkbox"/> Others, (specify) _____ _____	<input type="checkbox"/> Institutional Organization (e.g. APEC, FAO, UNICEF, etc.)  <input type="checkbox"/> Private/foreign industry  <input type="checkbox"/> Others, (specify) _____ _____	<input type="checkbox"/> Institutional Organization (e.g. APEC, FAO, UNICEF, etc.)  <input type="checkbox"/> Private/foreign industry  <input type="checkbox"/> Others, (specify) _____ _____
3.4 How many individuals participated in the research?	No. of males ____ No. of females ____ Total _____	No. of males ____ No. of females ____ Total _____	No. of males ____ No. of females ____ Total _____
3.5 How many institutions participated in the research?	No. of govt. Institution ____  No. of private institution ____	No. of govt. Institution ____  No. of private institution ____	No. of govt. Institution ____  No. of private institution ____
3.6 How long was the research project?	<input type="checkbox"/> Less than 1 yr. <input type="checkbox"/> 1 to 2 years <input type="checkbox"/> 3 to 4 years <input type="checkbox"/> more than 5 years	<input type="checkbox"/> Less than 1 yr. <input type="checkbox"/> 1 to 2 years <input type="checkbox"/> 3 to 4 years <input type="checkbox"/> more than 5 years	<input type="checkbox"/> Less than 1 yr. <input type="checkbox"/> 1 to 2 years <input type="checkbox"/> 3 to 4 years <input type="checkbox"/> more than 5 years
3.7 How much was spent for the research program/project?	PS _____ MOOE _____ EO _____ CO _____ Admin. Cost ____	PS _____ MOOE _____ EO _____ CO _____ Admin. Cost ____	PS _____ MOOE _____ EO _____ CO _____ Admin. Cost ____

Specific Questions	Program/ Project	Program/ Project	Program/ Project
3.8 Are the research results or technologies developed and transferred and commercialized?	[ <input type="checkbox"/> ] Yes [ <input type="checkbox"/> ] No	[ <input type="checkbox"/> ] Yes [ <input type="checkbox"/> ] No	[ <input type="checkbox"/> ] Yes [ <input type="checkbox"/> ] No
3.9 If yes, number of technology adoptors per technology	_____	_____	_____
3.10 Mode of Technology	[ <input type="checkbox"/> ] Technology Business Incubator  [ <input type="checkbox"/> ] Communal Service Facilities  [ <input type="checkbox"/> ] Direct Transfer to Industry  [ <input type="checkbox"/> ] Training/ Demonstration  [ <input type="checkbox"/> ] Others, specify _____	[ <input type="checkbox"/> ] Technology Business Incubator  [ <input type="checkbox"/> ] Communal Service Facilities  [ <input type="checkbox"/> ] Direct Transfer to Industry  [ <input type="checkbox"/> ] Training/ Demonstration  [ <input type="checkbox"/> ] Others, specify _____	[ <input type="checkbox"/> ] Technology Business Incubator  [ <input type="checkbox"/> ] Communal Service Facilities  [ <input type="checkbox"/> ] Direct Transfer to Industry  [ <input type="checkbox"/> ] Training/ Demonstration  [ <input type="checkbox"/> ] Others, specify _____

**Part B - APPLIED RESEARCHES**

Specific Questions	Program/ Project	Program/ Project	Program/ Project
3.1 Title of Program/Project			
3.2. Who initiated research/or inspired research idea?	<input type="checkbox"/> Client <input type="checkbox"/> Consumer	<input type="checkbox"/> Client <input type="checkbox"/> Consumer	<input type="checkbox"/> Client <input type="checkbox"/> Consumer

Specific Questions	Program/ Project	Program/ Project	Program/ Project
<p>(Multiple answer)</p> <p>3.3.1 How was the research funded?</p> <p>3.3.2 Source of local research fund</p> <p>[            ] Philippine government</p> <p>[            ] Private</p>	<input type="checkbox"/> Supervisor <input type="checkbox"/> Mandate <input type="checkbox"/> Other (specify) _____ _____ _____	<input type="checkbox"/> Supervisor <input type="checkbox"/> Mandate <input type="checkbox"/> Other (specify) _____ _____ _____	<input type="checkbox"/> Supervisor <input type="checkbox"/> Mandate <input type="checkbox"/> Other (specify) _____ _____ _____
	Local fund  Foreign fund  [    ] Both	Local fund  Foreign fund  [    ] Both	Local fund  Foreign fund  [    ] Both
	[    ] GAA/GF  [    ] GIA  [    ] Research fund from other government institution (e.g. DA. Etc.)  [    ] Others, (specify) _____ _____ _____	[    ] GAA/GF  [    ] GIA  [    ] Research fund from other government institution (e.g. DA. Etc.)  [    ] Others, (specify) _____ _____ _____	[    ] GAA/GF  [    ] GIA  [    ] Research fund from other government institution (e.g. DA. Etc.)  [    ] Others, (specify) _____ _____ _____
	[    ] Industry  [    ] NGO  [    ] Others, (specify) _____	[    ] Industry  [    ] NGO  [    ] Others, (specify) _____	[    ] Industry  [    ] NGO  [    ] Others, (specify) _____

Specific Questions	Program/ Project	Program/ Project	Program/ Project
3.2.2 Source of foreign research fund	<p>_____</p> <p>_____</p> <p>[ ] Institutional Organization (e.g. APEC, FAO, UNICEF,ET C.)</p> <p>[ ] Private/foreign industry</p> <p>[ ] Others, (specify)</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>[ ] Institutional Organization (e.g. APEC, FAO, UNICEF,ET C.)</p> <p>[ ] Private/foreign industry</p> <p>[ ] Others, (specify)</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>[ ] Institutional Organization (e.g. APEC, FAO, UNICEF,ET C.)</p> <p>[ ] Private/foreign industry</p> <p>[ ] Others, (specify)</p> <p>_____</p> <p>_____</p> <p>_____</p>

Specific Questions	Program/ Project	Program/ Project	Program/ Project
3.4 How many individuals participated in the research?	No. of male ____ No. of female __ Total _____	No. of males ____ No. of female __ Total _____	No. of males ____ No. of female __ Total _____
3.5 How many Institutions participated in the research?	No. of govt. Institution ____ No. of private Institution ____	No. of govt. Institution ____ No. of private Institution ____	No. of govt. Institution ____ No. of private Institution ____
3.6 How long was the research project?	[ ] Less than 1 yr. [ ] 1 to 2 years [ ] 3 to 4 years [ ] more than 5 years	[ ] Less than 1 yr. [ ] 1 to 2 years [ ] 3 to 4 years [ ] more than 5 years	[ ] Less than 1 yr. [ ] 1 to 2 years [ ] 3 to 4 years [ ] more than 5 years
3.7 How much was spent for	PS _____	PS _____	PS _____

<p>the research program/project?</p> <p>3.8 Are the research results or technologies developed transferred and commercialized?</p> <p>3.9 If yes, number of technology adopters per technology</p>	<p>MOOE_____</p> <p>EO _____</p> <p>CO _____</p> <p>Admin Cost ____</p> <p>[ ] Yes</p> <p>[ ] No</p> <p>_____</p>	<p>MOOE_____</p> <p>EO _____</p> <p>CO _____</p> <p>Admin Cost ____</p> <p>[ ] Yes</p> <p>[ ] No</p> <p>_____</p>	<p>MOOE_____</p> <p>EO _____</p> <p>CO _____</p> <p>Admin Cost ____</p> <p>[ ] Yes</p> <p>[ ] No</p> <p>_____</p>
<p>3.10 Mode of Technology Transfer</p>	<p><input type="checkbox"/> Technology Business Incubator</p> <p><input type="checkbox"/> Communal Service Facilities</p> <p><input type="checkbox"/> Direct Transfer to industry</p> <p><input type="checkbox"/> Training /</p> <p><input type="checkbox"/> Demonstration</p> <p>Others, (specify)</p> <p>_____</p>	<p><input type="checkbox"/> Technology Business Incubator</p> <p><input type="checkbox"/> Communal Service Facilities</p> <p><input type="checkbox"/> Direct Transfer to industry</p> <p><input type="checkbox"/> Training /</p> <p><input type="checkbox"/> Demonstration</p> <p>Others, (specify)</p> <p>_____</p>	<p><input type="checkbox"/> Technology Business Incubator</p> <p><input type="checkbox"/> Communal Service Facilities</p> <p><input type="checkbox"/> Direct Transfer to industry</p> <p><input type="checkbox"/> Training /</p> <p><input type="checkbox"/> Demonstration</p> <p>Others, (specify)</p> <p>_____</p>

4. **Factors which contributed to technology transfer effectiveness**

- Management (Specify) \_\_\_\_\_
- Nature of Technology ( e.g. simple, viable, etc.)  
(specify) \_\_\_\_\_
- Market demand (specify) \_\_\_\_\_
- Others (specify) \_\_\_\_\_

5. **Factors which 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 = Non-Government Organization
6. APEC = Asia Pacific Economic Cooperation
7. FAO = Food and Agriculture Organization
8. UNICEF = United Nations International Children Educational Fund
9. PS = Personnel Services
10. MOOE = Maintenance and Other Operating Expenses
11. EO = Equipment Outlay
12. CO = Capital Outlay

**Appendix 4.**  
**Questionnaire for Technology Adoptor**

**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:**

**3.1. 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 organization

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

3.4 Technical Information

3.4.1 Personnel Involved

Management

No. of male \_\_\_\_\_

No. of Female \_\_\_\_\_

Functions of Male

Functions of Female

(pls. Indicate no. of staff)

(pls. Indicate no. of staff)

[ ] Supervisor/manager

[ ] Supervisor/manager

- |   |   |
|---|---|
| <input type="checkbox"/> Human Resource Devt.   | <input type="checkbox"/> Human Resource Devt.   |
| <input type="checkbox"/> Cashier                | <input type="checkbox"/> Cashier                |
| <input type="checkbox"/> Assistant              | <input type="checkbox"/> Assistant              |
| <input type="checkbox"/> Maintenance/Engineer   | <input type="checkbox"/> Maintenance/Engineer   |
| <input type="checkbox"/> Purchasing/Buyer       | <input type="checkbox"/> Purchasing/Buyer       |
| <input type="checkbox"/> Budget                 | <input type="checkbox"/> Budget                 |
| <input type="checkbox"/> Auditor                | <input type="checkbox"/> Auditor                |
| <input type="checkbox"/> Clerk/Support          | <input type="checkbox"/> Clerk/Support          |
| <input type="checkbox"/> Janitorial Services    | <input type="checkbox"/> Janitorial Services    |
| <input type="checkbox"/> Others (specify) _____ | <input type="checkbox"/> Others (specify) _____ |
| Remarks: _____                                  | Remarks: _____                                  |
| _____   | _____   |
| _____   | _____   |

### Production/Quality Assurance/Control

No. of male \_\_\_\_

No. of Female \_\_\_\_

Functions of Male

Functions of Female

(pls. Indicate no. of staff)

(pls. Indicate no. of staff)

Production Supervisor

Production Supervisor

<input type="checkbox"/> Production Engineer	<input type="checkbox"/> Production Engineer
<input type="checkbox"/> Medical Technologist	<input type="checkbox"/> Medical Technologist
<input type="checkbox"/> Quality Control Staff	<input type="checkbox"/> Quality Control Staff
<input type="checkbox"/> Clerk/Support	<input type="checkbox"/> Clerk/Support
<input type="checkbox"/> Janitorial Services	<input type="checkbox"/> Janitorial Services
<input type="checkbox"/> Others (specify) _____	<input type="checkbox"/> Others (specify) _____
Remarks: _____	Remarks: _____
_____	_____
_____	_____

3.4.2 Raw Material Requirement

Major raw material requirement /month \_\_\_\_\_kg (specify) \_\_\_\_\_

Other raw material requirement /month \_\_\_\_\_kg (specify) \_\_\_\_\_  
 (please specify) \_\_\_\_\_kg (specify) \_\_\_\_\_  
 \_\_\_\_\_kg (specify) \_\_\_\_\_  
 \_\_\_\_\_kg (specify) \_\_\_\_\_

3.4.3 Volume of Business

Income generated/year

Export P \_\_\_\_\_ Local P \_\_\_\_\_

Total employment generated

No. of male \_\_\_\_ No. of female \_\_\_\_

3.4.4 Classification of the Industry as to total number of employees

- Less than 5 workers (micro industry)
- 6 to 9 workers (cottage industry)
- 10 to 99 workers (small scale industry)
- 100 to 199 workers (medium scale industry)

200 or more workers (large scale 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 which contributed to technology transfer effectiveness**

Management (Specify) \_\_\_\_\_

Nature of Technology ( e.g. simple, viable, etc.)  
(specify) \_\_\_\_\_

Market demand (specify) \_\_\_\_\_

Others (specify) \_\_\_\_\_

5. **Factors which 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)