



# MISSING LINKS

**Gender Equity in  
Science and Technology  
for Development**

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# Missing Links

Gender Equity in Science and Technology  
for Development

*Gender Working Group,  
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*This book is dedicated to Stanislas Ruzenza,  
a member of the Gender Working Group.  
Professor Ruzenza died in June 1995,  
a victim of civil strife in Burundi.*

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## Chapter 3

# Claiming and using indigenous knowledge

*Helen Appleton, Maria E. Fernandez,  
Catherine L.M. Hill, and Consuelo Quiroz*

Knowledge is generated by communities, over time, to allow them to understand and cope with their particular agroecological and socio-economic environment (Brouwers 1993). Such knowledge — referred to as “local,” “indigenous,” or “traditional” — can be termed science, because it is generated and transformed through a systematic process of observation, experimentation, and adaptation.

Local knowledge systems are geared to dealing with diversity, in both the natural environment and social organization and continue to evolve over time. Like other scientific systems, local knowledge systems develop technology and management practices to improve the quality of life of people. However, local knowledge systems differ fundamentally from those based on modern science and technology (S&T) in that they are managed by the users of the knowledge and they are holistic. Although both “bodies of knowledge” — traditional and modern — are structured by systems of classification, sets of empirical observations about local environments, and systems of self-management that govern resource use (Johnson 1992), they differ in their capacity to deal with local problems and in the degree to which they are accessible to the members of the social group charged with resource management and production.

Because the primary social differentiation among adult, economically active members of a society is based on gender, specific spheres of activity become the domains of different genders as they increase their knowledge and skill over time. As a result, local knowledge and skills held by women often differ from those held by men. For example, in certain parts of the Andes, women have much more knowledge of livestock management practices than men, whereas men know much more about soil classification than women. This specialization is publicly recognized: women are consulted when decisions about health and breeding strategies have to be made; men are consulted when the appropriateness of a particular field for a

crop is being weighed (Fernandez 1992). Relations between men and women in a culture will affect hierarchies of access, use, and control resulting in different perceptions and priorities for innovation and their use of technology (Appleton 1993a, b).

Full recognition of local knowledge systems is central to the issue of sustainable and equitable development. Until recently, they have been viewed as "backward," "static," and a "hinderance" to modernization. This negative view has been fostered by a tradition of Western science, which has resulted in today's highly specialized disciplines such as cell biology, molecular biology, and epidemiology (Hill 1994). Although the idea of scientists and technologists working together globally to find solutions to the world's problems is inspiring, the reality is many different units racing independently toward goals that are defined principally in terms of the profit potential (Appleton 1993b).

The view that modern science is capable of providing the solution to "underdevelopment" is also responsible for the depreciative view of indigenous and local knowledge systems. Furthermore, the focus on objectivity, rigor, control, and testing has helped to develop the perception that S&T are value-free, and that they operate outside of the societies in which they are based. Unfortunately, given the tremendous influence of S&T, this attitude has undermined the capacity of local knowledge systems to innovate and has lowered the status of the innovators themselves, especially women whose contribution to technological development has been historically undervalued.

For example, in a study in semi-arid areas of western India, researchers set out to establish the degree of knowledge scientists had about farmers' practices and to highlight the importance of understanding scientists' assumptions about local knowledge (Gupta 1989). The scientists, from various scientific backgrounds, were working for the All India Coordinated Research Project on Dryland Agriculture (AICRPDA), Haryana Agricultural University, Hissar, and the University's Dryland Research Station at Bawal. The study concluded (Gupta 1989):

These scientists have rarely investigated the reasons for the practices they mentioned. Thus the science underlying the rational practices and the myths behind not-so-scientific practices have not been understood. We want to state unambiguously that the mere documentation of peasant practices is not enough. We have to identify the scientific basis of peasant practices and link it with their rationality.

Gupta (1989) also set out to test the validity of biologists' assumptions about women's homestead gardens. At a meeting, the scientists revealed that they believed the homesteaders used space inefficiently; that the vegetation was planted randomly or left to chance; and that trees were grown for only a single purpose, fuel or fruit. The validity of these assumptions was then tested by a team of women scientists working through maps of homesteads with local women. They discovered a complex system of planning, indicating some order in the apparent disorder. It also emerged that responsibilities for the homestead were divided among the men and women, and did not rest solely with the women as had been previously assumed.

The women scientists concluded that greater emphasis had to be placed on women's knowledge and practices: "The role of women in the homestead needed to be understood in terms of their own specialist knowledge and not just by regarding them as exploited workers who contribute to post-harvest chores" (Gupta 1989).

If a productive structure, based on the satisfaction of basic human needs and collective rather than individual consumption, is concomitant with sustainable development, the need for imported technology must be replaced by increased demand for local S&T innovation. However, the development of endogenous S&T capabilities should not necessarily follow the route of S&T in Western industrialized nations (Sagasti 1979). In Sagasti's view of resources, S&T systems focus on control and utilization, whereas local knowledge systems focus on usufruct and management. The generation of S&T is directly linked to centralized control over the distribution of information; information in local knowledge systems is the common property of integrated social groups.

Recognition and reinforcement of local knowledge systems can be the basis for an alternative development model. The capacity of these systems to integrate multiple disciplines, and the resultant synergism, are beginning to demonstrate higher levels of efficiency, effectiveness, adaptability, and sustainability than many conventional technologies. If they are to continue to contribute to sustainable development, however, local knowledge systems must be respected for what they are.

Currently, the United Nations (UN) agenda includes two interrelated issues that have to do with the interface of gender, S&T, and respect and recognition of local knowledge systems in their own right:

- ♦ Conservation and reproduction of the natural environment for use by future generations; and

- ♦ The intellectual property rights (IPRs) of local groups who have been responsible over time for the construction and conservation of biodiversity.

These issues directly affect the rights of women and men to manage resources critical to their innovative capacity and, therefore, their ability to contribute to a sustained development from which future generations may benefit.

## **Gender, biodiversity, and new agrotechnologies**

Although women have long been key food producers and “managers” of their environments and play a central role in the sustainable use of biological resources and life support systems, especially in the conservation and enhancement of genetic resources, their work remains relatively unnoticed by researchers and development workers (Shiva and Dankelman 1992, p. 44). In Dehra Dun, India, for example, local women were able to identify no fewer than 145 species of trees and their uses; forestry “experts” were familiar with only 25 species (Shiva and Dankelman 1992). The stability and sustainability of the intricately interwoven ecosystem of forest, crops, and livestock depended on the practices and knowledge systems of the local women. Their collection of fodder, fuel, and other forest material was vital to the continued flow of resources that maintained the local economy in a sustainable way (Shiva and Dankelman 1992, p. 46).

The introduction of new agricultural technologies is resulting in women increasingly losing control in areas where they once had considerable control. In India, for example, the shift from subsistence to commercial agriculture has led to a reduction of women's sphere of influence. Women are shown to be increasingly dependent on men for extension services, purchase of seeds, and handling of tools and money (Indian Institute of Management 1992, p. 47). These problems have been exacerbated by the fact that outside “experts” have tended to interact with men in rural communities. Women, who are often not directly represented in local political decision-making structures become increasingly disadvantaged, because they lose both their knowledge and their status derived from their control over resources and knowledge. As Shiva and Dankelman (1992) argue, this situation breaks “women's sense of dignity, self-respect and self-determination.” There is then the immediate danger that women's ecological knowledge will be “packaged as a product to be collected,

owned, and sold in the marketplace of ideas of the scientific community" without them being compensated in any way (Shiva and Dankelman 1992).

Women's knowledge systems tends to be holistic and multi-dimensional. The introduction of agricultural technologies usually results in "resource fragmentation, undermining the position of women. The flows of biomass resources, that is, plant material for food, fodder and fuel, as well as animal wastes traditionally maintained by women, are disturbed and the different linkages between the agriculture, forest and livestock sectors of the system break down" (Shiva and Dankelman 1992, p. 48). In addition, inputs and outputs become completely dependent on external markets. Within this environment, the "women's role becomes more and more that of a labourer as she loses her control over production and access to resources" (Shiva and Dankelman 1992, p. 47).

## Gender and intellectual property rights

IPRs refer primarily to international and national legal mechanisms used to protect primarily corporate and individual interests within a profit-motivated S&T system. The term is ineffective when applied to local knowledge as it does not recognize its status as a community responsibility rather than "private" property.

For thousands of years, plant genetic material has been collected, initially by local communities, then by colonizers, and later by botanists, plant breeders, and biotechnologists. Over the last 20 years, germplasm has been systematically collected from and stored in "genebanks." There has been much debate over the "ownership" of these collections as well as the safety of the material, the development of national laws restricting the availability of germplasm, and IPR to new varieties.

Because of the recent practice of "biodiversity prospecting," IPRs focus disproportionately on protecting corporate or individual knowledge in the area of biological products, leaving a whole range of cultural or community knowledge open to exploitation. Genetic resources are often incorrectly referred to as the "raw materials" for biotechnology, whereas in reality they are the products of the intellectual, cultural, and environmental contributions of local innovators, both women and men. Describing them as raw materials allows dominant S&T systems to exploit not only the matter, but also the people, as they are seen to belong to "no one in particular."

An exploitive asymmetry is thus created. When information is collected from Andean women peasants and Amazonian native peoples, for example, scientists consider it to be the “common heritage” of humanity, a public good for which no payment is appropriate or necessary. However, when the information is processed and transformed in the laboratories or factories of so-called “developed” nations, its value is enforced by legal and political mandate.

In the era of biotechnology, all biological “products” and processes could become patentable material, and countries such as the United States could be in a position to act against any country that did not provide exclusive opportunities for their corporations protected by their national laws. As Greaves (1994, p. ix) argues,

[Local knowledge] now far more than in the past, is under real or potential assault from those who would gather it up, strip away its honoured meanings, convert it to a product, and sell it. Each time that happens the heritage itself dies a little, and with it its people.

Acquirers of local knowledge have power, technology, “inside” information, and sophisticated economic systems that allow them to take unfair advantage of knowledge innovators, particularly women, who have less access to power structures.

Currently, there are few provisions for the protection of local knowledge systems from outside exploitation. Applying existing patent and copyright laws to local knowledge is not only impossible, but also impractical for various reasons: there is no identifiable inventor; all traditional culture is already in the “public domain”; and the protection would, at best, last only a finite number of years. Furthermore, the present purpose of patent and copyright protection is to encourage profits for a few, not to sustain a community and environment as a living system.

A new legal instrument is needed — one that confers ownership and control of local knowledge on those who create, develop, and enhance it and that recognizes the differential access of women and men to political decision-making structures. This instrument would include ownership of, and control over, knowledge that is commonly held rather than individual. This kind of instrument cannot be developed without the active participation of those who possess the knowledge — both men and women.

## The work of governments, universities, nongovernmental organizations, and local groups

Few programs have focused specifically on women's indigenous S&T knowledge. To obtain information in this area, it is necessary to examine a range of relevant programs and research that fall into three broad categories: S&T programs with women; general women's programs; and programs focused on indigenous knowledge. However, these categories are self-limiting in terms of adding to knowledge about women's existing S&T capacities. Also, information derived from an activity-specific approach encourages a focus on particular areas of work rather than general issues around women's indigenous technical knowledge. There is little analysis of how information contributes to a broader understanding of the issues or, at a strategic level, about the implications of this information for the design of policies and strategies.

S&T programs generally focus on integration of women into S&T activities. Women are viewed as the recipients of knowledge, rather than the generators, and the focus is on transfer of technologies to women through "training" and equipping women with the "necessary skills." This emphasis on delivery *to* women of the necessary opportunities, technologies, and management skills detracts from examination of existing capacity.

Women's programs tend to focus on improving women's status, access to resources, education, training, decision-making, and empowerment *in relation to men*. There is little critical examination of the value of women's knowledge in relation to identified problems and available resources in the wider environment, or of the integrity of women's knowledge as a sphere of knowledge in its own right. The identification of "women" as a group "in need" further militates against recognition of existing strengths, as does the view of S&T as a "male" area of expertise.

Indigenous knowledge programs are not always clear about their approach, either in relation to indigenous knowledge as a system or in relation to the gender-based nature of indigenous knowledge. "Researchers ... need to be clear in their own minds about whether they aim to legitimize local knowledge solely in the eyes of the scientific community, by picking out the 'tit-bits' of practical information, or whether they are trying to strengthen and maintain its cultural integrity" (Chambers et al. 1989). Knowledge is evaluated in terms of how well it correlates to orthodox scientific and technological thought, rather than in terms of the belief system that



supports it (Last and Chavunduka 1986). Even when the system as a whole is examined, differences in type, status, and classification of women's and men's knowledge, which are fundamental to understanding the contributions and priorities of both sexes within a system, are ignored.

In the following sections, we provide examples of research and projects related to women's S&T knowledge. Much existing information is based on work in agriculture or food processing, where the essential contributions of women are finally being recognized; activities and programs in "hard" technology are less evident.

Work designed to strengthen women's indigenous skills is often carried out in teams comprising nongovernmental organizations (NGOs), research institutes, local groups, and universities at local national and international levels. It reflects two main areas of interest: the collection of information about indigenous knowledge systems, that is, their content, validity, and integrity; and the examination and development of suitable participatory research techniques for improving understanding of and working with local knowledge systems. Some universities and academic networks have also attempted to create links between formal research and development (R&D) and local experimentation (see, for example, Chambers et al. 1989, p. 165).

### **Gender and indigenous knowledge systems**

Between 1990 and 1993, offices of the Intermediate Technology Development Group (ITDG) in Asia, Africa, Central and South America, and the United Kingdom carried out research designed to focus on women as technology users, producers, and innovators. The project (IWTC n.d.), called *Do It Herself*, was based on the hypothesis that women's technological capacities are less visible than men's and that a different approach to research would, therefore, be needed. This was achieved by working with researchers (mainly women) from organizations that had established links with women technology users at the community level. Because most of the researchers were relatively inexperienced, they were taught the necessary skills — methods of research and analysis — through a series of group workshops.

The program attempted to build understanding of the existence of women's technical knowledge, and constraints to its recognition, through communication with regional audiences of NGOs, government personnel, and academic networks. After analyzing 22 case studies across a range of technical areas, researchers concluded that the invisibility of women's technology is linked to the domestic

nature of their work (which denies its technical content) and the fact that women's techniques tend to focus on processes and organization of production rather than "hardware" and are, therefore, less prestigious and have a lower profile. However, at the community level, it was clear that women's technical skills are critical in survival responses to crises and problems, and that the safety nets created by these responses may be destroyed by insensitive, uninformed policies. The potential contribution that existing skills and knowledge could make to tackling problems is ignored rather than built upon.

For example, in Sudan, as many as 60 fermented food products prepared by women form an important part of people's diet (Dirar 1991). The most complicated, a clear beer called *assaliya*, is the result of a 40-step process, starting with germinated sorghum grain; it takes 3 days to produce.

Fermentation is a complex chemical process that is still not fully understood. Variations in temperature and time during the different stages, affect the quality of the final product. Fermentation adds to the nutritional content of food. Using this process, women have been able to produce nutritious food from such substrates as bones, leaves, caterpillars, and cow urine.

Because fermentation increases nutritional value and preservative qualities, the process has played an important role in enabling people to cope with food shortage and famine in the past. Unfortunately, international drought and famine relief operations have been based on supplying imported foods rather than building capacity to produce local foods. This capacity is beginning to diminish as older women die without passing on their knowledge.

The information derived from the *Do It Herself* study has been disseminated to policymakers in NGOs and governments nationally and internationally. However, an important element of research is the feedback of information to the owners of knowledge. Therefore, the program includes the repackaging of information for women technology-users to build up their own knowledge and awareness of the skills and techniques that they are using (see Appleton 1993a,b).

Chambers et al. (1989) document a wealth of evidence of S&T knowledge, innovation, and activities of farmers in the South. The paper sets out "flexible research processes" to facilitate interaction between farmers and scientists and develop or adapt existing methods and technologies. The editors advocate a "complementary relationship" between knowledge possessed by scientists and technical experts and farmers' indigenous S&T knowledge. Although the message is not new, the approach is particularly helpful in bridging

the gap between theoretical and abstract literature, and providing actual case material from which practical methods can be developed.

The editors stress the role of women farmers as a group who possess a wealth of often neglected knowledge. For example, the On-Farm Seed Project (OFSP), was a collaborative program of the Peace Corps Senegal, the African Food Systems Initiative, a Senegalese rice agronomist and plant breeder from Institut Sénégalais de Recherches Agricoles, and women rice farmers in the Casamance (southern Senegal). Individual interviews revealed that the women farmers were knowledgeable about the varieties of rice they grow and are using methods best adapted to the local environment. "Rice projects have found it impossible to improve on this indigenous *kajando* technology" (Chambers et al. 1989, p. 15).

### **Women promoting diversity**

Several programs have highlighted the importance of recognizing gender issues in the maintenance of diversity. Women and men have different roles and areas of knowledge in relation to seed selection, for example. A further factor is that women depend on environments rich in diversity to ensure household and community survival during periods of crisis.

*Curators of diversity:* A few of the old women farmers in the Quechua communities of the Andes possess rare knowledge of plant breeding, which is probably a legacy of the ancient Inca civilization (Ojeda 1994). Potatoes are normally propagated by asexual reproduction, that is, by planting whole potatoes or sections. The resulting plants are, therefore, clones, genetically identical to the parent plant. However, the wise women gather potato seeds from the fruit of the potato — a practice which has been all but abandoned.

Because potatoes were first cultivated in the Andes, there are countless varieties of the crop, and people have different uses for each type. Gathering seeds enables the women to breed new varieties with characteristics they prefer. The process includes collecting the fruit, storing it outside until the following season to promote the production of the chemicals that activate the dormant seeds, planting the seeds just before the rains, harvesting tiny tubers and hiding them until the following year, then planting them to produce first generation tubers. The "tuber seed" products of this harvest, "grandchildren" of the original seeds, are sorted by shape, colour, and other characteristics. The various types are usually distributed among the woman's children to be planted to produce food crops. So far, younger generations have not taken on this role of "curator of diversity."

*Developers of a new crop:* In 1957, the Tonga of northwestern Zimbabwe were moved to Matabeleland, because their valley was to be flooded during the Kariba hydroelectric scheme (Mpande and Mpofu 1991). Soil conditions at the new site were poor, rainfall low, and hunting was prohibited. People could not produce enough to feed their families and became dependent on government handouts. To survive, Tonga women have invented and adapted food production and processing technologies and have identified new sources of food – 47 indigenous plants whose leaves are used for relish and over 100 tree species with a variety of edible parts.

One of these plants is the tamarind, *Tamarindus indica*. Although tamarind is widely used throughout the world for many purposes from medicine to fish preservation, it is relatively unknown in Zimbabwe, except among the Asian population. Women store the fruit for up to 12 months. It has some nutritional value and does not rot, making it especially valuable during famine. Tamarind is processed and used:

- ♦ As a flavouring agent in sorghum or millet porridge – the fruit or, in times of shortage, the leaves are soaked and boiled;
- ♦ As a substitute for commercial beverages such as tea and coffee, which are expensive or unavailable – ripe or unripe fruits are used, the acidity of the latter being neutralized with ash;
- ♦ As a snack – the seeds, which have a high protein content, are fried;
- ♦ As a substitute for or supplement to scarce maize, sorghum, or millet meals – the seeds are soaked, boiled, pounded, and added to cereals;
- ♦ As a medicine – concentrated tamarind juice is used to cure gastrointestinal disorders and may also be added to animal drinking water as it is thought to cure sleeping sickness; and
- ♦ As a coagulant – the juice is used to curdle fresh milk.

Tonga women have begun to realize the commercial potential of tamarind and other wild fruits, and are trading the fresh fruit for clothing from agents outside the area. The women are aware of the market, but have not yet developed strategies for dealing with it. They are afraid that large-scale commercialization will cause them to lose control over the source of the fruit, and that it will no longer be available to them as a subsistence crop.

## The comparative advantage of indigenous knowledge

The assumption that technology introduced from the outside is more cost-effective or more productive has begun to be challenged. Various studies highlight the necessity of evaluating existing indigenous technologies, with full understanding of local conditions and local priorities, *before* introducing new ones. Other work demonstrates how interventions can build on the comparative advantages of existing systems, providing an interface between external and internal knowledge.

*Traditional processes versus mechanization:* The aim of one study (Luery et al. 1992) was to "analyse the effect of innovation on rural women, with particular reference to *gari* processing in the Ibaden area of south-western Nigeria" — cassava processed into *gari* is the most important staple food in most of Nigeria. The study focused initially on obtaining estimates of costs, returns, and amount of labour involved in processing from the 105 women participants. The women were asked to suggest solutions to problems they had identified, and traditional production processes were compared with those used by the "mechanized" cooperative and a nearby factory. The most significant finding was that the traditional *gari*-processing system is more efficient than mechanized systems, in terms of cost, returns, and relevance to the needs of the village economy.

*Governments using indigenous medicine:* In China, traditional medicine has been practised for about 3 000 years and has developed into a complex system of methods, including acupuncture, herbal medicine, moxibustion, massage, and deep-breathing exercises. Chinese medicine is low cost and accessible. From the early 1950s, the integration of Chinese and Western medicine was encouraged, and the practice was officially recognized in the Chinese constitution of 1982. Today, hospitals and research institutes incorporate both systems. Results have been impressive: major breakthroughs have been achieved in medicines for the treatment of certain types of cancer, hepatitis B, lupus erythematosus, leukemia, bone fracture, acute abdominal disease, and coronary heart disease. Among those who practise integrated medicine, 26% are women; women make up 22% of doctors working in Chinese medicine and 46% of those working in Western medicine.

In its development plan, the Government of Ghana identified as a national priority the need for

a thorough investigation of the processes and techniques involved in all the important traditional economic activities in farming, processing of agricultural products.... This will help evolve and develop the

appropriate technology which can help create reasonably self-reliant communities enjoying progressively better standards of living.

With financial support from the Dutch government, a project was launched, under auspices of the International Labour Organisation (ILO), to place special emphasis on improving the status, education, development, and employment of women and to improve their living and working conditions. The specific objectives were to promote the use of appropriate technologies by rural women; arrange the local and indigenous manufacture of the necessary tools and equipment; and strengthen the technological capabilities of indigenous R&D institutions (Ewusi 1987).

For example, soap-making (*alata* and *amonkye*) has been a traditional activity among rural women in Ghana long before the introduction of bar soap (Ewusi 1987). *Alata*, in particular, is used by women who like its mildness and cosmetic properties. However, the commercial value of light-coloured bar soap has prompted many women to produce it rather than the traditional soaps, even though problems were associated with its production: they were not able to produce enough pale soap to make the enterprise commercially viable; foaming during the boiling stage constituted a health hazard; and caustic soda had to be imported.

At Essam, women use a combination of traditional methods of soap-making and technology developed by the Technical Consultancy Centre (TCC) to overcome these problems. They have also been able to combine palm-oil processing with soap production. The palm oil can be used either for home consumption or in soap-making. The work is carried out by a cooperative. Different members with varying levels of experience are involved at different stages. As a woman gains experience, she takes on different responsibilities; thus, skills are shared within the group.

Overall, the initiative created a valuable contact between individual women's cooperatives and R&D institutions, particularly the TCC, and local manufacturers. The women were able to identify and relay their concerns about the technology and highlight safety, resource, and sociocultural constraints. Because of their experience, they were able to contribute ideas to improve the process. Where the technology proved inadequate or inappropriate, they were able to compensate with traditional methods. The skills that women already possessed contributed to the overall success of the introduction of the technology. Women were also able to suggest enhancements, such as perfumes and alternative oils, to increase the commercial value of the soap.

## The role of NGOs and networks

Indigenous knowledge is often passed informally by word of mouth from generation to generation. People's ability to gain access to information or to pass it on vary according to, among other things, the amount of time available, literacy rates, access to written material, ability to travel, and control over household media (such as radio or television).

Formal S&T information is shared in high-profile, widely recognized forums such as academic journals and national or international conferences. Communications networks are thus developed on the assumption that such knowledge has global relevance and applicability; there is an internationally understood language and symbolism, and although scientists may argue about the hypotheses or findings of a piece of work, they do not question the knowledge system that has produced it.

Networks specializing in indigenous knowledge face different challenges. First, they are working with information derived from many different systems that may not be comparable. Second, the information may be geographically limited, that is, its applicability in other conditions cannot be assumed. Third, indigenous knowledge, skills, and information are strongly gender-based. Fourth, networks specializing in indigenous knowledge have an interest in sharing information outward from a knowledge system, repackaging information so that it can be used by people within a knowledge system, and facilitating the exchange of information between people in the same knowledge system.

*Indigenous Peoples' Biodiversity Network (IPBN)*: The IPBN is a growing global network of indigenous peoples' organizations working on biodiversity issues and the protection of local knowledge systems and genetic material. It was established by indigenous peoples who acted as observers at the initial meeting of the Intergovernmental Committee on the Convention on Biological Diversity (ICCBD), held in Geneva, Switzerland, in October 1993, to give such groups influence over policy development and access to information on biodiversity and IPR issues.

The IPBN has a Women and Biodiversity Working Group, which acknowledges that women have special knowledge of biodiversity and a crucial role in its maintenance. Noting that women's needs and perspectives are not currently addressed in biodiversity-related agreements and actions, the IPBN plans to address the effect of the Convention on Biological Diversity on women and their potential role in policy development in the area.

*World Council of Indigenous Peoples (WCIP)*: The WCIP facilitates communication among individual communities, participates in workshops, seminars, and conferences on topics of concern to indigenous peoples, and encourages the enactment of legislation that recognizes the reality of indigenous peoples in different countries. In 1992, the Council established an Indigenous Women's Commission and it has also worked on environmental issues of relevance to indigenous peoples, including biodiversity. WCIP is interested in looking at local and indigenous knowledge systems, particularly in terms of gender. It recently endorsed a project to explore the gender perspectives of indigenous and local knowledge in animal health and production systems.

*Indigenous Knowledge and Development Monitor*: This publication is produced by the Centre for International Research and Advisory Networks (CIRAN), with cooperation from the Centre for Indigenous Knowledge for Agriculture and Rural Development (CIKARD), the Leiden Ethnosystems and Development Programme (LEAD), and the national and regional indigenous knowledge resource centres. The *Monitor* is published three times a year and is aimed at "the international community of people who are interested in indigenous knowledge." Recognizing that formal S&T knowledge is disseminated through a variety of well established channels, the *Monitor* aims to provide a route for less-formal knowledge. An issue on women's indigenous knowledge is being prepared for late 1994.

*International Federation of Institutes for Advanced Study (IFIAS)*: IFIAS is an association of independent research institutions that collaborate to address global, long-term issues. In 1991, a Gender, Science, and Development Programme was launched to further the "contributions and well-being of women in the process of scientific and technological changes for just development." IFIAS has tended to focus on formally trained women scientists, and an attempt has been made to broaden this to include grassroots knowledge and skills by joining other organizations in the "Once and Future" Consortium. IFIAS's activities include: a working paper series, with titles on energy, health, trade, and environment issues; workshops on science at the service of women; and a symposium on "mainstreaming" women in S&T.

*Third World Organisation of Women in Science and Technology (TWOWS)*: TWOWS's overall objective is to promote the role of women in S&T development in the South. It conducts surveys to analyze the status and potential for women in S&T, to improve access to training and education, and to increase the scientific productivity of women scientists in the South. TWOWS produces a newsletter and a database directory of Southern women scientists.



*The International Women's Tribune Center (IWTC):* Based in New York, IWTC works with women's and community groups in the areas of community economic development, women organizing, S&T, and communications networking. Its newsletter *The Tribune*, which is written in simple language and well illustrated and with names and addresses of contacts, is published in English, French, and Spanish three times a year. IWTC is a key player in preparations for the Beijing conference in 1995 as it publishes a regular "roadmap" to Beijing.

*Center for Indigenous Knowledge for Agricultural and Rural Development:* CIKARD and several other indigenous knowledge centres around the world support R&D efforts in indigenous knowledge systems. CIKARD has long been involved in research into local knowledge systems, particularly with respect to agriculture, agroforestry, and other related areas. It is based at Iowa State University, with offices scattered throughout Africa, Asia, and Latin America. The global network is well-placed to conduct further research in the area of gender, local knowledge systems, and S&T.

## **Work of the United Nations and its agencies**

For the most part, policy recommendations and technical applications regarding gender, S&T for development, and indigenous knowledge are uncommon within the UN system. "Indigenous (or) traditional knowledge as 'science' ... has only been marginally conceived," but accords such as the *Draft Declaration of Rights of Indigenous Peoples* and other arenas within the UN system offer opportunities for change (Posey and Goeldi 1994, p. 240). Gender concerns and women's local knowledge remain invisible in agreements on indigenous peoples.

### **S&T agreements**

Throughout most of the following documents, a common theme prevails — one that emphasizes women's access to Western-developed technology, education, extension, and credit and their subsequent impact on women. More specifically, these resolutions are often made in relation to men's main areas of concern. Although there is call for protection of traditional sciences, conspicuously lacking are resolutions and recommendations calling for the strengthening,

exploration, and support of women's locally developed technologies, initiatives, and inventions in all sectors.

*The Vienna Programme of Action on Science and Technology for Development* (UN 1979b) acknowledges that men and women can contribute constructively to the realm of S&T for the enhancement of development (UN 1979b, p. 1). Recommendations with particular relevance include: the stimulation of demand for indigenous research and technology (para. 21.g); the protection of traditional S&T bases and upgrading such knowledge to use it fully (para. 21.m); and the call to ensure women's full participation in the S&T development process (para. 23.g).

*The Report of the Ad Hoc Panel of Experts on Science and Technology and Women* (UN 1984) highlights the area of endogenous research and development. It recommends that national governments and scientific communities listen to the needs of the average (woman) user in setting research and development priorities (Recommendation 33). This suggests possible exchange of local indigenous expertise and so-called "scientific" expertise. Likewise, Recommendation 58 promotes joint technology projects between scientific groups with urban and rural women in the development of scientific education and training techniques and materials.

## Women and gender

General agreements on gender issues also tend to ignore women's local initiatives, innovations, inventions, and processes. These agreements again focus on the improvement of women's status and access to "modern" technologies, education, and decision-making processes rather than on the value, promotion, and strengthening of their local knowledge systems.

Support for women's rights to administer property, act as signatories on contracts, and hold land and other means of production is important in terms of women's control and use of their local knowledge systems. However, the emphasis remains on the rights of the individual rather than both individual and collective, or community, rights.

Although the *Convention on the Elimination of All Forms of Discrimination Against Women* (UN 1979a) does not specifically mention "indigenous" women or women's indigenous knowledge systems, it recommends that "State Parties ... take into account the particular problems faced by rural women and the significant roles ... [they] play in the economic survival of their families, including their work in the non-monetized sectors of the economy" (Article 14.1). The convention also recommends that all parties ensure the rights of

rural women to access to all types of training and education, including access to appropriate technology (Article 14.2). Perhaps, most importantly Article 15 recommends that state parties "accord to women equal rights to administer property and conclude contracts."

*The Nairobi Forward-Looking Strategies for the Advancement of Women* (UN 1985b) was the first agreement to provide specific recommendations for indigenous women. Paragraph 303 calls for governments to ensure that all fundamental human rights and freedoms enshrined in international conventions be guaranteed for women belonging to minority groups and indigenous populations. Regarding S&T, it recommends that governments "ensure respect for the economic, social and cultural rights of these women ... [and provide] vocational, technical ... and other training ... [with] access to all services in their own language" (UN 1985b, para. 303).

Paragraph 26 suggests that a "new international economic order" should include, "self-reliance, collective self-reliance, and activation of indigenous human and material resources." Of particular significance to women's indigenous knowledge systems, a directive on agrarian reform measures suggests that "reforms should guarantee women's constitutional and legal rights in terms of access to land and other means of production and should ensure that women will control the products of their labour and their income, as well as benefits from agricultural inputs, research, training, credits and other infrastructural facilities" (UN 1985b). Finally, drawing two systems together, the document calls for an improvement of traditional knowledge and the introduction of modern technology for food production (para. 179), a recommendation particularly pertinent to women as they are intensely involved in this realm.

*Agenda 21* (UN 1992a) refers to women throughout. Chapter 24 is completely devoted to women and their particular role in, and relation to, the environment. However, there are no particular recommendations directed at "indigenous women" or women's indigenous knowledge systems per se. This is possibly due to the continued confusion over the term "indigenous."

*Improvement of the Situation of Women in Rural Areas*: The report of the Secretary-General (1993) on women in rural areas repeats much of what has been said in previous UN documents. Given the post-Rio climate and the *International Year for the World's Indigenous Peoples*, it is unfortunate that it does not address some of the issues raised in the areas of women's local knowledge systems, the protection of that knowledge in light of the "bio-gold rush" in which Northern companies and researchers are engaged to exploit the natural resources of the South. This trend has grave implications

for rural women as keepers of much agricultural and health-related knowledge.

The *Draft Platform for Action* (ECOSOC 1994) for the 4th World Conference on Women is a rather innocuous document with few far-reaching recommendations. Rather, it calls for the ratification of past agreements, aims for women's equality with men, and reiterates that women are not a homogeneous mass. Like past agreements, its approach to gender and S&T is to promote women's increased access to, and control over, "modern" technology, capital, land, and so forth (para. 29). Only one paragraph (74) mentions the specific promotion of women's indigenous knowledge. It suggests that NGOs "might include non-formal health education and advisory services for women and girls at the community level, giving particular emphasis to women's traditional health knowledge." The draft rarely mentions rural women, let alone women's indigenous knowledge or sciences. General comments on "critical areas of concern and action to be taken" mention indigenous women in general (para. 17) and reiterate interest in promoting traditional health (para. 33).

The Food and Agriculture Organization (FAO) of the United Nations' plan of action for women (FAO 1990b) focuses on engaging women in new practices and incorporating "modern" techniques in agriculture rather than promoting and strengthening their local, indigenous techniques and innovations. However, examples of the increasing interest in the gendered nature of local knowledge systems are found in various areas, including forestry and animal-production systems.

The World Health Organization's (WHO's) office for traditional medicine has a particular concern with traditional birth attendants; other areas of gender, indigenous knowledge, and health concerns are lacking (WHO 1991c). At a Pan American Health Organization (PAHO 1993, p. 7) workshop on indigenous peoples and health, several recommendations were tabled regarding indigenous women's position in the family as well as their relation to the dominant sectors of local and national society. Some of the concerns were problems related to reproduction and child care; mental health; sexual abuse; working conditions in agriculture; and cultural discrepancies between home-based and hospital care.

### **Indigenous people, biodiversity, and intellectual property rights**

Work in the area of indigenous people, biodiversity, and intellectual property rights tends to focus on the concerns of indigenous people, per se, not specifically indigenous knowledge systems. Many people

associate the term "indigenous" only with *specific* ethnic, religious, or cultural peoples or populations occupying ancestral lands. Indigenous knowledge systems, however, encompass *local* as well as *indigenous* communities, their experiences, their environment, and their processes of innovation. Furthermore, indigenous (or local) knowledge systems are, by their very nature, gender-related. Although many agreements on indigenous peoples recognize the special nature of these knowledge systems, they do not acknowledge the gendered nature of these systems.

The various forums on indigenous peoples note the importance of recognizing the individual and the collective. In pointing out the inadequacies of current intellectual property agreements for addressing indigenous peoples' concerns, they also acknowledge the necessity for linking "content" and "context." In addition, current IPR agreements recognize only new knowledge. Old knowledge, or that which would normally be generated in local communities, cannot be protected under current international IPR agreements. Moreover, none of the forums currently include a gender focus.

In 1972, a special subcommission to address discrimination against indigenous peoples was formed under the Commission on Human Rights and authorized by ECOSOC. In 1982, the Working Group on Indigenous Populations emerged out of the subcommission to become the focal point for the efforts of indigenous peoples working for international legal recognition of their human rights (Suagee 1994, p. 197). Annual meetings bring together indigenous representatives, NGOs, and state representatives. Actions of national governments and transnational corporations are examined to see how they conflict with the rights and interests of indigenous peoples.

Several organizations of indigenous people are questioning the values and approaches of the dominant science systems and struggling with the impact of these systems on their own communities and environments. Their views are reflected in the report of the Working Group on Indigenous Populations (ECOSOC 1993). Focused on the protection of cultural and intellectual property, the report highlights the importance of addressing the concerns of indigenous peoples, particularly with respect to their sciences in light of the "renewed interest in acquiring indigenous peoples' arts, cultures, and sciences" (ECOSOC 1993, para. 19).

Some of the critical issues for women's control over, access to, and potential compensation for their indigenous knowledge systems emerge out of the debate over IPRs. As mentioned earlier, women have long been, and remain, key actors in seed and animal selection. The *Study on the Protection of the Cultural and Intellectual Property of Indigenous Peoples* (ECOSOC 1993, para. 99) notes that, "in

principle, the industrial property laws of most countries only protect 'new' knowledge. 'Old' knowledge, such as the herbal remedies used by traditional healers for centuries, has generally been regarded as not patentable". Yet, as the World Intellectual Property Organization (WIPO) maintains, much of the world's diversity is still only known to local peoples, and incompletely understood by outsiders (ECOSOC 1993). Because of current international legal mechanisms and the accelerating profit-driven race for genetic resources in the North, local and indigenous women are at risk of losing further control over their knowledge systems and resource base.

So-called "modern" science has long depended on, although not credited or adequately compensated, the innovations of local communities (ECOSOC 1991, para. 22).

World food systems, textile industries, medicine and pharmacology still rely heavily on plant and animal varieties selected and modified by pre-industrial societies, including the isolation, modification and creative use of micro-organisms. Fermentation and the production of wine, beer, breads and cheese employs ... specialized strains of yeasts and molds. Staple foods [such as] maize, potatoes and rice were significantly improved by selective cultivation long before the discovery and commercial application of genetic chemistry.

Current international agreements on IPRs do not provide coverage for indigenous knowledge and sciences, due in large part to an "artificial distinction between cultural and intellectual property" (ECOSOC 1993, para. 21).

The distinction between cultural and intellectual property is from indigenous peoples' viewpoint, an artificial one and not very useful. Industrialized societies tend to distinguish between art and science, or between creative inspiration and logical analysis. Indigenous peoples regard all products of the human mind and heart as interrelated, and as flowing from the same source: the relationships between the people and their land, their kinship with the other living creatures that share the land, and with the spirit world. Since the ultimate source of knowledge and creativity is the land itself, all of the art and science of a specific people are manifestations of the same underlying relationships, and can be considered as manifestations of the people as a whole.

It is more appropriate to refer to "collective heritage" (ECOSOC 1993, para. 23) than to distinguish between "cultural" and "intellectual" property. "Collective heritage" includes human thought and ingenuity, songs, arts, stories, and *scientific knowledge*. Heritage is not seen in terms of "property" with a specific owner, but rather a community responsibility and "a bundle of relationships, rather than a bundle of economic rights" (para. 26). It is "inappropriate to try to subdivide the heritage of indigenous peoples into separate legal categories such as 'cultural,' 'artistic,' or 'intellectual,' or into separate elements such as songs, stories, *science*, or sacred sites" (para. 31).

In 1993, the International Year for the World's Indigenous Peoples was declared; it led to the International Decade for the World's Indigenous Peoples (1995–2005). Although there is no particular gender focus in the Working Group on Indigenous Populations, it has suggested that 1996 be dedicated to indigenous women and that there is much interest in promoting women's indigenous S&T in that year.

The Working Group has developed a draft declaration that, if approved by the General Assembly, unfortunately holds the status of a Statement of Principles and is, therefore, not binding or justiciable (Suagee 1994, p. 198). However, it is an important document that sets out recommendations pertinent to the process of recognizing indigenous people and knowledge as legitimate and critical.

Although specific gender issues are not addressed, Article 41 notes that "all the rights and freedoms recognized herein are equally guaranteed to male and female indigenous individuals." Article 22 mentions women as one subgroup requiring specific attention regarding vocational training. Article 23 recommends that indigenous peoples have the right to "determine and develop all health, housing and other economic and social programmes ... and to administer them through their own institutions." Article 24 also supports indigenous peoples' "right to their traditional medicines and health practices, including the right to the protection of vital medicinal plants, animals, and minerals."

This could mean increased support for traditional health systems as practised by indigenous peoples and would have particular relevance for indigenous women, who are in many places, the health-care givers and traditional birth attendants. Article 24 also holds implications for the protection of intellectual and cultural property within these communities. Particularly applicable to the focal point of gender, indigenous knowledge, and S&T for development is Article 29 which states that

indigenous peoples are entitled to the recognition of the full ownership, control and protection of their

cultural and intellectual property. They have the right to special measures to control, develop and protect their sciences, technologies and cultural manifestations, including human and other genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs and visual and performing arts.

*Agenda 21* (UN 1992a) recognizes the role of indigenous communities in relation to the environment. Women are mentioned infrequently: for example, the last line of chapter 26 urges that “particular attention ... be given to strengthening the role of indigenous women.” Suggested activities propose that UN bodies and other international development and finance organizations and governments should “incorporate (indigenous peoples’) values, views and knowledge, including the unique contribution of indigenous women, in resource management and other policies and programmes that may affect them” (UN 1992a, para. 26.5).

Perhaps, most importantly, chapter 26 acknowledges, as a basis for action, generations of holistic traditional scientific knowledge about land, natural resources, and environment held by many indigenous peoples (para. 26.1). Disappointingly, however, the chapter lacks any concrete recommendation and remains a shadow of a potentially strong document.

The *Convention on Biological Diversity* (UN 1992b, p. 19), developed to “curb the destruction of biological species, habitats and ecosystems,” was signed by 157 countries. For it to become law, it must be ratified by at least 30 countries, most likely through national legislation. It is seen by many indigenous groups as one of the best forums for expressing their concerns about their sciences, knowledge, and cultural and IPRs as biodiversity, being a local concern requires local participation (Appleton 1994). However, many indigenous groups are apprehensive about the degree to which national and international laws will “adequately recognize and protect their knowledge, innovation and practices” (Posey and Goeldi 1994, p. 234). As an ongoing global process, and recognizing both indigenous peoples’ and women’s vital roles in conservation and sustainable use of biological diversity, the convention provides an important entry point for addressing indigenous knowledge, gender, and S&T.

Article 8 on in-situ conservation calls for the respect, preservation, and maintenance of indigenous and local knowledge, innovations, and practices in biological diversity conservation and sustainable use, as well as the wider application of such knowledge and practices “with the approval and involvement of the holders”; however, women are not specifically mentioned (UN 1992b, article



8.j). Article 17.2 calls for the exchange of indigenous and traditional knowledge with other systems, whereas article 18.4 encourages methods of cooperation for developing and using technologies, "including indigenous and traditional technologies." Again, women, their ways of communication exchange, and their development of knowledge and technologies are left out of the equation.

Posey and Goeldi (1994, p. 227) note that the ILO was the first UN organization to deal with the concerns of indigenous peoples, having first established standards for the "protection of native workers" as early as 1926. It developed a *Convention [107] Concerning the Protection and Integration of Indigenous and Other Tribal and Semi-Tribal Populations in Independent Countries* (ILO 1957) and revised it in Convention 169 in 1989 (ILO 1989a).

Importantly, Convention 169 recognizes the collective aspects of indigenous cultures and values, which is critical in appreciating women's and men's indigenous knowledge systems in the holistic community sense in which they are based. Unfortunately, few countries have ratified it, and its provisions are not applicable to nonsignatories (Chapman 1994, p. 218).

The UN system with its associated agreements and conventions has worked within, rather than across, sectors. Subsequently, gender, local knowledge systems, and S&T have been addressed, for the most part, as separate spheres, rather than as an intersection, resulting in the marginalization, circumvention, or outright subjugation of many of the world's peoples and their indigenous knowledge systems.

Particularly problematic is the disaggregation of documents and programs between women or gender, on the one hand, and indigenous peoples, on the other. Furthermore, because of the continuing confusion around, and interpretation of, the term indigenous and its association with certain groups of people, other local knowledge systems are rendered invisible in UN documents. Local knowledge systems do not fit into documents on indigenous peoples, and documents focusing on women in general tend to promote modern S&T. Recommendations have focused on improving women's access to "modern" technologies, education, and credit based on men's prioritized needs and in relation to often alien, inappropriate modern expressions of need. They have also tended to focus on the "content" or "hardware" of science, rather than its "context" or "software."

Certain forums, including the Working Group on Indigenous Populations, the *Draft Declaration on the Rights of Indigenous Peoples*, and the ongoing processes for the *Convention on Biological Diversity*, provide particularly valuable entry points for future considerations of

gender and indigenous knowledge systems within the UN and other international systems.

## **Recommendations and agenda for future research**

In this paper, we have addressed the nature of indigenous knowledge systems, their potential role in sustainable and equitable development, and possible strategies for creating an interface that promotes mutually beneficial interactions between local and S&T knowledge systems. Local knowledge systems have evolved from ongoing experimentation to resolve agricultural, environmental, health, and other social problems in a particular agroecological and sociocultural context. Only recently have researchers acknowledged that men and women may have different knowledge about materials, their environment, or processes; and that they may also have very different ways of organizing, maintaining, and transferring their systems of knowledge. Western S&T systems have stereotyped men's and women's roles and social relations and in doing so have, for the most part, marginalized women and their local knowledge systems. However, case studies demonstrate that it is often local women, not foreign scientists or "experts," who have the "expertise" in their environment.

Women's local knowledge is crucial to the maintenance of biodiversity. The introduction of new biotechnologies and biodiversity prospecting threatens women's control over and access to the very materials necessary for them to sustain the multidimensional knowledge systems and environments on which they depend for their livelihood and survival.

Most research, policy directives, and programs have tended to disembodify local knowledge systems. Rather than providing an interface, research and policy efforts have developed three separate spheres: S&T related to women; general studies of gender or women; and programs and policies on indigenous knowledge.

A critical area of concern is the current view of knowledge as individual or corporate property rather than community held and a community-regulated responsibility. This perspective, grounded in a market-driven political, economic, and social context, is generally alien to peoples who see their local knowledge as something to be shared with others for the good of their society and their environment.

To counteract the existing exploitive asymmetry between the different systems of knowledge (S&T and local), policy initiatives and programs concerned with IPRs should recognize and support concepts of knowledge that are more holistic, community-held, and "old" in contrast to the present acceptance of rights to knowledge protection only for "new" knowledge held by individuals or corporations.

Given the current attitudes of scientists to local knowledge systems and the resulting invalidation of those systems or their exploitation for the "good of "humanity," efforts should be made both at the policy level and in training syllabi to counter these attitudes and develop in scientists a respect for local knowledge systems, encompassing both holistic and gender perspectives. At all levels of education, efforts should be made in culturally appropriate and respectful ways to include local knowledge in syllabi to ensure that it continues to be reproduced by communities.

National and international bodies should develop mechanisms to promote respect for local knowledge systems and community-based technical processes.

At all levels of policy and programming, the UN system should make concrete efforts to create an interface among S&T, women and gender issues, and indigenous knowledge. UN bodies should develop mechanisms to ensure that gender expertise is spread across sectors and through technical divisions and enable two-way dialogues.

National and international governments should support the research and advocacy efforts of NGOs and indigenous organizations working to protect their local knowledge systems and their social and environmental spheres. Organizations, such as the IPBN, that are centrally involved in the ongoing conferences on the *Convention on Biological Diversity* should be supported financially and in terms of supporting research.

International bodies should also elevate the concerns of indigenous organizations such as the WCIP and incorporate their suggestions on gender and indigenous women's and men's needs and interests including their holistic knowledge systems.

An International Year for Indigenous Women should be proclaimed by the UN, possibly as early as 1996, to highlight the concerns of indigenous women.

All UN and other international agreements and all working documents and amendments should include statements supporting the enhancement and protection of indigenous knowledge systems.

A monitoring system should be implemented to monitor and evaluate the interface of gender, indigenous knowledge systems, and S&T in the UN system.

As has been shown, little research has been undertaken around the area of gender and local knowledge systems. More research is needed in this area to address the implications of biodiversity prospecting and the introduction of new agrotechnologies on the people's control of and access to local knowledge systems.

Research should address the specific social, political, economic, and environmental effect of current IPRs on local knowledge systems and the consequences of ignoring "old" knowledge.

Every effort should be made to promote research by indigenous people and local communities and opportunities created for their input into local, national, regional, and international decision-making processes, policy directives, implementation, and evaluation processes.