ENVIRONMENT, HEALTH AND DEVELOPMENT: RESEARCH FOR PEOPLE BY PEOPLE

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SUMMARY

This paper illustrates how research can be a powerful tool in assisting the world's poorest peoples to develop solutions for coping with environmental health risks. It builds on a number of research projects supported by the International Development Research Centre (IDRC) of Canada in the developing world.

The paper is intended for submission to the Preparatory Committee meeting (Prepcom IV) of the UNCED secretariat to take place in New York in March 1992. More specifically, it aims to be relevant to:

1) The Earth Charter, which is to set out the underlying principles to guide local and global environment and development strategies;

2) Agenda 21, which is to identify key sectoral issues to be discussed at the Earth Summit and result in a blueprint for action in all major areas affecting the relationship between environment and development; and

3) The effective implementation of Agenda 21 following UNCED, in particular, concerning the use of research as a tool for assisting communities in developing countries.

Section 1 places environment, health, and development issues in the context of the UNCED and beyond. This section emphasizes the importance of focusing on both the physical dimensions of environment and the human dimensions of development. It also illustrates the highly interdependent nature of the conceptual and operational linkages between health, population, poverty, and environmental degradation.

Section 2 identifies the potential contribution of research to development and sketches out some of the underlying principles of a people-centred research strategy concerning environment, health, and development issues.

Section 3 illustrates the application of these principles through the presentation of lessons learned from a series of research projects in the subsectors of the living environment, the working environment, and the protection of the quality and supply of fresh water.

Section 4 highlights the key issues of the paper and proposes some recommendations for the UNCED Secretariat to consider in planning the UNCED Conference and the process for the implementation of Agenda 21.
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1. THE IMPERATIVE FOR INVESTING IN PEOPLE: HEALTH, DEVELOPMENT AND ENVIRONMENTAL ISSUES IN THE CONTEXT OF UNCED AND BEYOND

1.1 NEW TECHNOLOGY, THE ENVIRONMENT, AND HEALTH

The introduction of new technologies often leads to major transformations of the local environment. New technologies are often associated with large-scale development initiatives (for example, hydroelectric dams and agroindustrial activities) that lead to major environmental transformation such as deforestation, water pollution, and air pollution. Such effects often expand or create new health risks for local populations.

For example, a proliferation of water bodies increases the number of breeding sites for disease vectors such as mosquitoes (which transmit malaria, yellow fever, and dengue) and aquatic snails (which are the intermediate hosts for human schistosomiasis). Also, deforestation and soil erosion expand the habitat of sand flies, which transmit leishmaniasis.

Industrial development also brings with it the risk of chemical contamination of the living environment. It may provide a new source of income for local people in the short term; however, the longer term health effects of the associated environmental contamination is seldom considered in the planning process for such activities.

Industrial development is not alone, however. The evolution of agricultural production has also introduced new technologies that represent serious environmental risks. For example, the large-scale use of pesticides may have revolutionized food production, but these chemicals are responsible of over 2 million human poisonings every year, with a resultant 20 000 deaths (WHO 1986). In many cases of accidental poisoning, the major cause is a lack of knowledge on the part of the user, both on the dangers of these compounds and on how to use them properly (for a discussion of pesticide poisoning in the developing world, see Forget 1991).

In their quest for self-sufficiency, developing countries often face the same health problems that industrialized countries are only now effectively beginning to solve. Clearly, developing countries must continue to consider interventions such as those outlined above if they are to become self-sufficient. These interventions are usually for the greater good of all citizens of the country. Regretfully, they may also have negative effects on health, especially on people living close by. How then can local populations protect themselves from new health risks that are brought about by unwanted environmental change?
1.2 WILL THE POOR REAP ANY BENEFITS FROM THE EARTH SUMMIT?

The UNCED documents and the interventions at the third meeting of the preparatory committee (Prepcom III) clearly indicate the direct links between poverty and environmental degradation in both developing and developed countries. However, there is a predicament that is not stated so clearly in relation to poverty: poor people can rarely cope with environmental health risks.

To date, the emphasis at the Prepcom deliberations has been on resolving global challenges such as the depletion of the ozone layer and global warming. Concern for these global issues may lead delegates to pay less attention to human development and how it relates to environmental degradation.

The nature of international consultation is such that the positive effects of any agreement reached on these critical issues next June in Rio de Janeiro are unlikely to filter down to the Third World poor, at least not in a way commensurate with the environmental health risks they face every day: lack of clean water, endemic diseases, and a shortage of wood for cooking.

Of course, the environmental problems that face the Third World poor can be a partial result of global problems. In turn, global problems are exacerbated by the reaction of people trying to cope with the local degradation of their environment. It is increasingly recognized that poverty in the developing world contributes to environmental damage (Leonard et al. 1989; OECD 1990; The South Commission 1990). This situation was well summarized by Ramphal (1990):

Poor people often destroy their own environment - not because they are ignorant, but to survive. They over-exploit thin soils, over-graze fragile grasslands, and cut down dwindling forest stocks for firewood. In the context of short-term needs of survival, each decision is rational; in the longer term and wider context the effects are disastrous... Poverty is both a cause and an effect of environmental degradation.

1.3 HOW CAN PEOPLE COPE WITH CHANGING ENVIRONMENTAL HEALTH RISKS?

One step toward helping people cope would be an alternative, more equitable development model predicated on the principle of investing in people. This model would identify intersectorial options for action to reverse the downward spiral of poverty, ill health, and environmental degradation.

This model need not be one that reduces the pace of development. In 1968, Gunnar Myrdal, the then future Nobel laureate, argued convincingly for the need to strike a new
balance between investment in people (in particular, health and education) and economic growth. He not only proposed that health and education were basic human needs, but also that healthier and more educated populations produced more resilient and skilled workers, better equipped to compete in national and international economies.

In the past two years, several public policy reports prepared by international agencies have reinforced a more people-centred and participatory model of development (OECD 1990; UNDP 1990; World Bank 1990). People of the developing world must be allowed to identify the environmental health risks that plague them. Furthermore, the relationship between these risks and development efforts must be recognized. More importantly, sustainable, affordable solutions for countering the health risks represented by environmental changes must be found and tested. This is why research is a vital tool for development in the context of health and the environment. The corollary is that this research cannot find sustainable solutions unless populations at risk are allowed to participate.
2. UNDERLYING PRINCIPLES OF A PEOPLE-CENTRED RESEARCH STRATEGY

2.1 WHAT KIND OF RESEARCH AND WHY?

Why research? There are three general reasons. First, research will allow the production of new knowledge vis-a-vis changing environmental conditions and the new health risks they may represent. Second, research is essential if solutions to these new environmental health risks are to be found and tested. Third, the impact of these solutions on the health of affected populations must be evaluated before expansion and replication is even considered. In this, the greater participation of those most at risk will be the key to success. Too many miracle devices that worked wonders in laboratory or limited field trials have failed miserably in their application.

The current emphasis on global environmental problems is timely. How humanity responds to this challenge may well decide the future of our planet. Regrettably, concern for a similar micro approach to health in relation to the environment is not so clearly articulated. We must openly recognize that the poor of the developing world must cope on a daily basis with environments that threaten their well-being as well as that of their children. More, our recognition must translate into action.

The conventional approach to resolving environmental health risks tends to be grounded largely in biomedicine and engineering. It often relies on a vertical problem-solving approach. Many of the solutions developed through this conventional approach are applications of products already developed in industrialized countries. The problem with such an approach is that it ignores the developing-country context in which the situation exists, often making the intervention irrelevant to the circumstances at hand.

Another shortcoming of this conventional approach is that it presupposes that the poor of the developing world are incapable of dealing with environmental health risks or have no interest in doing so. Yet, the contribution that the poor can make to solving these problems must not be overlooked. Individuals and communities already live and cope under formidable circumstances, attesting to their knowledge of environmental problems and their skill to survive.

The research challenge will be to identify, develop, and implement effective, sustainable, and practical technologies that are simple, serve the needs of the poor, and are within the range of their capabilities and capacity.

2.2 SOME GUIDING PRINCIPLES

There is an emerging consensus in the world community that greater participation by beneficiaries is key to successful development efforts (UNDP 1990). At the same time, a new challenge is recognized: How can these new concepts be translated into action?
One way to address this challenge is to identify "success stories" and learn from them. These examples could then be gradually replicated and expanded. Such an approach would enable us to build on past success and further experiment with a diversity of projects aimed at improving human development.

To succeed in the field of development, however, research will have to go beyond the familiar format of hypothesis formulation and testing. Research must include action. As pointed out by Chen (1991), "setting of the research agenda" should go beyond the rather naive and simplistic format of "academics being supported by donors to produce research for use by policy-makers." People-centred research strategies can make important contributions to development; improving health in the context of environmental risks is one area where this is especially true.

Some key principles in the development and planning of such a research strategy are

1. Active participation of the beneficiaries in the identification, planning, execution, and monitoring of research and action strategies.

2. Identifying priority needs for research and assessing the capacity of the beneficiaries to participate.

3. Transferring appropriate technology and strengthening local technical capabilities.

4. Sustainability, replicability (via networking), and empowerment of beneficiaries to address their own problems.

The importance of the first point (active participation of beneficiaries at all stages of the research) cannot be overstated. It should be seen as the starting point in identifying appropriate strategies to counter environmental health risks.

The ultimate test of the sustainability of a development project is whether it can be successfully maintained once external funding is no longer available. Furthermore, the solution discovered must be applicable (albeit in a modified form) to similar environmental problems elsewhere in the developing world. As noted by Anns (1987), "small is beautiful but it may also be insignificant." In this respect, a multilevel networking strategy (linking local, national, and global beneficiary communities, including development workers, scientists, and policymakers) will maximize the prospects of replication.

Such a research strategy allows people to take control of their own environmental circumstances and promotes self-reliant development. Only by empowering beneficiaries to cope with environmental health risks will sustainable solutions be found and implemented.
3. TRANSFORMING CHALLENGE INTO OPPORTUNITY FOR CHANGE: RESEARCH EXPERIENCE IN ENVIRONMENT, HEALTH, AND HUMAN DEVELOPMENT

This section illustrates how technologies can be developed, adapted, and applied to reduce, if not eliminate, environmental risks to the health of people in developing countries. The projects outlined here focus on people, their health problems in relation to the environment, and the quest for practical, community-based solutions. All of the projects were supported financially by the Health Sciences Division of the International Development Research Centre (IDRC) of Canada. IDRC's ultimate objective is that of the developing countries: to create an indigenous capability to use science and technology for the benefit of society. The Health and Environment Program of IDRC's Health Sciences Division focuses on research that identifies, develops, applies, and evaluates technologies and approaches to help people cope with environmental health risks.

3.1 SHELTER-LINKED ENVIRONMENTAL RISKS TO HEALTH

3.1.1 Building better homes to prevent Chagas' disease

Humans shield themselves from the environment in various types of shelters. These afford protection from wind, rain, and extremes of temperature. They also provide a modicum of privacy as well as safer storage space for personal possessions. What is often not realized is that humans can guard themselves from environmental health risks with a properly constructed shelter. Poorly constructed quarters on the other hand may present favourable conditions for disease vectors and, in fact, increase the risk of acquiring disease.

A case in point is the infestation of wall cracks and roofing by blood-feeding bugs that transmit Chagas' disease (see Box 1). The insects vectors of Chagas' disease are endemic to nearby fields and forest and naturally infest dwellings constructed of conventional mud wattle, substandard cement, and thatch roofs. Furthermore, traditional construction methods foster a lack of natural interior light and poor ventilation, factors that maintain the dark and humid conditions that are favourable to these insects. One solution would have houses periodically sprayed with insecticides. This is an expensive intervention, using imported chemicals, which are costly, often a health risk, and usually cannot be sustained or replicated in developing countries. The endemic nature of the insects ensures that reinfection will occur as soon as the pesticide has lost its effectiveness (usually over the course of one year).

Building better homes could be an effective way to control the incidence of Chagas' disease. This was the hypothesis that researchers in Paraguay decided to explore (see Box 2).
In Paraguay, scientists from two institutions (the Appropriate Technology Centre at the Universidad Católica Nuestra Señora de la Asunción and the Health Sciences Research Institute at the Universidad Nacional de Asunción) developed a multidisciplinary project. The team analyzed construction techniques and building materials. It also carefully considered popular knowledge both of the disease and of shelter fabrication. The project demonstrated (see Box 1) that the transmission of Chagas' disease could be interrupted by simple interventions preventing the infestation of homes by the triatomid vector. The project resulted in more pleasant homes, the interventions were sustainable and the community was motivated to participate. Thus empowered by new knowledge, communities can take control of their own health.

A similar project took place in Brazil. Taken together, the Brazil and Paraguay studies show that community-based approaches and simple technologies can empower rural communities to control a serious environmental health risk. Following both studies, the ministries of housing and health of both Brazil and Paraguay have indicated their interest in incorporating these results into their respective primary health care strategies.

3.1.2 Fighting malaria with recycled materials

Houses may also protect humans from other insect-borne diseases, such as malaria. Malaria is an environmental problem that is exacerbated when humans modify the environment to fit their immediate and long-term development plans (see Box 3). Malaria is conventionally controlled by spraying with insecticides to reduce the mosquito population. This technique is exacting a toll on the environment, as insecticides are also toxic to organisms other than mosquitoes, such as humans and livestock. Although this strategy is becoming less and less efficient with the appearance of pesticide resistance, it is still a standard response.

Box 1: WHAT IS CHAGAS' DISEASE?

Chagas' disease is an American variant of the African sleeping sickness. It is one of the most serious tropical diseases found in Latin America, both in terms of occurrence and impact on human health and productivity. About 15 to 20 million people are infected, and another 65 million are exposed to the risk of acquiring the disease. It can kill after 10 years or more of debilitating illness. There is no satisfactory cure for the chronic phase of Chagas' disease, which is rarely diagnosed during the early, acute phase.

Chagas' disease is a serious environmental health risk. It is transmitted by blood-sucking insects (triatomid bugs) from the forest and fields that continuously invade human dwellings. There, they breed and feed, transmitting the disease.

1 Evaluation of Chagas' Disease Control (Brazil), IDRC project 88-0391.
Box 2: BUILDING BETTER HOMES TO PREVENT CHAGAS' DISEASE

THE ENVIRONMENTAL HEALTH RISK: Triatomid bugs capable of transmitting Chagas' disease invade human dwellings from the sylvatic habitat.

EXACERBATING CONDITIONS: Increasing population pressures lead to migrations to new settlement sites in areas endemic for the insect vector, thereby promoting increased disease transmission.

THE CONVENTIONAL SOLUTION: Periodic spraying of dwellings with imported pesticides to kill the resident bugs.

ITS DRAWBACKS:
1) High cost of imported pesticides makes this vertical intervention difficult to maintain in the long term.
2) It is not usually under the control of the people most at risk.
3) When the pesticide loses its effectiveness, the unmodified living quarters are rapidly reinfested.
4) Pesticides may pose a health risk to people and livestock.

THE RESEARCH HYPOTHESIS: Improving traditional construction methods and designing and testing affordable (but superior) building materials to repair existing (or construct new) dwellings can control Chagas' disease by preventing the infestation of homes by the triatomid bug.

THE RESEARCH TEAM: A multidisciplinary group of biologists, sociologists, architects, and communicators working in the laboratory and local inhabitants from three rural communities.

THE ACHIEVEMENTS

NEW KNOWLEDGE:
1) The prevalence of Chagas' disease in rural Paraguay is high; however, rural inhabitants have little or no knowledge of Chagas' disease or its mode of transmission.
2) People are aware of the infestation of their homes by bugs and would welcome their eradication (the bugs inflict painful bites during the night). They would welcome home renovation to achieve this.

NEW SUSTAINABLE TECHNOLOGIES:
1) After extensive testing and design, new building materials based on traditional substances were identified. These substances are more durable and resistant to environmental degradation, promoting a bug-free habitat.
2) New building techniques were devised. They provide better, stronger, brighter, and easier to clean dwellings, while remaining relatively affordable.
3) Popular education interventions on Chagas' disease and its control by improved housing were designed and implemented. These measurably increased community awareness and participation in the renovation and upkeep of Chagas-free homes.

PROJECT FINDINGS: Chagas' disease can be controlled in rural Paraguay by a combination of three sustainable, community controlled, and environmentally friendly interventions: 1) Popular education (Chagas' disease and triatomid bugs/improved construction and home maintenance). 2) A single, initial fumigation of existing homes to kill all resident triatomids. 3) Dwelling renovation in a way to make the living quarters inhospitable for triatomid bugs, followed by a home-maintenance program.

THE FUTURE: Is the intervention sustainable over the long term? What will be the impact on the occurrence of Chagas' disease? What is needed to maintain active community awareness and participation? How can these interventions be integrated as a national strategy for disease control?
For night-biting mosquitoes, breeding opportunities are better around human settlements, taking advantage of environmental modifications. Of course, this also places these blood-sucking insects in an ideal feeding habitat (close to sleeping humans).

Bed netting is a conventional, yet costly response to night-biting insects. In recent years, bed nets have been treated with insecticides to either repel or kill mosquitoes on contact. It appears that bed nets treated with insecticides are actually reducing mosquito numbers. The effect on malaria incidence, however, is much harder to measure. Some studies report a considerable reduction in childhood malaria mortality. However, unless the technology can be made affordable, it is unlikely to have any profound impact on global malaria.

Researchers at the National Institute of Medical Research in Muteza, Tanzania, are exploring an affordable alternative (see Box 4). If successful, it would empower communities to control this environmental health risk. The study explores the use of old sacking material to fabricate bed curtains that can be treated with the same insecticide used on the bed nets. It is known that treated bed nets with holes in them perform as well as intact nets; therefore, these curtains will likely be effective. The key issue in this study is that of empowerment: empowering people to protect themselves and their families against a grave environmental health risk. This approach integrates villagers in the process of controlling malaria with local resources. Furthermore, the approach is sound in the context of environmental management. It is an elegant, practical, and innovative use of material that would otherwise be disposed of and increase the environmental problem of solid wastes.

3.2 HEALTH RISKS FROM THE EXTERNAL, LOCAL ENVIRONMENT

There are many factors in the living environment that present a risk to our health. Global environmental considerations affect both North and South. More often than not, however, it is the day-to-day, local environmental health risks that have an immediate impact on the poor of the developing world.

In both rural and urban communities, polluted sources of water for domestic use, as well as poor drainage of excess water and wastewater, create environmental conditions that favour disease transmission. As noted earlier, stagnant ponds are excellent breeding sites for insect
Box 4: FIGHTING MALARIA WITH RECYCLED MATERIALS'

THE ENVIRONMENTAL HEALTH RISK: Several species of mosquitoes enter homes at night and bite humans with a high probability of transmitting malaria.

EXACERBATING CONDITIONS: Water resource development projects provide ideal conditions for the proliferation of mosquitoes through widespread increase of breeding sites and prolongation of the breeding period. Human habits related to solid waste disposal around the home have also intensified this problem.

THE CONVENTIONAL SOLUTIONS: Insecticide spraying for mosquito control; antimalarial drugs as a prophylactic or curative intervention; bed nets.

THEIR DRAWBACKS:
1) Insecticides and antimalarial drugs are expensive and foreign currency is required for importation.
2) Insecticide spraying can cause serious environmental contamination with effects on non target organisms, including humans.
3) Resistance by mosquitoes to insecticides and by the parasite to antimalarial drugs is becoming widespread.
4) Bed nets are often too costly.

THE RESEARCH HYPOTHESIS: Sustainable malaria prevention can be achieved through community participation by fashioning bed curtains from the plastic recovered from locally available sacking material made for agricultural products, and then treating these curtains with pyrethroid insecticides.

THE RESEARCH TEAM: Scientists from the National Institute of Medical Research (at the Amani Medical Research Centre) in Muteza, Tanzania.

SIGNIFICANCE OF THE RESEARCH

There is a growing body of evidence indicating that bed nets treated with insecticides have a dramatic effect in reducing the mosquito population. However, the effect on malaria incidence is much harder to measure. Some studies are reporting considerable reduction in childhood malaria mortality associated with the use of treated bed nets.

This new project will test the following hypotheses:
1) The incidence of malaria is reduced by the use of insecticide-treated bed nets.
2) Bed curtains made of polypropylene fibres obtained from old sacking material and treated with pesticides are as effective in reducing the incidence of malaria.
3) The cost and simplicity of the technology make it sustainable at the community level.

THE FUTURE: The project is still in its infancy; therefore, results are not yet available. The project epitomizes the type of simple, environmentally friendly technology that is likely to become a sustained, community-driven intervention with the potential to greatly alleviate a very serious environmental health risk.

Community Prevention of Malaria (Tanzania), IDRC project 89-0216

disease vectors. The expansion of endemic areas for malaria and schistosomiasis in relation
to irrigation schemes and hydroelectric dams is well documented. If the consequences of such water-related development schemes could be addressed by the people most at risk, it would empower them to protect their health at the micro level, notwithstanding macro schemes that are outside their control. The next two studies illustrate how research can provide communities with the technology to do just that.

### 3.2.1 Coconut milk for malaria control

For countries like Peru, the economic costs, the resources, and the logistics required for mass spraying campaigns against malaria are very limited. There would be a clear advantage for any program that relied on self-directed community action.

Can people modify environmental parameters to reduce health risks? This was the question posed by scientists at the Alexander von Humboldt Tropical Medicine Institute in Lima, Peru. There has been increasing interest on the part of public health officials for using bacterial insecticide to control malaria. It is environmentally safe and deadly only to target organisms such as mosquito and black fly larvae. However, there are logistical problems with its distribution, mainly because of its biological nature (storage, production, shelf life, etc). How could this novel technology be transferred effectively to people in communities in a way that would empower them to reduce the environmental health risk posed by malaria?

The research team developed an innovative and low cost approach to making *Bacillus thuringiensis* var. *israelensis* (Bti) available cheaply in communities where malaria is endemic (see Box 5). The technology focused on using locally available coconuts to grow the biological insecticide. Research demonstrated that coconut water was a good culture medium for Bti. The research team demonstrated that whole coconuts could be inoculated directly with Bti and that laboratory conditions were not necessary. This opened the door to implementing the strategy in the field. Research has shown that two or three inoculated coconuts produce enough Bti to maintain a small, shallow pond free of mosquito larvae for 45 days. A prototype kit for inoculating coconuts was devised.

The second phase of the project will concentrate on the economic, social, and technical constraints that define the practicability, potential impact, and sustainability of the method. Researchers will attempt to gain an understanding of the community and its perceptions of malaria. The purpose being to design a health education program for malaria control.

The success of this project has raised the interest of Peru's Ministry of Health. The Ministry is looking at using this technology within the national primary health care system.

Again, the emphasis of this project was on integrating the community into the problem-solving process. The technology uses locally available material that may otherwise have been
Box 5: COCONUT MILK FOR MALARIA CONTROL

THE ENVIRONMENTAL HEALTH RISK: Mosquitoes breed in ponds surrounding human dwellings and their proliferation seriously increases the risk of contracting malaria.

EXACERBATING CONDITIONS: Human activity multiplies mosquito breeding sites, notably in the vicinity of human dwellings.

THE CONVENTIONAL SOLUTION: Spraying with pesticides to kill mosquitoes and their larvae.

ITS DRAWBACKS:
1) High cost of imported pesticides makes regular application impossible.
2) It is not usually under the control of the population most at risk.
3) Pesticides pose a continuous threat to the environment, more specifically to nontarget species including humans.
4) Mosquito resistance to pesticides is reducing the effectiveness of this strategy.

THE RESEARCH HYPOTHESES:
1) A bacterial insecticide (*Bacillus thuringiensis* var. *israelensis*) can be produced in whole coconuts and used to destroy mosquito larvae.
2) The technology can be transferred to communities, which can be taught to produce the insecticide and to use it to control malaria.
3) The strategy is effective for controlling malaria in humans.

THE RESEARCH TEAM: Scientist from the Alexander von Humboldt Tropical Medicine Institute in Lima, Peru.

THE ACHIEVEMENTS

NEW KNOWLEDGE:
1) *Bacillus thuringiensis* var. *israelensis* can be grown in whole coconuts where they survive for at least 18 days in sufficient quantity for use in mosquito larvae control.
2) When the inoculated coconut milk is added to pond water, virtually all mosquito larvae are killed; further larval growth was stopped for up to 45 days.

NEW SUSTAINABLE TECHNOLOGY: A low-cost prototype kit that villagers can use to inoculate coconuts with only minimal instructions.

PROJECT FINDINGS:
1) *Bacillus thuringiensis* var. *israelensis*, which is deadly to mosquito and black fly larvae, but harmless to humans and livestock, can be grown in whole coconuts and represents a simple, low-cost, and effective means of malaria control through an environmentally friendly intervention.
2) The technology is simple and affordable enough to make it accessible to people with no scientific training and very modest means.

THE FUTURE: How can the technique be disseminated to other malarial regions? Will the use of the strategy bring down the actual incidence of malaria in other ecological settings?
wasted. Thus, expensive resources do not have to be deployed from outside the village, thereby improving the potential sustainability of the technique.

3.2.2 A snail-killing berry

Water is essential to all life and access to clean water is a daily concern in the developing world. Water is also an ubiquitous component of the environment and is often tied to severe environmental health risks for people. This was already alluded to in the previous discussion on malaria, as an indirect influence. It can have a more direct effect, however.

In rural tropical areas, people come in daily contact with water for a variety of reasons: drinking, bathing, washing clothes, and crossing by foot. Such frequent contact with water can lead to infection by water-borne parasites, such as those that cause schistosomiasis (see Box 6). Although the disease is clearly environmental in nature, the health risk is increased by human activity.

Currently, the conventional environmental fix is to spray bodies of water with a chemical molluscid to kill the intermediate snail host. The major drawbacks of this intervention are that it is difficult to sustain (because of its cost) and that it seriously contaminates the environment. The recommended molluscid is toxic to many aquatic organisms, and is persistent in the environment, thus amplifying its toxic effects on nontarget organisms.

In the early 1960s, a group of researchers in Ethiopia discovered that when tiny amounts of a dried soapberry (Phytolacca dodecandra) were crushed and mixed with water, the resulting solution killed freshwater snails, the intermediate host for the schistosome parasite. The active ingredient in this solution was Endod, a saponin produced by the soapberry plant. Because the soapberry plant was endemic to the region, scientists thought that this plant could replace the conventional synthetic molluscid. Soapberry was already used by local populations to wash clothes; thus, its acceptance for schistosomiasis control would be relatively easy. Scientists at the Institute of Pathobiology of Addis Ababa selected some high-yielding cultivars of the plant and studied their life history.

Box 6: WHAT IS SCHISTOSOMIASIS?

Schistosomiasis is a serious parasitic disease affecting approximately 350 million people, with a further 600 million at risk. Four species of Schistosoma are pathogenic for humans. The infection is acquired through contact with water inhabited by aquatic snails, who are the intermediate hosts. The infective larvae penetrate the skin and develop into worms that inhabit the blood vessels, the intestines, or the urinary bladder.

Schistosomiasis is a serious chronic disease that seriously impedes to child growth and human productivity. In its more severe forms, it can cause paralysis and death.

Schistosomiasis is an environmental health risk, and is exacerbated by any human activity that increases the habitat for aquatic snails, such as irrigation and damming projects.
A series of international workshops and consultations was initiated, culminating in a full battery of toxicity testing in accordance with OECD Minimal Data Requirements for Pre-market chemicals. It was established that Endod is either nontoxic or only slightly toxic to mammals and is nonmutagenic. Ecotoxicity testing has indicated that Endod is no more toxic than the recommended synthetic molluscicides. Indeed, after application, Endod does not remain or build up in the environment.

A team of researchers at the Blair Research Laboratories in Zimbabwe have now started studying the effectiveness of Endod application for schistosomiasis control, looking at the actual decrease of infection rates, the community acceptance of the scheme and the cost efficiency of the intervention. The control of schistosomiasis through the application of this botanical molluscicide can only become a reality if the people at risk find it practical and affordable.

The use of Endod as a botanical molluscicide would offer many advantages. It is both biodegradable and locally available. It can be grown on marginal land by rural people, with the added advantage of stabilizing soils and preventing erosion. Its acceptance as a method for the control of schistosomiasis may also increase its value as a cash crop. Furthermore, it would put the means of controlling a severe environmental health hazard in the hands of the people most at risk, increasing the sustainability of the solution.

Already, networking of scientists in the South with those in the North has enabled a discovery from Ethiopia to be further investigated in the laboratories of North America and Europe. Its practical advantages are now being analyzed in Zimbabwe.

3.3 HYGIENE AND ENVIRONMENTAL HEALTH RISKS: TRANSFERRING TECHNOLOGY TO PEOPLE

As rural and urban populations increase, people live closer to each other and to their own wastes. The pollution of water sources and the living environment with faeces is a serious environmental health hazard. Faecal contamination of drinking water and food is the major cause acute diarrhoea in the developing world. The World Health Organization (WHO) predicts that 3.2 million children under five years of age will die from diarrhoea in 1991 (WHO 1991). The following projects illustrate how the use of simple, locally produced, community-based technologies can have a more prolonged, substantial impact on human health relative to conventional strategies that focus on breaking the cycle of disease. The people who are the beneficiaries are directly and actively involved in the intervention and, therefore, have a stake in its outcome. The aim of this approach is to assist people to resolve local environmental conditions through the use of methods that are perceived by people as practical, easy to use, and immediately and visibly beneficial.
Box 7: A SNAIL-KILLING BERRY*

THE ENVIRONMENTAL HEALTH RISK: Fresh water harbours the snails that are the intermediate host of human schistosomiasis. Simple contact with water (drinking, bathing, washing clothes, or crossing by foot) is sufficient for infection by the schistosome parasite.

EXACERBATING CONDITIONS: Expansion of the snail’s habitat (irrigation schemes, hydroelectric dams, etc.) and unsanitary human practices favouring the contamination of the environment with the parasite’s eggs.

CONVENTIONAL SOLUTIONS: Massive spraying of water bodies with chemical molluscicide. Massive chemotherapeutic treatment of affected populations.

THEIR DRAWBACKS: The molluscicides of choice are persistent and toxic to many aquatic organisms, and their use poses a serious environmental hazard. Chemotherapy alone does not eliminate the environmental risk of contracting the disease. The cost of combined massive molluscicidal and chemotherapeutic interventions make them impractical to sustain in developing countries.

THE RESEARCH HYPOTHESES:
1) The saponin contained in the fruit of a naturally occurring bush is a safe, efficient molluscicide.
2) It is an practical alternative to existing molluscicides for preventing schistosomiasis.
3) The berry can be grown and used by communities for effective, sustainable schistosomiasis prevention.

THE RESEARCH TEAM:
1) Scientists from the Institute of Pathobiology of Addis Ababa, Ethiopia.
2) Scientists from a number of laboratories for toxicity testing in Canada, the United States, the Netherlands, and Ethiopia.
3) Scientists from the Blair Research Institute, Ministry of Health, Zimbabwe.

THE ACHIEVEMENTS

NEW KNOWLEDGE:
1) Soapberry (*Phytolacca dodecandra*) produces a saponin, Endod, that efficiently and quickly kills the intermediate snail host of the schistosome parasite.
2) Endod passed all the toxicity tests in accordance with OECD Minimal Data Requirements for Pre-market chemicals with a rating of either nontoxic or slightly toxic (except for eye irritation) and is nonmutagenic.
3) Eco-toxicity tests indicate that Endod is no more toxic than currently recommended synthetic molluscicides.

NEW SUSTAINABLE TECHNOLOGY: High-yielding cultivars of soapberry were identified and propagated.

THE FUTURE: Can traditional practices, such as the use of soapberry for laundering, be modified slightly and strategically to have sustainable effects on the occurrence of schistosomiasis? The first comprehensive community-based trials of Endod is now underway in Zimbabwe and include environmental impact studies.

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Endod (Ethiopia); Botanical Molluscicide (Endod) Toxicology (Canada); Schistosomiasis Intervention Trial with a Botanical Molluscicide - Endod (Zimbabwe), IDRC projects 87-4260, 89-0136, 90-0278
3.3.1 Safeguarding health through the practical use of knowledge

Ticari and La Chaves are two young rural communities in the District of Rio Frio on the Atlantic coastal plain of Costa Rica. The standard of living in this region is low. People lack many basic services including electricity, public transportation, potable water, and sanitation. Visits by health workers and doctors are irregular.

In 1988, a Costa Rican nongovernmental organization (NGO), Fundatec (based at the Instituto Tecnologico de Costa Rica), began to study the transfer process of low-cost handpumps from Asia. The project evolved and, eventually, the NGO was conducting applied research to improve community health by controlling factors in the physical, biological, and social environments that affect the transmission of water- and excreta-related diseases.

The project did not begin as planned. The handpumps imported from Asia took over six months to arrive. During this time, the researchers regularly visited the communities, keeping them informed of the whereabouts of the hardware and the expected arrival date. They used the opportunity to become acquainted with the problems of the communities, their needs, and their expectations. For their part, the people of the communities were struck by the candid and forthcoming attitude of the "outsiders," their preoccupation for keeping them informed, their punctuality, and their commitment to keeping their word, a trait they had not previously seen in external experts.

This people-to-people interaction, based on mutual respect and trust, helped maintain the interest of the communities in the project. Researchers and communities became interested in learning from each other. Project activities became a learning process in which people were invited to help shape, change, and criticize the implementation. The fact that the project investigators took the time to understand community perceptions proved to be very helpful in overcoming the apathy of the communities to improve the hygienic conditions of water sources and latrines. From their discussions about hygiene, with both young and old, the researchers realized that the people of the communities had no understanding of the microscopic world. Any talk about improving hygiene practices was, therefore, meaningless.

To overcome this problem, the team organized a meeting with the community leaders and water committees. A flea with whiskers was drawn on a blackboard and a microscope was set up. The researchers then asked the puzzled audience if they had ever seen the whiskers of a flea, and invited them to see for themselves. The discovery of the microscopic world was a fascinating experience. The people discovered things they had not previously imagined before were now normal facts. With the help of the researchers, community leaders organized a "health week" to talk to their communities about the role of hygiene and the transmission of disease. The microscope and the flea's whiskers were one of the main
features of the event. Through this exercise, the communities became aware of the microbial world and the links between health, hygiene, and their living environment.

As the project progressed, a number of technologies were developed or adapted (including handpumps, ferrocement wells, and training workshops on sanitation, hygiene, organization, and management). Community members were also trained as instructors in these technologies. The community instructors successfully replicated the project in a neighbouring community, with the research team acting as technical advisors.

In this project, the aim of the "outside experts" was not to introduce technology, but to add their knowledge to that of the community and work jointly with the communities to solve immediate problems. From this people-to-people interaction and sharing of knowledge, a new form of consciousness emerged. People began to understand how the problems they were trying to solve were part of a larger picture. Today, self-help and self-organization are very much in the minds and actions of the communities of Rio Frio.

3.3.2 Transforming faecal contamination into food production

After the 1976 earthquake in Guatemala, several governmental agencies and NGOs began latrine construction and health-improvement programs in rural areas. Simple pit latrines were introduced with limited success, even though the latrine slabs were donated to the users. The digging of pits was difficult in the rocky ground. People living on small plots did not view the pit latrine as useful or practical because of the lack of space to relocate the latrine once the pit was full. In areas with high groundwater, the pit contents became wet, odorous, and attracted flies.

In 1978, the Centro Mesoamericano de Estudios sobre Tecnologia Apropiada (CEMAT) began to evaluate the technical performance and social acceptability of various improved latrine designs for rural areas. CEMAT was searching for an economical answer that could both fight disease and provide fertilizer. It was very aware that subsistence farmers in Guatemala, many of whom must cultivate land with poor soil, could not afford the ever-increasing cost of chemical fertilizer. The possible use of composted excreta could decrease the dependence on imported, expensive chemical fertilizers and, at the same time, diminish the health risks associated with the lack of proper sanitation facilities (see Box 8).

A modified version of the Vietnamese double-vault latrine was developed in close collaboration with community users. It was named the Letrina Abonera Seca Familiar (in English, the Dry Alkaline Fertilizer Family (DAFF) latrine). This latrine does not have a pit (it is built above ground) and produces fertilizer. It offers several advantages: no digging is required; it can be built in densely populated areas or on small plots; it does not pollute the groundwater; and it reduces the farmer's need for chemical fertilizer while helping rebuild the organic content of the soil.
Between 1981 and 1986, CEMAT promoted the diffusion of this technology through training workshops for rural micro-enterprises, national and international NGOs, and public institutions working in the sanitation and health sectors. By 1986, over 3,600 DAFF latrines had been constructed throughout the country.

Since then, CEMAT has conducted many surveys to assess the levels of use, status, and acceptance of the DAFF latrines. They found that over 60% of the latrines installed by the various organizations had either been abandoned or had never been completed. Through the experience of these evaluation projects, CEMAT discovered that it was not enough simply to develop a sound technology.

Widespread acceptance and effective use depends on the proper organization and execution of replication programs. Complications can easily arise when different organizations, with different levels of expertise and approaches to replication, become involved in the transfer of the technology from one location to another. Promising new technologies can easily fall into disrepute if the quality (of both the technology and the introduction process) suffers and the intended benefits fail to materialize. Mechanisms are therefore necessary to link local, regional, and national organizations into a supportive multilevel network to ensure proper transfer while remaining sensitive to user needs.

CEMAT has been very active during the last four years developing networking mechanisms between communities and macro-level development agents to promote the exchange of information and collaboration. They have also instituted a number of remedial actions, including standardization of essential design features and monitoring tools; training and technical support through technology-transfer workshops for communities and interested organizations; and providing follow-up support to communities on rehabilitation and proper use of the latrines, as well as on fertilizer use.

3.3.3 South-North technology transfer

It is often assumed that developing countries have little interest and little to contribute to developing of technologies that protect the environment, decreasing environmental risks to health, or helping to monitor changes in the environment. Yet, the people of the developing world are very aware of environmental concerns and development needs. The following case study is a good illustration on how simple, low-cost technology from the South can be used to help solve intractable problems in Canada’s North.

The community of Split Lake is located on a peninsula on the north shore of Split Lake in Northern Manitoba, Canada. It has a population of approximately 1,600, all of which are members of the Cree Nation. This community is one of five Indian reserves affected by the Churchill-Nelson hydroelectric project. One of the effects of the hydro project is fluctuating of water levels in the lake because of hydro demands. The changes in lake levels affect, in turn, the quality of the community’s drinking water.
Box 8: TRANSFORMING FAECAL CONTAMINATION INTO FOOD PRODUCTION

THE ENVIRONMENTAL HEALTH RISK: Indiscriminate defecation practices contaminate drinking water and the peridomiciliary environment with pathogenic organisms causing diarrhoea.

EXACERBATING CONDITIONS: The migration of rural populations to the periurban habitat, with concomitant crowding in areas devoid of services and sanitation, has intensified the environmental contamination from faecal wastes.

THE CONVENTIONAL SOLUTION: Building pit latrines.

ITS DRAWBACKS:
1) Digging the pits can be arduous in rocky ground or impractical in sandy soil.
2) On small plots, general lack of space is a disincentive for latrine construction.
3) If the water table is high, contamination of the aquifer is a risk and the pit content becomes wet and odorous, attracting flies.

THE RESEARCH HYPOTHESIS: Human faeces can be managed simply and safely while providing fertilizer for food production.

THE RESEARCH TEAM: Scientists from the Centro Mesoamericano de Estudios sobre Tecnologia Apropiada (CEMAT) of Guatemala.

THE ACHIEVEMENTS

NEW TECHNOLOGY: A modified version of the Vietnamese double-vault latrine. It is built above ground and produces fertilizer. When one vault is full, the second is used, the contents of the first vault is naturally composted to fertilizer.

NEW KNOWLEDGE:
1) All pathogenic organisms are destroyed by the composting process, producing a safe fertilizer.
2) The composted faecal material is an excellent fertilizer, improving agricultural yield.

SUSTAINABILITY PROBLEMS: By 1986, 3,600 latrines had been constructed in the country. Since then, surveys conducted by CEMAT have indicated that over 60% of the latrines had either been abandoned or had never been completed. It was not enough simply to develop a sound technology. CEMAT has been very active in the last four years developing networking mechanisms between communities and macro-level development agents to promote the exchange of information and collaboration.

LESSEONS LEARNED: Community-based actions can only be replicated or expanded to the extent that micro-level activities are organized in networks that support and facilitate the exchange of information. Links must be established between the action groups and regional/national organizations.
Water-quality monitoring in the whole region is difficult. The required laboratory facilities are located hundreds of kilometres to the south. Current monitoring procedures, administered by Health and Welfare Canada, involve a community health representative collecting samples at predetermined sites. Samples are collected, packaged, and delivered over land or by air to a provincial laboratory.

The South-North transfer in water-testing technology began in response to concerns expressed by the local Cree health representative. He complained that when a water sample was sent into the provincial system, results were received back four to six weeks later. By this time, not only were the results useless but also, and even worse, Band Council members were never told about the health implications of the test results.

The inability of governments to provide adequate water-quality monitoring and feedback to isolated communities is a very common problem in the developing world because of the cost of conventional methods. In fact, since 1983, a network of researchers in Brazil, Chile, Egypt, Malaysia, Morocco, Peru, Singapore, and Thailand have been experimenting with simpler and cheaper tests. With the assistance of the National Water Research Institute (NWRI), part of Canada’s Ministry of the Environment, researchers in these various countries have been developing and testing a number of simple, reliable, and inexpensive water quality tests that can be performed in the field (see Box 9).

Based on the involvement of NWRI with the developing-country network on water quality, personnel from Environment Canada proposed a collaborative project with the community Band Council. The objective of the project was to assess the feasibility of introducing simple microbiological water quality tests for routine use by members of the Band Council. The first phase of the study confirmed the potential usefulness of the tests. No difficulties were encountered with their routine use. When contamination of samples was detected, household heads were informed of the results and remedial measures were promptly applied. The project helped improve the community’s understanding of potential sources of contamination, the frequency and types of contamination of both drinking and recreational waters, and the available options for solving the problems.

A second phase is now under way to evaluate the feasibility and sustainability of a locally operated water quality monitoring system. It will also continue to build the technical capability of the Cree Band Council. The eventual goal is to establish a basic microbiological laboratory, operated by members of the Cree Nation, to service other Indian Bands within boat or car access of Split Lake. The Assembly of First Nations of Canada and the Department of National Health and Welfare, the agency responsible for the supervision of environmental health in the North, are fully supportive of the objectives of these projects.
Box 9: SOUTH-NORTH TECHNOLOGY TRANSFER

THE ENVIRONMENTAL HEALTH RISK: Faecal contamination of drinking water transmits diarrhoeal diseases to humans, with a high risk of child mortality.

THE CONVENTIONAL SOLUTION: Vertical government programs for inspection and testing of drinking water sources.

ITS DRAWBACKS:
1) Although there are methods to test the safety of drinking water, these usually require a central laboratory facility, and results of the analysis often do not reach high risk populations in time for remedial action.
2) The prospect of carrying out regular inspection of all national water sources is daunting, and logistics are rarely adequate.

THE RESEARCH HYPOTHESIS: A battery of simple, cheap, and rapid tests could be used, with modest training, to test water quality on-site, with as much sensitivity and reliability as tests used in a central laboratory facility.

THE RESEARCH TEAM: A network of scientists and laboratories in Brazil, Chile, Egypt, Malaysia, Morocco, Peru, and Singapore with the collaboration of scientists from Canada’s National Water Resources Institute.

THE ACHIEVEMENTS

NEW TECHNOLOGIES: Three simple and rapid methods for testing water quality were improved and adapted and for field use; a fourth method, measuring the presence of a virus as indicator for faecal bacteria, was developed, tested, and packaged in a prototype kit.

NEW KNOWLEDGE: Water quality can be tested rapidly, affordably, and reliably in the field using simple methods. The broad spectrum of available techniques makes possible reliable testing in varied ecological and geographical regions of the developing world. Community members can be easily trained to use these methods.

THE FUTURE: Can the methods be disseminated as easily to other cultural groups? How can the concept be scaled up in a national/regional plan of water-quality control based in communities? Are there technical questions that still need to be answered?

SPECIAL FEATURE: The technologies have been successfully transferred to Canada’s North allowing members of a native community to effect its own water quality testing.

3.4 HEALTH AND THE WORKING ENVIRONMENT

Most human adults spend more of their waking time in a work setting than they do in their domestic environment. In developing countries, this is sadly often true of children as well. The working environment frequently holds special health risks. These risks are often
exacerbated by foreign technology for which developing-country labourers are often ill prepared either socioculturally or intellectually. Mechanization and processes using toxic chemicals are examples of such technology.

The very nature of the work can also produce environmental health risks. Herders, loggers, and oil-prospecting crews, for example, have a higher risks of contracting leishmaniasis.

3.4.1 Leishmaniasis as an occupational disease

In Peru, Andean leishmaniasis affects agricultural populations of the slopes and valleys of the Western Andes. Treatment of lesions with drugs is a difficult, lengthy, and expensive process, often requiring hospitalization. Drastic and painful practices causing disfigurement are commonplace as local therapeutic measures are used (see Box 10).

In 1986, a collaborative project supported by IDRC between the Universidad Peruana Cayetano Heredia, the Alexander von Humbolt Tropical Medicine Institute, both located in Peru, and the University of British Columbia (Canada) was carried out to define the epidemiological pattern of Andean cutaneous leishmaniasis (see Box 11). The project not only attracted overwhelming support from the Peruvian Ministry of Health, but also stimulated for the first time, greater awareness and concerted action by the Andean communities to control this debilitating disease. Although the research team focused initially on the control of a specific disease, it is their environment-focused and community-based strategy that is worthy of note. By actively involving communities in the control strategy, these communities built a local health centre and organized volunteer health committees to facilitate active and passive case detection and treatment of leishmaniasis, as well as other health problems.

The project revealed that the transmission of the disease was related to the working habits of the population. Farmers and their families travel to their fields and remain there for varying periods of time (ranging from several days to several weeks) using provisional shelters. As these shelters are open, people are exposed to sandfly bites. Peak rates of transmission occur while people are in the crop fields. The project revealed that disease
Box 11: LEISHMANIASIS AS AN OCCUPATIONAL DISEASE

THE ENVIRONMENTAL HEALTH RISK: Sandflies, which inhabit deforested zones, transmit leishmaniasis to humans from infected domestic and wild animals through bites.

EXACERBATING CONDITIONS: Ecological changes associated with development and industrial projects, such as deforestation, road construction, mining, oil drilling, and mega-agricultural activities, as well as occupationally related migration, place populations at greater risk of transmission.

CONVENTIONAL SOLUTIONS:
1) Limited scale insecticidal spraying for sandfly control.
2) Animal reservoir destruction campaigns.
3) Antileishmaniasis drugs.

THEIR DRAWBACKS:
1) Insecticide spraying is ineffective and prohibitive (sandfly breeding and activity are widespread) and can generate widespread contamination of the environment.
2) Destruction of domestic animals is often unacceptable to the local population.
3) Drugs are very expensive and cause side effects that often require careful follow-up care.

THE RESEARCH HYPOTHESIS: People can be trained to reduce leishmaniasis by simple early diagnosis methods and environmental control of sandfly breeding through appropriate forestation practices.

THE RESEARCH TEAM: A multidisciplinary field research team from the University Peruana Cayetano Heredia and the Alexander von Humboldt in collaboration with scientists of the University of British Colombia (Canada) working closely with the national health authorities.

ACHIEVEMENTS

NEW KNOWLEDGE:
1) Transmission of leishmaniasis is related to working habits and conditions of the Andean population.
2) There are specific intense transmission foci (ravines scattered throughout agricultural land and grazing fields).
3) There is a marked decrease of sandfly infestation in areas planted with eucalyptus trees.

NEW TECHNOLOGY:
1) A new sensitive diagnostic test (ELISA) was developed and validated for leishmaniasis.
2) A local health centre has been established to move beyond leishmaniasis into general health and to facilitate education, early diagnosis, and simplified treatment strategies, with only minimal assistance from the traditional health authorities.

THE FUTURE: The establishment of cost-effective, replicable procedures for widespread application in all endemic foci of the country and, hopefully, in the entire region.
transmission was intensely focused near ravines scattered throughout agricultural land and grazing fields. These ravines, conspicuous for being rocky and having sparse vegetation and few trees, are resting places for sandflies. There is also evidence that indicates a marked decrease in sandfly population after the planting of eucalyptus trees.

The same research team is carrying out a second project, to develop an appropriate control strategy for Andean leishmaniasis with the participation of the valley communities. It will investigate the effect of controlling the vector population (sandflies) around community working environments. This will be done through reforestation of the sandflies' common resting places. Community participation will focus on reforestation activities. The people in the project communities have experience in this activity; they own and manage a small eucalyptus forest, which provides wood for construction, carpentry, and other needs. This strategy will also improve the local environment, increasing the availability of fuel wood and building materials, helping to stabilize the soil, thereby preventing soil erosion and landslides, and regenerating the local natural ecology.

The comparative advantage of the strategy used in this project is its use of local knowledge and practices to resolve an environment risk to human health. The simplicity of the solution and its compatibility with the day-to-day activities of the beneficiaries serve to reinforce sustainability and success.

3.4.2 Participatory research and the steel workers of Mexico

Industrial development in many developing countries is occurring within a context of scarce resources and ineffective structures to address issues of health and safety within the workplace. Poor countries are being squeezed between scarce financial resources, more competitive global markets, and an imperiled environment. In the developing world, it is not uncommon to find a concentration of heavy industries in particular locations, designated by governments as "export-processing zones" or "development poles". But the rapid introduction of technologically complex and potentially hazardous processes into a social context ill prepared to control the associated risks can result in serious consequences to the environment and the health of people.

Short-term maximization of profits often means minimizing costs. A consequence of this is that the occupational health risks to workers are assigned very low priority. Many industries operate sophisticated production processes with obsolete or unsafe machinery. Skilled and experienced personnel to service and maintain equipment is often lacking. Spare parts are difficult to obtain. In many countries, the process for establishing standards and regulations to govern occupational health and safety in the workplace is either very recent or outmoded.

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3 Andean Leishmaniasis Control (Peru), Phase II, IDRC project 90-0081.

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Governments often lack adequate resources and technical capability to develop, implement, and sustain institutional and regulatory mechanisms to protect the well-being and health of workers.

Within these constraints, the challenge is to plan and implement compatible policies for industrial development and occupational health and safety. One means of evolving toward sound policies may be through the active participation of the people most directly affected by an unhealthy workplace: the workers. Opportunities for change can be created through participatory research mechanisms that build on the knowledge of workers and generate action around health issues.

The experience of a research project supported by IDRC in the steel industry of Mexico demonstrates how workers can make a valid contribution toward improving their working environment. Through a worker-participation approach, a university-based research team worked with the union and the workers to identify and assess health risks in the workplace. They then used this information to plan practical solutions to redress safety and health issues.

The labour force, young men of rural origin, had little previous experience in industrial work. The technical personnel lacked the knowledge to plan and implement the necessary protective measures in the workplace. A paradoxical social situation occurred: the workers had, on the one hand, comparatively favourable wage and social security conditions, but, on the other hand, they were exposed to very dangerous working conditions. Because of the workers' lack of experience, it took them several years to recognize the health risks associated with their working environment. It was only after health problems started to appear that workers' concerns began to grow and actions to reduce the health risks were initiated.

The first step was taken in 1986, when researchers from the Universidad Autonoma Metropolitana-Xochimilco, at the request of the union, began to work together with the workers to raise their awareness of occupational health issues. A research project was initiated to develop simple participatory tools to identify and evaluate occupational risks in the workplace. The results were to be used by the workers to generate proposals on remedial and preventive actions. The underlying assumption of this methodology is that the day-to-day experience of a group of workers sharing the same working conditions is a rich source of knowledge that can be used in the formulation of proposals for intervention.

A subsequent study was carried out to validate this methodology. Its purpose was to analyze the reliability and possible biases in the information collected by the workers. The study confirmed that the approach and the data were particularly useful in changing working and health conditions and establishing preventive measures. Application of the method by

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*Occupational Health in the Metal Industry (Mexico), IDRC project 87-0155.*

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the workers serves two purposes: it produces organized knowledge about risks and health issues related to the workplace and it serves as an educational process, allowing the workers to analyze and become aware of the specific problems involved in their work. The combination of these two aspects empowers the workers to formulate and carry out valid actions for change.

A similar project is being conducted by the Zimbabwe Congress of Trade Unions (ZCTU). Its purpose is to develop participatory mechanisms to assess the major health hazards in the workplace and to build the problem-solving capabilities of workers with respect to occupational health and safety issues.

The difference between the Mexican and Zimbabwean experiences rests with the nature of the research team. In the Mexican case, a university-based research team assisted the union in planning and implementing the research project. In Zimbabwe, the research team is the union. This illustrates that research is not the exclusive domain of academics. The demystification of applied research and the use of participatory research are two of the principles of a people-oriented approach. The people most affected are empowered through the generation of knowledge to resolve environmental conditions that threaten their health, and the health and welfare of their dependents.

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5 Workers' Participation (Zimbabwe), IDRC project 90-0080.
4. LEARNING FROM AND WITH PEOPLE: NEW PERSPECTIVES ON OLD PROBLEMS

The continuing degradation of the environment increases the risks to the health and well-being of populations everywhere. This reality demands urgent and immediate remedial action. Even though earnest dialogue at the international level heightens public and political awareness about this issue, direct benefits to disadvantaged populations are often slow to follow. The time required to adopt national policies, develop strategies and programs, allocate resources, implement programs, and develop national standards and measures can often be very long.

Under these circumstances, it may be too much to expect that international dialogue could significantly and immediately benefit the poor of the developing world, who face serious environmental health risks on a continuing and daily basis. Moreover, new international policies and conventions are unlikely to address the major environmental risks they are already facing and increasingly likely to be facing tomorrow.

Using concrete examples, this paper illustrates that applied research can go a long way in helping people to solve their immediate and medium-term health problems. The chances of finding sustainable solutions are enhanced by the active participation of beneficiaries and a sharing of knowledge about the environment and its associated health risks. With funding from IDRC, the projects illustrated in this document have confirmed that it is possible to link laboratory-based research to the realities and conditions of the field. Such technology transfers are only possible, however, if their initial development took into consideration the real needs and existing capabilities of the intended beneficiaries.

The technologies described share the following characteristics:

1) They are environmentally sound.
2) They empower the users to cope with health risks.
3) They are sustainable within the context of prevailing local resources.
4) They are people-oriented rather than disease oriented.

It is possible for people to organize and act to identify problems, find solutions, and assist other people facing the same or similar environmental health risks. People are the strength of a people-centred strategy, a strategy for research in which IDRC believes.

UNCED and Agenda 21 will highlight the need to investigate the environmental determinants of ill health. We must strive to resolve the environmental health risks that face humanity all over the globe in a more permanent and sustainable manner. To do this in an equitable fashion, the people of the developing world must be allowed to identify and solve their own problems. To achieve this, industrialized countries must continue to fund applied research, must strengthen the research capacity of developing-country scientists and institutions, and must increase their investment in people-oriented research.
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