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New Technologies and Achieving the UN Millennium Development Goals

Prof M S Swaminathan  
UNESCO Chair in Ecotechnology and  
President, Pugwash Conferences on Science and World Affairs, Chennai, India

### I. Introduction:

I feel privileged to have this opportunity to deliver a lecture in honour of Amilcar Herrera. Prof Herrera's "Latin American World Model" shows how we can shape our future in such a manner that it leads to lasting human happiness and security. It has been an act of vision on the part of the United Nations University and the Government of the Netherlands to have established this Institute for New Technologies. Technology has been in the past an important factor in enlarging the rich-poor divide in the world. Today, the challenge lies in enlisting technology as an ally in the movement for economic and gender equity. This can be achieved if there is a new social contract between technologists and the women and men living in poverty. I hope this Institute will become the flagship of a global movement for technologies for achieving the UN Millennium Development Goals.

### II. UN Millennium Development Goals (MDG):

At the global level, the following eight UN Millennium Development Goals illumine the path to a world free of hunger and unacceptable deprivation.

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women

- Reduce child mortality
- Improve maternal health
- Combat HIV/AIDS, malaria and other diseases
- Ensure environmental sustainability
- Develop a global partnership for development

Details of these MDGs are given in Annexure 1. Achieving these goals will require appropriate inputs of traditional ecological prudence and frontier technologies. The scientific aspects relating to the elimination of hunger are discussed in this lecture.

### III. Bridging the Nutritional Divide:

UNDP's Human Development Report 2001 has introduced a Technology Achievement Index (TAI). TAI is an aggregation of 4 groups of indicators, relating to the creation of technology, diffusion of recent innovations, diffusion of old innovations and human skills. Creation of Technology has been measured by the number of patents per capita and receipts of royalty and license fees from abroad per capita. The emphasis is thus on the intellectual property rights (IPR) of nations, evidenced by the power of proprietary science. The other indicators relate to digital, extension and educational divides. This Report titled "Making New Technologies Work for Human Development", has however not drawn attention to the fact that bridging the expanding nutritional divide is fundamental to bridging the other divides, particularly that relating to IPR

The Commission on the Nutrition Challenges of the 21<sup>st</sup> century in its report titled "Ending Malnutrition by 2020 : An agenda for change in the Millennium", has pointed out that some 30 million infants are born each year in developing countries with intra-uterine growth retardation, representing about 24% of all new births in these countries (Philip *et al*, 2000). Low birth weight (LBW) children are characterised by mental impairment. Worldwide, there are more than 150 million under-weight pre-school children and more than 200 million stunted children. At current rates of progress in fighting these maladies, about one billion children will be growing up by 2020 with impaired mental development. What will be the impact of such a denial to the child of opportunities for the full expression on its innate genetic potential for mental and physical development on the intellectual property of a nation? Denying the child an opportunity for mental and physical development even at the foetal stage is the cruellest form of inequity. In contrast, overweight is the major health problem among children in

most industrialised countries and some developing ones (Table 1). **Thus, bridging the nutritional divide is the first requisite for a more equitable and humane world.**

Table 1 – Share of Children who are Underweight and Adults who are Overweight, Selected Countries, Mid-1990s

Country	Share Underweight (percent)	Country	Share Overweight (percent)
Bangladesh	56	United States	55
India	53	Russian Federation	54
Ethiopia	48	United Kingdom	51
Vietnam	40	Germany	50
Nigeria	39	Colombia	41
Indonesia	34	Brazil	36

Source : Gardner and Halweil, 2000

#### IV. Growing disparities

The nutritional divide is increasing between the rich and the poor within and among nations. The situation is particularly alarming in developing countries. The nutritional paradox of South Asia lies in the co-existence of grain mountains and hungry millions. This is largely due to inadequate purchasing power arising from lack of sustainable livelihood opportunities. **Famine of income is becoming the most important cause of a famine of food at the household level.** Pregnant and nursing mothers and children belonging to the families living below the poverty line (the World Bank poverty line is an income of one US dollar per capita per day or below) are the worst sufferers. For example, severe anaemia during pregnancy is associated with very high relative risk of maternal death. Maternal mortality rates are as low as 3 to 4 per 100,000 births in industrialised countries, while in many developing countries they are at least 100 to 200 fold higher. Protein-energy malnutrition (PEM) affects nearly 30% of children under five years of age in countries in sub-saharan Africa. A comparison of the nutritional status of populations in 3 Asian countries – China, India and Sri Lanka – provides some interesting insights into the impact of public policy on the nutritional well being of the population.

#### V. Nutrition Profile among a few nations in Asia : Role of Non-Nutritional Factors

Four parameters-underweight, stunting, wasting and low birth weight-reflect the nutritional status of children below 5 years of age. The comparative profile of Sri Lanka, China and India is given in Table 2. The data show the importance of non-nutritional factors like education and health care in the nutritional well being of an individual.

Table 2 - Comparative Nutrition Profiles of children

Parameter	Sri Lanka	China	India
	In percentage		
Undernourished	25	11	21
Underweight	38	10	53
Stunting	24	17	52
Low birth weight	25	6	30

*Source: HDI Report 2001 and Planning Department of Sri Lanka*

a. Body Mass Index gives the nutritional status of adults. Adults having BMI less than 18.5 are considered to be chronically energy deficient. Body Mass Index over 25 indicates over weight. Obese persons will have BMI over 30. The situation in Sri Lanka is given in Table 3.

Table 3 - Body Mass Index (BMI) in Sri Lanka

BMI	Men	Women
< 18.5	36.2	33.4
> 25	9.0	12.8
> 30	0.8	1.5

b. Iron Deficiency Anaemia:

In Sri Lanka, 58% of the children in the age group of 5 to 10 years suffer from iron deficiency anaemia affecting cognitive capacity and academic performance. In the case of adults, 45% suffer from iron deficiency anaemia. In the case of pregnant mothers, the proportion suffering from anaemia is less, namely 39%.

c. Mortality Rates:

Thanks to advances in preventive and curative medicine, mortality has been declining between 1970-75 to 1999-2000 in China, India and Sri Lanka (Table 4). IMR and MMR are still high, although there is considerable variability among states within the country. The State of Kerala, in India for example, has figures similar to those of Sri Lanka.

Table 4 – Mortality Rates

Category	Years	Sri Lanka	China	India
Life Expectancy in years	1970-75	65.1	63.2	50.3
	1995-2000	71.9	69.8	62.3
Infant mortality	1970-75	65.0	85.0	127
	1996-2000	17.0	33.0	70.0
Under-5 mortality	1970-75	100	120.0	202.0
	1995-2000	19.0	41.0	98.0
Maternal mortality*	1995-2000	60.0	55.0	408.0

*Source: Human Development Report 2001* \* Per 100,000 live births

d. Female Literacy and Child Health:

Education of women and a rapid increase in the rate of female literacy have been achieved in Sri Lanka as a result of the introduction of free education from 1945 onwards. It enabled girls to have equal access to education as boys. The situation is similar to that observed in the Indian State of Kerala.

Both men and women have achieved high literacy rates with 83% for women and 90% for men. They also have very low drop out rates viz. 4% for girls and 6% for boys. There is a significant impact of mothers' education on the nutritional status of children (Table 5).

Table 5 - Mother's education and child malnutrition in Sri Lanka

Category	Stunting	Wasting	Underweight
All category	23.8	15.5	37.7
No education	46.0	16.7	57.9
Primary	33.6	18.7	37.8
Secondary	22.6	16.8	39.1
More than secondary	13.0	11.3	24.6

*Source: Planning and Development Department Sri Lanka*

e. People Power Revolution in Nutrition:

Ultimately the success of various nutrition related programmes depends upon the effectiveness of the delivery systems. Hence, Sri Lanka is attempting a community based nutrition intervention programme. This is called participatory nutrition improvement project (PNP). This programme was started in 1993 with the help of UNICEF. The guiding principle was to mobilize the energies of the community and their commitment to their own and their families' nutritional well being. PNP is a people-focused project,

enhancing the ability of mothers and fathers, through group formation and strengthening, to identify or explore their nutritional problems, identify their nutritional needs and maximise their potential in meeting those needs. Countries like Cuba, China and India have also rich and varied experience in the development of effective delivery systems. In sub-saharan Africa, Ghana has made rapid progress in overcoming PEM through community based nutrition (Gardner and Halweil, 2000). **Mobilising “people power” in the cause of nutritional security is the most effective and sustainable strategy.** The example of Thailand illustrates this fact.

f. Thailand’s Nutrition Security Compact

During the past 10 years, Thailand has achieved remarkable progress in reducing maternal mortality as well as the incidence of LBW children. The strategy consisted of the following components.

- Eliminate severe, moderate and mild protein-energy malnutrition (PEM).
- Monitor growth among all pre-school children and provide food supplements where needed
- Mainstream nutrition in health, education and agricultural policies
- Retrain and retool existing staff and mobilise community volunteers. Choose one community volunteer for every 10 households and build their capacity.
- Encourage breast feeding and organise school lunch programmes
- Promote home gardening, consumption of fruits and vegetables, aquaculture and food safety standards
- Introduce an integrated food safety net with emphasis on household food and nutrition security.

The positive impact of the above Nutrition Security Compact is evident from the decline of maternal mortality from 230 per 100,000 live births in 1992 to 17 in 1996 (Philip *et al* 2000). Thailand’s initiative in organising a **Community Volunteer Corps for Household Nutrition Security** is worthy of emulation by other nations.

## VI. Challenges Ahead

Among the nutritional challenges facing the countries in transition, the following need priority attention;

a. Low birth weight

For the reasons already mentioned, Governments and civil society organisations in developing countries should accord high priority to overcoming maternal and foetal, under-nutrition and malnutrition. Future intellectual attainments of nations will depend very much on success in this area.

b. Under-nutrition and Stunting among children:

Because of its linkages to mental impairment, stunting should be addressed through an integrated package of health care, education and nutritional measures. Early under-nutrition accentuates adult chronic diseases including diabetes, heart disease, hypertension and cancer.

c. Undernourished adults

Judged by a body mass index of less than  $17 \text{ kg/m}^2$ , over 240 million adults in developing countries are severely undernourished. The nutritional safety net for this category could include programmes like food for eco-development i.e. food for work and food for nutrition.

d. Vitamin A and Iodine deficiencies

Subclinical Vitamin A deficiency still affects nearly 200 million pre-school children in developing countries. Sustained efforts are also needed to eliminate iodine deficiency disorders.

e. Pandemic Anaemia

Maternal anaemia is pandemic and is associated with high MMR; Anaemia during infancy, compounded by maternal under-nutrition, leads to poor brain development.

f. Lack of access to clean drinking water:

This is a major nutritional problem since contaminated water is a major cause of intestinal infections and diarrhoea in children. Access to clean drinking water is becoming a luxury in many developing countries.

g. Access to sustainable livelihoods:

Ultimately, it is the lack of purchasing power that is responsible for poor access to balanced diet. In India, poverty line is defined in nutritional terms. The estimation of poverty is based on the consumption expenditure level below which a household of 5.5 persons, on an average, cannot meet the recommended intake of 2400 kcal for adults in rural areas and 2100 kcal in urban areas. In the case of poor households, over 70% of the daily income goes to food. Even by this austere yardstick, over 250 million persons in India live below the poverty line. In the area of income poverty, South Asia is the “hot spot” (Table 6).

Table 6 - Regional Comparison of Income Poverty in Developing Countries

	1987	1990	1993	1996	1998*a
East Asia and Pacific	417.5	452.4	431.9	265.1	278.3
South Asia	474.4	495.1	505.1	531.7	522.0
Asia and Pacific *b	891.9	947.5	937.0	796.8	800.3
Europe and Central Asia	1.1	7.1	18.3	23.8	24.0
Latin America and Caribbean	63.7	73.8	70.8	76.0	78.2
Middle East and North Africa	9.3	5.7	5.0	5.0	5.5
Sub-Saharan Africa	217.2	242.3	273.3	289.0	290.9
Asia & Pacific as % of world total	75.4	74.2	71.8	66.9	66.8
Total	1183.2	1276.4	1304.3	1190.6	1198.9

Source: IFAD (2001)

## VII. Meeting the Challenges:

### 1. Food based approach to nutrition security

Such an approach will involve the following steps.

#### a. *Food Availability*

This is a function of both home production and imports. In many developing nations, the gap between potential and present yields is high in most farming systems, even with the technologies available on the shelf. High priority should hence go to bridging the productivity gap through a mutually reinforcing blend of technologies, services and public policies. Also, mainstreaming the nutritional dimension in the design of cropping and farming systems is essential. There is no time to relax on the food production front. The present global surplus of food grains is the result of inadequate consumption on the

part of the poor, and should not be mistaken as a sign of over-production. Developing nations should aim to achieve revolutions in five areas to sustain and expand the gains already achieved. These are:

*Productivity revolution:* The scope is great since average yields are still low in most cropping and farming systems. However, the production techniques should be environmentally sustainable, so that high yields can be obtained in perpetuity.

*Quality revolution:* This can be achieved through greater attention to post harvest technologies and bio-processing, as well as to sanitary and phytosanitary measures and **codex alimentarius** standards.

*Income and employment revolution:* This will call for an integrated attention to on-farm and non-farm livelihoods and to farming systems intensification, diversification and value addition. Post harvest processing offers scope for generating additional livelihoods through micro-enterprises supported by micro-credit.

*Small Farm Management revolution:* Institutional structures which will confer upon farm families with small holdings the advantages of scale at both the production and post-harvest phases of agriculture are urgently needed. For example, thanks to the cooperative method of organisation of milk processing and marketing, India now occupies the first position in the world in milk production. Strategic partnerships with the private sector will help farmers' organisations to have access to assured and remunerative marketing opportunities.

In relation to factors of production, water is likely to become the key constraint during this century. Hence every effort should be made to enhance productivity and income per every drop of water.

Enlarging the food basket: During the last century, there has been a rapid decline in the number of crops contributing to global food security. In the past, local communities depended upon a wide range of crops for their food and health security. It is important that we revive the old dietary traditions. Particular attention needs to be paid to leafy vegetables which are rich in micronutrients.

b. Food Access

Inadequate livelihood opportunities in rural areas results in household nutrition insecurity. India today has over 30 million tonnes of wheat and rice in government godowns; yet poverty induced hunger affects over 200 million persons. Macro-economic policies, at the national and global level, should be conducive to fostering job-led economic growth based on micro-enterprises supported by micro-credit. Where poverty is pervasive, suitable measures to provide the needed entitlement to food should be introduced.

c. *Food Absorption:*

Lack of access to clean drinking water, as well as poor environmental hygiene and health infrastructure, lead to a poor assimilation of the food consumed. Nutrition security cannot be achieved without environmental hygiene, primary health care and clean drinking water security. Culinary habits also need careful evaluation. Some methods of cooking may lead to the loss of vital nutrients.

d. *Transient hunger*

Ferro-Luzzi *et al* (1994) have carried out a detailed study of seasonal cycling in body weights related to changes in weather. Any strategy for nutrition security should provide for steps to meet such transient hunger. The Indian State of Maharashtra introduced nearly 25 years ago an Employment Guarantee Scheme to assist the poor to earn their daily bread during seasons when opportunities for wage employment are low. Similarly there is need for mainstreaming considerations of gender, age and occupation in the national nutrition strategy.

2. Fortification and synergy among dietary components

Our understanding of low cost and high synergy nutritional systems is growing. Fortification of flour with folic acid and genetic enrichment of staple grains with beta-carotene and iron are now receiving attention.

Knowledge relating to the metabolic interrelationships among micronutrients is also growing, as for example among Vitamin A-protein-zinc-iron-folic acid-Vitamin C. However, in the absence of dietary interventions, iron-folate supplementation often fails

to bring about a complete correction of anaemia. **Hence, the attack on under-nutrition induced hunger and micro-nutrients deficiency caused hidden hunger should be an integrated one.** Such an integrated strategy should accord concurrent attention to food availability, access and absorption. In addition, there should be provision in the strategy for overcoming seasonal or transient under-nutrition caused by loss of opportunities for livelihood during seasons of drought, floods or other natural calamities.

### 3. Genetic enrichment of Nutritional quality

While the problems relating to the food and environmental safety aspects of genetically modified foods are yet to be fully resolved, there is little doubt that an integrated approach to mendelian and molecular breeding is likely to make a food-based approach to nutrition even more effective in the future. The quantity and quality of proteins, carbohydrate, fats, vitamins and minerals can all be improved now. The scope for the genetic enhancement of nutritional quality will be evident from the following examples;

#### a. *Quality Protein Maize (QPM)*

Scientists have long had an interest in improving maize protein quality. Quality Protein Maize (QPM) refers to enhanced levels of the two 'essential' amino acids, lysine and tryptophan, in the endosperm protein. Using Mendelian breeding methodologies supported by rapid chemical analysis of a large number of samples, scientists led by S Vasal and Evangelina Villegas at the International Maize and Wheat Research Centre(CIMMYT) in Mexico were able to slowly accumulate modifier genes to convert the original soft opaque-2-endosperm into vitreous hard endosperm type (Vasal *et al*, 1984). This conversion took nearly 3 decades. These remarkable new varieties look and taste like normal maize but the nutritive value of their protein is nearly equivalent to cow's milk. They also produce yields as much as 10% higher than the best local hybrid maize varieties and are more tolerant to biotic and abiotic stresses. QPM, which is a product of Mendelian breeding promises improved nutritional value and cost savings for a wide array of products ranging from infant food to corn chips and feed for non-ruminant livestock. The impact of this breakthrough is likely to be felt throughout the food industry and has great promise in the developing world both for human and animal nutrition.

b. *Beta-carotene rich Rice*

A promising development in the field of genetic engineering is the success in breeding a nutritionally enriched rice variety now popularly referred to as 'golden rice'. This genetically modified rice contains genes that produce high levels of beta-carotene and related compounds, which are converted in the human body into the crucially needed vitamin A. Vitamin A deficiency (VAD) causes more than a million childhood deaths each year and is the single most important cause of blindness among children in developing countries. Rice plants do produce carotenoid compounds (that our body converts into Vit-A) but only in the green parts of the plant and not in the part of the grain normally eaten. Dr Ingo Potrykus and Dr Peter Beyer of Germany of the Swiss Federal Institute of Technology inserted genes from a daffodil (*Narcissus pseudonarcissus*) and a bacterium (*Erwinia uredovora*) into rice plants to produce the modified grain, which has sufficient  $\beta$ -carotene to meet total Vit-A requirements in a typical Asian diet (Ye *et al*, 2000). If golden rice, currently still in the laboratory stage becomes a success in the field, it will help to strengthen the food based approach to nutrition security.

c. *Iron enrichment*

Iron-deficiency anaemia is the most widespread nutrient deficiency in the world, affecting an estimated 2 billion people worldwide. Between 40 and 50 % of children under the age of 5 in the developing countries are iron deficient and iron deficiency accounts upto 20% of all maternal deaths. It also impairs immunity and reduces the physical and mental capacities of people of all ages. In short, iron deficiency is a major public health problem world wide with enormous social and economic costs. Rice fortified with iron was created through the introduction of proteins from the kidney beans *Phaseolus vulgaris* by the same researchers of Swiss Federal Institute of Technology (Lucca *et al*, 2000). It is reported that the iron content increased two fold in the modified crop, currently under testing stage. Japanese scientists have also succeeded in enriching the rice grain with iron. The International Rice Research Institute (IRRI) has developed rice breeding lines high in iron and zinc using traditional plant breeding techniques. This rice is currently being tested by Novititates at a convent in the Philippines to see how well the nutrients are absorbed in the human body.

d. *Designer potato*

Advances in plant tissue culture techniques and gene transfer technology have opened up possibilities for modifying the amino acid contents of plants. Potato, which is the most important non-cereal food crop, ranks 4<sup>th</sup> in terms of total global food production, besides being used as animal feed and as raw material for the manufacture of starch, alcohol and other food products. This crop was genetically modified using a seed albumin gene *AmAl* from *Amaranthus hypochondriacus* by researchers of Jawaharlal Nehru University (JNU), New Delhi, India (Chakraborty *et al*, 2000). The *AmAl* protein is non-allergenic in nature and is rich in all essential amino acids. Its composition corresponds well with the WHO standards for optimal human nutrition (Raina and Datta, 1992). The JNU team was able to use a seed albumin gene with a well-balanced amino acid composition as a donor protein to developing transgenic potato. Total soluble protein content of 9 transgenic lines belonging to 6 cultivars, i.e. Kufri Chipsona-1, Kufri Chipsona-2, Kufri Sutlej, Kufri Jyoti, Kufri Bahar and Kufri Pukharaj was significantly **higher (20-49%)** than their respective controls. Amino acid composition of transgenic tuber protein of these lines has also been analysed and **one line each of three cultivars, i.e. Kufri Chipsona-1, Kufri Jyoti and Kufri Sutlej** has been selected on the basis of improvement in yield, protein content and protein quality. Selection of the best lines for the other cultivars is underway. The genetic enrichment of protein quantity and quality in potato can make a significant contribution to child and adult nutrition, since mashed potato can be fed to young children.

The above are a few examples of the work in progress in improving through conventional and molecular breeding techniques protein quantity and quality in important food crops. Consumer confidence based on an appreciation of the scientific evidence and the regulatory checks and balances will ultimately decide whether or not genetically modified foods (GMOs) will make a significant contribution to feeding the 8 billion people who are likely to inhabit our planet by 2020. Marker-aided selection and transgenic approaches are two powerful tools to accelerate plant breeding to produce crop varieties with improved nutritional traits and qualities. An intelligent integration of Mendelian and Molecular breeding techniques will help to enhance the nutritive value of staples. By integrating pre-breeding in laboratories with participatory breeding in

farmer's fields, it will be possible to breed location specific varieties and maintain genetic diversity in crop fields.

## VIII. Building a Sustainable Community Nutrition Security System

Conferring the right to food and thereby an opportunity for a productive and healthy life on those who go to bed undernourished now, is the fundamental duty of the State as well as of the well to do sections of the population. Thanks to both the spread of democratic systems of governance at the grassroot level and technological advances, we now have an uncommon opportunity to foster a Community Centred and Controlled Nutrition Security System. Such decentralised community management will help to improve delivery of entitlements, reduce transaction and transport costs, eliminate corruption and cater to the twin needs of introducing a life-cycle approach to nutrition security, and meeting the challenge of seasonal fluctuations in nutritional status. The basic guidelines for such a system are the following:

### 1. Adopt a whole life cycle approach to nutrition security:

#### a. *Pregnant Mothers*

Overcoming maternal and foetal under- and mal-nutrition is an urgent task, since nearly 30% of the children born in countries in South Asia are characterised by low birth weight (LBW), with the consequent risk of impaired brain development. Ramalingaswami et.al (1997) have pointed out that half of the world's malnourished children are in India, Pakistan and Bangladesh. LBW is a proxy indicator of the low status of women in the society, particularly of their health and nutrition status during their entire life cycle (Rama Narayanan, 2001).

#### b. *Nursing Mothers*

Appropriate schemes will be necessary to provide support to enable mothers to breast feed their babies for atleast 6 months, as recommended by WHO. Policies at work places, including the provision of appropriate support services should be conducive to achieving this goal.

#### c. *Infants (0-2 years)*

Special efforts will have to be made to reach this age group through their mothers, since they are the most unreached at present. Eighty percent of brain development is completed before the age of two. The first 4 months in a child's life is particularly critical, since the child is totally dependant on its mother for food and survival.

d. *Preschool Children (2-6 years)*

A well designed integrated child development service will help to cater to the nutritional and health care needs of this age group (Measham and Chatterjee, 1999).

e. *Youth (6 to 20 years)*

A nutrition based Noon Meal programme in all schools (public and private and rural and urban) will help to improve the nutritional status of this group. However, a significant percentage of children belonging to this age group are not able to go to school due to economic reasons. Such school 'push-outs' or child labourers need, special attention.

f. *Adults (20 to 60 years)*

The **Nutrition Safety Net** to cater to this category should consist of both an Entitlements programme like Food Stamps and Public Distribution System (PDS), as well as a Food for Eco-development programme (also called "Food for Work" programme). The Food for Eco-Development programme can promote the use of food grains as wages for the purpose of establishing water harvesting structures (Water Banks) and for the rehabilitation of degraded lands and ecosystems. Thus, many downstream benefits and livelihood opportunities will be created. In designing a Nutrition compact for this age group, persons working in the organised and unorganised sectors will have to be dealt with separately. Also, the intervention programmes will have to be different for men and women taking into account the multiple burden on a woman's daily life.

g. *Old and infirm persons*

This group will have to be provided with appropriate nutritional support, as part of the ethical obligations of society towards the handicapped.

The above whole-life cycle approach to Nutrition Security will help to ensure that the nutritional needs of everyone in the community and of every stage in an individual's life, are satisfied.

2. Adopt a Holistic Action Plan to achieve sustainable nutrition security at the level of each individual:

The major components of such an integrated action plan are the following:

- *Identification:* Identify those who are nutritionally insecure through the local community. Trained Community Volunteers of the kind mobilised in Thailand will be useful for this purpose.
- *Education and Information Empowerment:* Empower those who are not aware of their entitlements about the nutritional safety nets available to them and also undertake nutrition education. An entitlements database can be developed for

each area and household entitlement cards can be issued, indicating how to access nutritional, health care and educational programmes. The educational programmes should also lay stress on culinary habits in relation to the conservation of essential nutrients in cooked food.

- *Overcome protein-calorie under nutrition:* The various steps indicated under the whole life cycle approach will have to be adopted. The problems of child labour and of persons working in the unorganised sector will need specific attention.
- *Eliminate hidden hunger caused by the deficiency of micronutrients in the diet:* Introduce an integrated approach including the consumption of vegetables and fruits, millets, grain legumes and leafy vegetables and the provision of fortified foods like iron and iodine fortified salt and oral dose of Vitamin A. The basic approach should be a food based one, with emphasis on home and community nutrition gardens, wherever this is socially and economically feasible (Gopalan, 2001).
- *Drinking water, Hygiene and Primary Health Care:* Attend to the provision of safe drinking water and to the improvement of environmental hygiene. Also, improve the primary health care system.
- *Sustainable Livelihoods:* Improve economic access to food through market-linked micro-enterprises supported by micro-credit. Also, create an economic stake in the conservation of natural and common property resources. Ensure that agreements under the World Trade Organisation (WTO) provide a level playing field for products coming from decentralised small scale production (production by masses or farmers' farming) as compared to those emerging from mass production technologies or factory farming. Promote job-led economic growth and not jobless growth.
- *Pay special attention to pregnant and nursing mothers and pre-school children:* Measure progress through monitoring MMR, IMR, incidence of LBW children and male-female sex ratio. Iron-folate supplements during prenatal care should be accompanied by steps to overcome protein-energy deprivation. Mina Swaminathan (1998) has proposed a maternity and child care code, which if adopted, will help to bring down speedily MMR, IMR, LBW and stunting. Sex ratio is a good index of the mind-set of a society in relation to the girl child.

### 3. Community Food Bank as an instrument of Sustainable Food and Nutrition Security

Community Food Banks (CFB) can be started at the village level, with initial food supplies coming as a grant from Governments and donor agencies like the World Food Programme. Later, such CFBs can be sustained through local purchases and from continued Government and international support for Food for Eco-development and Food for Nutrition programmes. The CFB can be the entry point to not only bridging the

nutritional divide, but also for fostering social and gender equity, ecology and employment. They can also be equipped to cater to emergencies like cyclones, floods, drought and earthquakes.

The CFBs can be organised with the following 4 major streams of responsibilities.

- *Entitlements:* The benefits of all government and bilateral and multilateral projects intended for overcoming under- and mal-nutrition can be delivered in a coordinated and interactive manner (as for example those intended for overcoming the deficiencies of macro- and micro-nutrients.)
- *Ecology:* Food for Eco-development with particular reference to the establishment of Water Banks, land care, control of desertification and afforestation. Thus, grains can be used to strengthen local level water security.
- *Ethics:* This group of activities will relate to nutritional support to old and infirm persons, pregnant and nursing mothers and infants and pre-school children.
- *Emergencies:* This activity will relate to the immediate relief operations following major natural catastrophies like drought, floods, cyclone and earthquake, as well as to meet the challenge of seasonal slides in livelihood opportunities.

Each of the above four streams of activities can be managed by 4 separate self-help groups of local women and men. This will help to generate a self-help revolution in combating hunger. The overall guidance and oversight may be provided by a multistakeholder Community Food Bank Council.

The World Food Program has pioneered many meaningful programs relating to the use of food for eco-development. The United States operates the following programs

- Food for Peace (PL-480) – started in 1949
- Food for Progress – started in 1985
- Food for Education – started in 2000

Other than the United States, India is in a position to launch such programs. India has reached a stage in its agricultural evolution when farm production will increase only if consumption is improved.

## IX. Green Revolution and Ecotechnology in the Third Millennium:

On the eve of the UN Conference on Environment and Development held at Rio de Janeiro in June 1992, the Union of Concerned Scientists published an open letter titled, World

Scientists' Warning to Humanity, which stated that "human beings and the natural world are on a collision course". The letter stated further, "if not checked, many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know". This warning was signed by over 1600 scientists from leading scientific academies in 70 countries. The list included 104 Nobel Laureates.

Colborn, Dumanaski and Myers (1996) in their book "Our Stolen Future" and James Morgan (1999) in his book "The Last Generation" also provide a picture of the grim future that awaits the generations yet to be born, if we lose further time in restoring harmony between humankind and nature.

It is now widely realised that the genes, species, ecosystems and traditional knowledge and wisdom that are being lost at an increasingly accelerated pace limit our options for adapting to local and global change, including potential changes in climate and sea level. The Hadley Centre of the UK Meteorological office has recently predicted that even if Governments cut green house gas emissions, sea levels may rise by at least 2 meters over the next few hundred years. If the global community can limit emissions upto 550 ppm, which is twice the preindustrial levels and 50% above today's, about 2 billion persons can be saved from water shortages, low crop yields and increased coastal flooding, especially in India and Africa (New Scientist, 30 October 1999)

The Global Biodiversity Assessment published in 1995 by the United Nations Environment Programme (Cambridge University Press) estimates that about 13 to 14 million species may exist on our planet. Of this, less than 2 million species have so far been scientifically described. Invertebrates and microorganisms are yet to be studied in detail. In particular, our knowledge of soil microorganisms is still poor. Also, biosystematics as a scientific discipline is tending to attract very few scholars among the younger generation.

Another important paradigm shift witnessed in recent decades in the area of management of natural resources is a change in the concept of "common heritage". In the past, the atmosphere, oceans and biodiversity used to be referred to as the common heritage of humankind. However, recent global conventions have led to an alteration in this concept in legal terms. Biodiversity is now the sovereign property of the nation in whose political

frontiers it occurs. Further, the Trade Related Intellectual Property Rights (TRIPS) provisions of the World Trade Agreement have made it mandatory to cover products of genetic improvement with either patents and *sui generis* methods of intellectual property rights protection. Under the UN Convention on the Law of the Sea, nations with coastal areas have access to a 200 mile Exclusive Economic Zone (EEZ). The Climate Convention and the Kyoto protocol provide for both common and differentiated responsibilities to countries. Thus, the global commons can be managed in a sustainable and equitable manner only through committed individual and collective action among nations. In the Asia-Pacific Region, Australia can play a catalytic role in fostering cooperation in both avoiding and mitigating the adverse impact of climate change.

A Chinese proverb warns, "if you do not change direction, you will end up where you are headed". Since we do not want to reach where we are presently headed, what change of course should we bring about in the field of agriculture?

## X. Ecstasy and Agony

At the beginning of a new century, we can look back with pride and satisfaction on the revolution which the farm men and women of the Asia / Pacific region have brought about in contemporary agricultural history through the integration of traditional wisdom with modern science. While we can and should rejoice about the past achievements of our farmers, scientists, extension workers and policy makers, there is no room for complacency. We will face several new problems, such as the following:

- First, increasing population leads to increased demand for food and reduced per capita availability of arable land and irrigation water.
- Second, improved purchasing power and increased urbanisation lead to higher per capita food grain requirements due to an increased consumption of animal products.
- Third, marine fish production is tending to become stagnant and coastal aquaculture is facing environmental problems.
- Four, there is increasing damage to the ecological foundations of agriculture, such as land, water, forests, biodiversity and the atmosphere and there are distinct possibilities for adverse changes in climate and sea level. Water famines are likely to be more serious in several parts of the world than food famines.

- Finally while dramatic new technological developments are taking place, particularly in the field of biotechnology, their environmental, health and social implications are yet to be fully understood.

Since land and water are shrinking resources for agriculture, there is no option except to produce more food and other agricultural commodities from less per capita arable land and irrigation water. In other words, the need for more food has to be met through higher yields per units of land, water, energy and time. It would therefore be useful to examine how science can be mobilised for raising further the ceiling to biological productivity without associated ecological harm. It will be appropriate to refer to the emerging scientific progress on the farms as an *'ever-green revolution'*, to emphasise that the productivity advance is sustainable overtime since it is rooted in the principles of ecology, economics, social and gender equity and employment generation.

The green revolution has so far helped to keep the rate of growth in food production above population growth rate. The green revolution, was however, the result of public good research, supported by public funds. The technologies of the emerging gene revolution in contrast, are spearheaded by proprietary science and can come under monopolistic control. How then can we harness the power of frontier science to promote an ever-green revolution in our farms?

The 20<sup>th</sup> century began with the rediscovery of Mendel's laws of inheritance. It ends with moving specific genes across sexual barriers with the help of molecular mapping and recombinant DNA technology. The impact of science and technology in every field of crop and animal husbandry, inland and marine fisheries and forestry has been profound. Let me illustrate this, taking the improvement of wheat production in India as an example.

Wheat cultivation started in the Indian subcontinent over 4000 years ago. Wheat kernels have been found in the Mohenjodaro excavations dated 2000 BC. From that period up to August 1947, when the colonial rule ended, Indian farm men and women developed the capacity to produce 7 million tonnes of wheat per year. Between 1964 and 1968, when semi-dwarf strains containing the Norin 10 genes for dwarfing were introduced in irrigated areas, wheat production rose from 10 to 17 million tonnes per year. In other words 4000 years of progress was repeated in 4 years (Swaminathan, 1993). During

2002-03, wheat production in India reached 80 million tonnes, i.e. a ten-fold increase in about 50 years.

Similar progress has been made in improving the production and productivity of rice, maize, soybean, potato and several other crops as well as in farm animals in many developing countries around the world. **New technologies supported by appropriate services and public policies as well as international scientific cooperation have helped to prove doomsday predictions wrong and have led to the agricultural revolution (the green revolution) becoming one of the most significant of the scientific and socially meaningful revolutions of the 20th century.** A world without hunger is now within our reach. A hunger free world will be possible if every nation pays concurrent attention to improving food **availability** through ecologically sustainable methods of production, to enhancing economic **access** to food by promoting a job-led economic growth strategy, and to ensuring the biological **absorption** of food in the body through the availability of safe drinking water and environmental hygiene. Steps should also be taken to enlarge the base of the food security basket by revitalising the earlier tradition of cultivating a wide range of food crops (See MSSRF, 1999).

Emerging farming technologies will be based on precision farming methods leading to plant scale rather than field scale husbandry. Farming will be knowledge intensive, using information from remote sensing, Geographical Information System (GIS), Global Positioning Systems (GPS), and information and computer technologies. Farmers in industrialised countries are already using satellite imagery and GPS for early detection of diseases and pests, and to target the application of pesticides, fertilizer and water to those parts of their fields that need them urgently. Among other recent tools, the GIS methodology is an effective one for solving complex planning, management and priority setting problems. Similarly, remote sensing technology can be mobilised in programmes designed to ensure drinking water security.

Biotechnology will play an increasingly important role in strengthening food, water and health security systems. Recent widespread public concern relating to genetically modified (GM) food stresses the need for more effective and transparent mechanisms for assessing the benefits and risks associated with transgenic plants and animals. The Cartagena Protocol on Biosafety addresses these concerns. All food safety and

environmental concerns should be addressed with the seriousness they deserve. Broad based **National Commissions on Genetic Modification for Sustainable Food and Health Security** could be set up, consisting of independent professionals, environmentalists, representatives of civil society, farmers' and womens' organizations, mass media and the concerned Government regulatory authorities. This will help to assure both farmers and consumers that the precautionary principle has been applied, while approving the release of GM crops. The recent public opinion survey conducted in the UK has revealed the need for assuring the public that regulatory mechanisms are in place to ensure that only safe and responsible use of genetic modification techniques is promoted (See Nature, 25 September 2003).

**Biodiversity-rich but biotechnology-poor** countries are adversely affected by the prevailing non-adherence to the ethical and equity principles in benefit sharing contained in Articles 8 and 15 of CBD. The primary conservers, largely tribal and rural women and men, live in poverty, while those who use their knowledge and material for producing commercial products become prosperous (Swaminathan, 1999). The invaluable contributions of tribal and rural families to genetic resources conservation and enhancement have been recognised in the Convention on Biological Diversity. Yet the political will to implement the equitable benefit sharing provisions of CBD is lacking. We need urgent steps to recognise and reward the contributions of indigenous communities to providing material of great importance to global food and health security. The following three validated findings will be adequate to stress the significance of traditional knowledge and conservation efforts to help mitigate handicaps caused by ageing in human beings.

Country	Plant	Property
India	<i>Trichopus Zeylanicus</i>	Helps to remove fatigue
India	<i>Bacopa monnieri</i>	Helps to improve memory
Tropical Africa	<i>Prunus africana</i>	Treatment for benign Prostatic hyperplasia.

Article 27(b) of the TRIPS component (Trade related intellectual property rights) of the World Trade Agreement is now under review. **All nations should agree to incorporate in this clause the ethics and equity principles enshrined in articles 8(j) and 15 of CBD.** The World Intellectual Property Rights Organization (WIPO) has also stressed the

need to recognise the intellectual property rights of the holders of traditional knowledge.

## XI. Humanistic Science and Scientific Humanism:

The blend of science and humanism should start with children. The problems of children faced by children of families living in poverty like underweight, lack of opportunities for education and child labour are well known. In addition sex discrimination resulting in female foeticide is growing. The Charter for the Child adopted in 1990 at the UN Children's Summit contains a detailed plan of action to foster a "Children for Happiness" movement.

The MSSRF – TATA National Virtual Academy for Food Security and Rural Prosperity (NVA) has as its ultimate goal the promotion of human security and happiness in all its dimensions. The starting point, obviously is the child. It can be said that care of the child is a down to earth index of a civilization. The NVA based on the integrated use of the internet, cable TV, radio and the vernacular press, will try to mobilise the power of modern information and communication technologies (ICT) for spreading the concept of "Child-Friendly Villages". Mr Kofi Annan, Secretary General of the United Nations articulated the need for focussing our attention on children in the following words.

"To look into some aspects of the future, we do not need projections by supercomputers. Much of the next millennium can be seen in how we care for our children today. Tomorrow's world may be influenced by science and technology, but more than anything, it is already taking shape in the bodies and minds of our children"

MSSRF has promoted several projects during the last fourteen years for early childhood care and education. It has also set up a School for Mangrove Dependent Communities in Pichavaram, so that today's school "push-outs" become tomorrow's scholastic leaders. M S Swaminathan explained the rationale of this approach by pointing out, "Saving mangrove forests without saving the children for whose well-being these forests are being saved makes no sense"(Mangrove Decade and Beyond).

MSSRF has also a programme titled, “Every Child a Scientist” for economically under privileged children as well as visually impaired children at Chennai and at Kalpetta in Wayanad, Kerala. The present Child Friendly Village Programme organised in collaboration with UNICEF is an extension of these activities.

A. The Programme:

The Programme will consist of information and knowledge empowerment linked to institutions which can help village communities to apply the knowledge. The following areas will receive attention in the early stages.

1. Measure the weight of children at birth and in case of children weighing less than 2.2 kg (i.e. Low Birth Weight children), take special steps for improving maternal and infant nutrition. Also sensitise the community about the implications of maternal and foetal under nutrition resulting in LBW children, from the point of view of brain development in the child.
2. Record male / female sex ratio at the time of birth and again at the age of 5 in the village
3. Ensure that no child is under weight
  - Use the mechanism of the public notice board to list the total number of children in the village and the numbers malnourished
4. Ensure that all children have birth certificates
  - Ensure that all new-born babies get a birth certificate
  - Over time, ensure that all children below 18 years have a birth certificate
5. Enable children to celebrate their first birthday
  - Keep track of how many children are born every year. A good way is to post the information month-wise on a public notice board.
  - Keep track of how many of these children live to be one year old - again, use the public notice board to record infant deaths every month.
6. Help all schools to offer hot cooked meals
  - Ensure that all children get a hot-cooked meal in school - again on the school notice board, record the days when food is served - and how many eat
7. Achieve 100 per cent immunisation of children
  - Ensure that all new born have an immunization card
  - Ensure that the card is filled up regularly

- Over time, ensure that all children below 18 years have had the necessary immunization shots
8. Help all children (and particularly girls) to attend school
    - Ensure that all children 6-14 years are enrolled in school - both boys and girls
    - Ensure that all children attend school daily. Have a notice board outside the school that shows total enrolment and attendance for the day - show details for boys and girls separately
    - Ensure that all children complete at least five years of primary schooling - Have a public notice board that lists the number and (if not too many) names of children completing 5 years of schooling
  9. Ensure that no child below the age of five years dies due to preventable diseases
  10. Help all children to have access to pre-school facilities
    - Ensure that all children have access to a well-functioning **anganwadi** centre (community centre)
  11. Mobilise the community to ensure that no girl child gets married before the age of 18 years
    - Register all marriages
    - Post list of girls getting married and proportion above 18 years
    - Ensure that all young girls receive appropriate life-skills education
  12. Foster pride among villages in achieving the status of “Child friendly village”

The new information and communication technologies can play a vital role in fostering the “Children for Happiness” movement.

#### B. Patents and UN Millennium Development Goals

From the beginning of time, science and technology have been key elements in the growth and development of societies. Entire eras have been named for the levels of their technological sophistication. Some examples are: the stone age, the bronze age, the iron age, the age of sail, the age of steam, the jet age, the computer age and the age of genomics and proteomics. We are now on the threshold of the nano-age. Unfortunately, the scientific revolution is taking place at a faster pace than our social evolution. As a result, we hear of growing divides like demographic, digital, gender, genetic, technological and economic divides. The rich-poor divide is widening and jobless

economic growth, which is best described as joyless growth, is spreading. Although skin colour based apartheid has ended, technological and economic apartheid are growing.

Since its inception, the United Nations University has remained a centre for both humanistic science and scientific humanism. It has therefore a moral responsibility for showing how we can bridge the various divides and foster unity wherever discord prevails. The University should instil pride in performance and excellence. UNU/INTECH should promote a global ecotechnology movement based on a blend of frontier science and traditional ecological prudence.

The world is facing today a trilemma, or a triple dilemma. Over 3 billion women and men, struggling to survive with an income of less than US \$ 2 per capita per day, are crying for peace and **equitable** economic development. Countries in Southern Africa, Ethiopia, Afghanistan and North Korea are in the midst of serious famines. In our country, the severe debt burden of small farmers in some areas takes the form of suicides. The Roman Philosopher Seneca said 2,000 years ago, "A hungry person listens neither to reason nor religion, nor is bent by any prayer".

Thus, one aspect of the trilemma is the craving for peace, and development which is equitable in social and gender terms. On another side, there is a **growing violence in the human heart**. Terms like ethnic cleansing and biological and biochemical terrorism are being widely used in the media. The revival of small pox is becoming a possibility. The nuclear peril has again raised its head. There are over 30000 nuclear weapons in the arsenals of major and minor nuclear powers. The availability of large quantities of highly enriched uranium increases opportunities for nuclear adventurism.

The third side of the trilemma is the spectacular progress of science and technology, resulting in increasing **technological divide** between industrialised and developing countries. Helping to bridge this divide can be an important contribution of UNU/INTECH.

In the report of the International Commission on Peace and Food, which I chaired, released in 1994, we had anticipated a substantial peace dividend, following the end of the cold war and collapse of the Berlin wall. Such a Peace Dividend has not only not

materialised, but also expenditure on military hardware and internal security is increasing day by day, particularly after the tragic events of September 11, 2001 in the United States of America and similar events elsewhere.

Contemporary developmental challenges, particularly those relating to poverty, gender injustice and environmental degradation are indeed formidable. However, the remarkable advances now taking place in information and communication technology, space and nuclear technologies, biotechnology, agricultural and medical sciences, and renewable energy and clean energy technologies provide hope for a better common present and future. Genomics, proteomics, internet, space and solar technologies and nanotechnology are opening up uncommon opportunities for converting the goals of **food, health, literacy and work for all** into reality. It is however clear that such uncommon opportunities can be realised only if the **technology push** is matched by an **ethical pull**. This is essential for working towards a world where both unsustainable life styles and unacceptable poverty become features of the past.

Also, there is a growing mismatch between the rate of progress in science, particularly in the area of molecular biology and genetic engineering and the public understanding of their short and long-term implications. There is an urgent need for institutional structures which can inspire public confidence that the risks and benefits are being measured in an objective and transparent manner. Scientists and Technologists have a particularly vital role to play in launching an **Ethical Revolution**. The Pugwash movement, which I now have the privilege to head, is an expression of the social and moral duty of scientists to promote the beneficial applications of their work and prevent their misuse, to anticipate and evaluate the possible unintended consequences of scientific and technological development, and to promote debate and reflection of the **ethical obligations of scientists in taking responsibility for their work**. Rabelais once said, “science is but the conscience of the soul”. It is the enduring task of our Universities, which are the breeding grounds of leaders who will shape our future, to ensure that science and technology are employed for the benefit of humankind and not its destruction.

We now have a **Global Convention on Biological Diversity** to help in the conservation and sustainable and equitable use of biodiversity. We need urgently a similar **Convention on Human Diversity**. While a Convention alone will not be able to halt the growing

intolerance of diversity, particularly with reference to religion and political belief, it will help to foster a mind set which regards diversity as a blessing and not a curse. Both biodiversity and human diversity are essential for a sustainable future. The human genome map shows that over 99.9% of the genomic constitution is the same in all members of the human family. UNU/INTECH should help to spread genetic literacy.

It is also necessary to reflect on methods of giving meaning and content to the ethical obligations of scientists in relation to society. The World Conference on Science held at Budapest in 1999 called for a new social contract between scientists and society. With a rapidly expanding Intellectual Property Rights (IPR) atmosphere in scientific laboratories, the products of scientific inventions may become increasingly exclusive in relation to their availability, with access being limited only to those who can afford to pay. The rich-poor divide will then increase, since orphans will remain orphans with reference to scientific attention and investment. How can we develop a knowledge management system which will ensure that inventions and innovations of importance to human health, food, livelihood and ecological security benefit every child, woman and man, and not just the rich? UNU and UNU/INTECH could help by establishing a **Patents Bank for UN Millennium Development Goals**. Scientists and technologists from all Universities and public research institutions should be encouraged to assign their patents to such a Bank, so that the fruits of scientific discoveries are available for public good. Such a **Patents Bank for UN Millennium Development Goals** would stimulate scientists to consider themselves as trustees of their intellectual property, sharing their inventions with the poor in whose lives they may make a significant difference for the better. The French Mathematician, Marquis de Condorcet, who was a contemporary of Thomas Malthus, said over 2 centuries ago that the human population will stabilise itself **if children are born for happiness and not just existence**. The Government of Bhutan has taken the lead in developing a **Gross National Happiness Index**, based on the economics of human dignity, love of art and culture and commitment to spiritual values. Making all well to do members of the human family regard themselves as trustees of their financial and intellectual property will be essential for fostering a human happiness movement. The 21<sup>st</sup> century holds great promise for advancing the human condition provided there is an appropriate blend of technology and public action.

XIII. I would like to end with an appeal issued by Bertrand Russel and Albert Einstein in 1955

“We appeal, as human beings, to human beings. **Remember your humanity and forget the rest.** If you can do so, the way is open to a new paradise; if you cannot, there has before you the risk of universal death”

The year 2005 marks the 60<sup>th</sup> anniversary of the use of atom bombs on Hiroshima and Nagasaki and the 50<sup>th</sup> anniversary of the Russell-Einstein manifesto. Can we use this opportunity to rid humankind from the nuclear peril and concentrate on harnessing science and technology for achieving the goals of food, water, health and work for all and for ever?

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## UN Millennium Development Goals

### 1. Eradicate Extreme Poverty and Hunger:

*Target for 2015: Halve the proportion of people living on less than a dollar a day and those who suffer from hunger*

More than a billion people still live on less than US \$ 1 a day : sub-Saharan Africa, Latin America and the Caribbean, and parts of Europe and Central Asia are falling short of the poverty target.

### 2. Achieve Universal Primary Education

*Target for 2015 : Ensure that all boys and girls complete primary school*

As many as 113 million children do not attend school, but the target is within reach. India, for example, should have 95 percent of its children in school by 2005.

### 3. Promote Gender Equality and Empower Women:

*Targets for 2005 and 2015 : Eliminate gender disparities in primary and secondary education preferably by 2005, and at all levels by 2015.*

Two-thirds of illiterates are women, and the rate of employment among women is two-thirds that of men. The proportion of seats in parliaments held by women is increasing, reaching about one third in Argentina, Mozambique and South Africa.

### 4. Reduce Child Mortality:

*Target for 2015 : Reduce by two thirds the mortality rate among children under five*

Every year nearly 11 million young children die before their fifty birthday, mainly from preventable illnesses, but that number is down from 15 million in 1980.

### 5. Improve Maternal Health:

*Target for 2015 : Reduce by three-quarters the ratio of women dying in childbirth*

In the developing world, the risk of dying in childbirth is one in 48, but virtually all countries now have safe motherhood programmes.

6. Combat HIV/AIDS, Malaria and Other Diseases:

*Target for 2015 : Halt and begin to reverse the spread of HIV/AIDS and the incidence of malaria and other major diseases*

Forty million people are living with HIV, including five million newly infected in 2001. Countries like Brazil, Senegal, Thailand and Uganda have shown that the spread of HIV can be stemmed

7. Ensure Environmental Sustainability:

*Targets :*

*Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources.*

*By 2015, reduce by half the proportion of people without access to safe drinking water*

*By 2020 achieve significant improvement in the lives of at least 100 million slum dwellers*

More than one billion people lack access to safe drinking water and more than two billion lack sanitation. During the 1990s, however nearly one billion people gained access to safe water and the same number to sanitation.

8. Develop a Global Partnership for Development:

*Targets:*

*Develop further an open trading and financial system that includes a commitment to good governance, development and poverty reduction – nationally and internationally.*

*Address the least developed countries' special needs, and the special needs of landlocked and small island developing States*

*Deal comprehensively with developing countries' debt problems*

*Develop decent and productive work for youth*

*In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries*

*In cooperation with the private sector, make available the benefits of new technologies – especially information and communication technologies*

Many developing countries spend more on debt service than on social services. New aid commitments made in the first half of 2002 could mean an additional \$ 12 billion per year by 2006.