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Towards a Hunger-free World : The Final Milestone

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I. Introduction:

The award of the Nobel Peace Prize to Dr Norman Borlaug in 1970 highlighted the interrelationships between hunger and peace. We witness today a growing violence in the human heart due to a variety of reasons. An important reason however is the growing sense of alienation and deprivation prevailing among nearly 3 billion members of the human family, who, according to the World Bank, live on an income of 2 US \$ or less per day. It is becoming clear that where hunger, which is the extreme manifestation of poverty, persists, peace cannot prevail.

There are both hunger hot spots and bright spots in the world. The human right to food is now widely accepted and slowly the political and legal will to implement this right is growing. Brazil, for example, has developed a Zero Hunger Program containing the following components.

- Ensuring availability
- Improving accessibility
- Employment generation
- Minimum wage
- Agrarian reform
- Supporting small scale farmers
- Minimum income programs
- Nutrition programs
- Public health and food safety programs

- Assistance to vulnerable social groups, reducing discrimination
- Increasing total social spending

(FIAN, 2003)

Norman Borlaug's work during the last 60 years has shown that given appropriate synergies between science and public policy, progress in improving food production can be fast. He has underlined the need to address the problems of hungry and thirsty soils in order to get the best of genetic strains of major food crops which have the potential for high yields. Pedro Sanchez (2002) has demonstrated that in many parts of Africa characterised by chronic hunger, soil fertility replenishment through appropriate agro-forestry techniques holds the key to raising the ceiling to yield. After the soil's fertility is replenished, high yielding crop varieties, integrated pest management, conservation tillage, high-value trees, vegetable crops and dairy cattle can all be introduced in the farming system.

Today, feasible and affordable approaches are available to address the following three major kinds of hunger.

- *Endemic hunger* or chronic protein-energy undernutrition
- *Hidden hunger*, caused by deficiencies of micronutrients in the diet
- *Transient hunger*, caused by drought or other natural calamities as well as ethnic conflicts.

It is also realised that to overcome these forms of hunger, there is need for an integrated strategy which pays concurrent attention to the following:

- Food availability, which is function of home production or food imports or both.
- Food access, which is a function of purchasing power or sustainable livelihood opportunities
- Food absorption, which is a function of access to clean drinking water, environmental hygiene, primary health care and primary education.

In India, detailed Food Insecurity Atlases have been prepared for rural and urban areas by MSSRF and the World Food Programme (WFP), which serve as valuable tools for public policy and action.

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

There are specific targets for being achieved by 2015. I would like to indicate why we are now in the final milestone with reference to ensuring food for all and for ever.

II. 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 21st 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 of 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

III. 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.

IV. 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.

V. 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 kg/m², 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)

VI. 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 β -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 Novitiates 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 4th 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 *Ama1* from *Amaranthus hypochondriacus* by researchers of Jawaharlal Nehru University (JNU), New Delhi, India (Chakraborty *et al*, 2000). The *Ama1* 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. 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.

VII. 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 catastrophes 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.

VIII. 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?

IX. Ecstasy and Agony

As we say good bye to this 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. 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 20th 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. An internationally agreed Biosafety Protocol on the lines recommended in Article 19 of the Convention on Biological Diversity is an urgent necessity. Biotechnology companies should agree to the labelling of GM foods in the market. 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.

X. Towards Hunger-free India : Count Down from 2007

During the last three years, scientists of the M S Swaminathan Research Foundation at Chennai and of the UN World Food Programme, New Delhi, have been working together on the causes of food insecurity in rural and urban India using multiple indicators relating

to food availability, access and absorption in the body. The Food Insecurity Atlases of Rural and Urban India provide valuable guidelines for public action to end chronic under- and mal-nutrition in the different States of the country.

Releasing the Food Insecurity Atlas of Rural India on 24 April, 2001, the Prime Minister of India, Mr Atal Bihari Vajpayee, called for concerted action to achieve substantial freedom from hunger by August 15, 2007, which marks the 60th anniversary of India's independence, thereby helping to fulfil the hope of Mahatma Gandhi that no child, woman or man should go to bed hungry in Independent India. To quote Mr Vajpayee,

“The sacred mission of a ‘Hunger Free India’ needs the cooperative efforts of the Central and State Governments, local self-government bodies, non-governmental organisations, international agencies and above all, our citizens. We can indeed banish hunger from our country in a short time. Let us resolve today to make this mission substantially successful by 2007, which will mark the sixtieth anniversary of our independence”

1. The Challenge

The quantitative and qualitative dimensions of the challenge of achieving a hunger-free India are daunting. The incidence of poverty, endemic hunger, communicable diseases, infant and maternal mortality rates, low birth weight children and stunting and illiteracy is high. There are however many examples where progress in the elimination of poverty-induced hunger has been rapid because of a symphony approach in dealing with the multi-dimensional problem of hunger and malnutrition. Successful experiences in the elimination of hunger and poverty have shown that synergy between political will and action and strategic partnerships can help local communities to achieve seemingly impossible tasks. Such “**messages and methods of hope**” should therefore be documented and spread widely, since they not only inspire confidence that the goal of a hunger-free India can be achieved, but will also help to build the self-confidence of all engaged in the mission of overcoming under- and mal-nutrition.

2. Basic Approach: Food with Human Dignity

Food with Human Dignity should be the basic approach. The poor should not be subjected to a patronage approach and referred to as “beneficiaries” but should be treated as partners in achieving the aim of ensuring that every child, woman and man in the

country has an opportunity for a productive and healthy life. The right to adequate food and clean drinking water should be regarded as a basic human right.

3. Guiding Principles for Converting Goals into Accomplishments

Hunger is the extreme manifestation of poverty, since the poor spend a high proportion of their earning on food. The elimination of hunger is thus the first requisite for eradicating poverty. Without adequate nutrition, the energy needed for higher work output will not exist in malnourished individuals. The following steps will help to accelerate the pace of progress in eradicating poverty induced hunger.

a. *Decentralisation*

The desired goal can be achieved speedily and surely only if a decentralised approach to implementation is adopted. “Think, plan and act locally and support at the state and national levels” should be the motto. Elected local bodies, together with the concerned Departments of Government (Health, education, women and child welfare, rural and tribal development, etc) should prepare **Micro level Action Plans**. They should form a local level “**Alliance for a healthy and productive life for all**”. Elected members of local bodies, particularly the one million elected women members can be empowered to spearhead the freedom from hunger movement, since they are more aware of the problems of nutrition and drinking water. Decentralisation will enhance accountability, reduce transaction costs and remove corruption in delivery systems.

b. *Life-cycle Approach*

For ensuring nutrition security at the level of each individual, a life-cycle approach is necessary so that the nutrition needs of an individual can be met from birth to death. Special programmes for adolescent girls, pregnant women, nursing mothers, infants (0-2 years) and old and infirm persons should continue. What is needed is the horizontal integration of numerous vertically structured programmes. Such a functional integration will help to create a symphony at the level of each village / town / city to ensure that all links in the food availability – access – absorption chain function at a high level of efficiency and effectiveness. Management tools and not additional monetary support will be needed to bring about at the field level such convergence and synergy among ongoing programmes.

c. *Information, education and communication*

There is need for launching a Nutritional Literacy movement to spread awareness of the adverse consequences of malnutrition induced intellectual and physical dwarfism among children. The Nutritional Literacy movement should include issues relating to food safety, *codex alimentarius* standards, sanitary and phytosanitary measures, etc. Mass media, particularly those in the public sector like Doordarshan and All India Radio can play a very important role in making the Hunger-free India movement a success.

Community Radio stations, giving location-specific information, should be encouraged to assist other mass media in spreading messages of hope. It will be useful to set up **Media Resource Centres for Freedom from Hunger**. Such centres can provide credible and timely information to the print, audio, video and new (i.e. internet) media.

d. *Household Entitlement Card*

It will be useful to provide every family with an **Entitlement Card**, giving information on the various government projects which they can access. The information may be disaggregated by gender and age and precise addresses of contact persons and offices may be given. Such information will enable everyone to make the best use of their entitlements. A single step of this kind will help enormously to ensure the effective utilisation of all the schemes of central and state governments and bilateral and multilateral donors.

e. *Asset Building and Community Development:*

The poor are poor because they have no assets like land, livestock or fish pond. They often are illiterate and lack proper dwelling. They survive on wage employment, which particularly in the case of women, does not reach the level of even the prescribed minimum wage. A massive effort is needed to help them to shift from unskilled to skilled work through training in market-driven skills. The on-going micro-finance led self-help revolution will be the speediest way to help them to rise above the poverty level. This will call for establishing effective forward and backward linkages, particularly with technology sources and markets. Insurance and Venture Capital support should also be available to micro-enterprises. We have now an opportunity to leapfrog in achieving our goal of enabling every one to earn his / her daily bread.

f. *Capacity Building:*

Since a decentralised approach involving the empowerment of over three million women and men members of local bodies holds the key to the success of this national movement for food and clean drinking water for all, it is essential that a national consortium of Agricultural, Rural and Womens' Universities as well as government and non-governmental training and research institutions is formed for undertaking capacity building in areas such as management, communication and organisational skills with reference to the implementation of the hunger-free area programme. The capacity building programmes can be organised on a **Trainers' Training model**, in order to achieve a multiplier effect.

4. Initiation of a National Food for Social Capital Programme

The social capital of a country is the product of interaction between the human capital and the cultural, political, economic, nutritional and natural environments. Human and social capitals constitute the most precious wealth of a nation. A society committed to building its social capital will try to promote programmes which represent a "win-win" situation for all, thereby avoiding winners and losers and the consequent social conflict

and disruption. It is now clear that farmers will produce more if there are opportunities for assured and remunerative marketing. Therefore, the initiation of a National Food Guarantee Scheme will help to ensure that all who are hungry today due to lack of livelihood opportunities or other constraints are able to have food for a productive life. Such a National Food Guarantee Scheme can serve as an umbrella for all ongoing projects like those mentioned earlier. In addition, it can provide food grains for initiating a wide variety of social support initiatives like Food for Health (TB, HIV / AIDS, Malaria etc.), Food for those employed in ICDS, Nutritious Noon Meal and other similar projects. **In other words, food can become a powerful currency for achieving the goal of a hunger-free India.** Using food as a currency has twin advantages, namely, there could be greater off-take of food grains from farmers, thereby providing them with an incentive to produce more, and secondly for meeting the immediate needs of the poor, destitutes, migrant labour and all who are under nourished today.

5. Consultative Group for Freedom from Hunger

Both at the national and state levels multi-stakeholder Consultative Groups for “Agenda 2007 : Hunger-free India” could be organised comprising representatives of the concerned Government of India Ministries and Departments, Professional Experts, National Commission for Women, Civil Society Organisations, Business and Industry, Mass Media and bilateral and multilateral donors, with the Union Planning Commission serving as the nodal agency for such a Consultative Group. Such a CGFFH would help to foster strategic partnerships as well as synergy among political leaders, professionals and peoples’ organisations.

XI. No time to relax on the Food Production Front

While the alleviation of hunger by improving access to income and balanced diets and safe drinking water should receive high priority, there is no time to relax on the food production front. We need to bring about productivity, quality (including food safety), profitability and sustainability revolutions in farming based on a Farming Systems Approach. There is an urgent need for enhancement of investment in agriculture and rural infrastructure development. There is also need for conferring on small producers the power of scale through cooperatives, self-help groups and other socially viable

methods of group endeavour both at the production and post-harvest phases of farming. Our spectacular progress in the Dairy sector is largely through such management innovations. There is need for a movement for trade and quality literacy including an understanding of sanitary and phytosanitary measures and codex alimentarius standards. There is also need for launching a Water Literacy Movement. Above all, there is need for a paradigm shift from jobless to job-led growth in order to ensure that every poor person is enabled to **earn** his or her daily bread.

Unless the agricultural competitiveness of developing countries improves, earnings from the farm sector in international markets will not grow significantly. In a predominantly rural and agricultural country like India, agricultural progress (ie. Crop and animal husbandry, fisheries, forestry and agro-forestry and agro-processing) is the most effective social safety net against hunger and poverty. Hence, the ongoing fatigue of the green revolution in wheat, rice and other major crops should be converted into an ever-green revolution designed to promote productivity improvement in perpetuity without associated ecological harm. A focus on improving factor productivity in agriculture should be designed to cover all the major agro-ecosystems. Agricultural and rural development, if given adequate and appropriate attention, will help predominantly agricultural countries to take to the path of job-led economic growth.

XII. Shaping Africa's Agricultural Future

The African continent, being the center of origin of *Homo sapiens*, is rich in ecological, ethnic, agricultural, cultural and climatic diversity. Amidst this diversity, there is also unity in terms of uncommon opportunities for enhancing through mutually reinforcing packages of technologies, services and public policies, the productivity, profitability, sustainability and employment intensity of major farming systems. Available scientific data indicate that the untapped production reservoir even with the technologies now on the shelf, is high in most African countries and farming systems. Therefore, progress in achieving a productivity revolution need not wait until new technologies become available. Integrated steps in the areas of soil health and fertility enhancement, water conservation and management, the conservation and sustainable and equitable use of agro-biodiversity, and greater emphasis on post harvest technology and agro-processing

will help most African nations to leapfrog in agricultural progress and agrarian prosperity. Unity of goals but diversity of approaches based on local socio-cultural, socio-economic and agro-ecological conditions will be needed to achieve the desired goals.

Technology, training, techno-infrastructure and trade are some of the major components of agricultural renaissance. Opportunity for assured and remunerative marketing has now become the most important component of agricultural progress. Another urgent need is effort to attract and retain youth in farming. The technological and skill empowerment of women in agriculture is vital for agricultural progress. There is rich traditional wisdom in relation to crop and animal husbandry, fisheries and forestry in African nations. It is essential to conserve such dying wisdom and blend them with frontier science and technology.

Symbiotic partnerships are vital for speedy progress and for the efficient and economic use of available resources. The partnerships could take the following forms:

- Lab to Lab (consortium of appropriate scientific institutions)
- Lab to Land (scientist – farm family interaction)
- Land to Lab (deriving benefit from traditional knowledge and ecological prudence)
- Land to Land (lateral sharing of knowledge and experience among farming families)

Such linkages will help to accelerate progress in the development, testing and dissemination of appropriate technologies.

According to the International Food Policy Research Institute, a one percent growth in agricultural productivity in Africa reduces poverty by 0.6 percent. A 1 percent increase in yield can help 6 million more people to raise their income above US \$1 per day. Also, higher the percentage of people who depend upon agriculture alone for their livelihoods, the greater is the incidence of hunger and poverty. **Improvements in agricultural productivity and non-farm employment opportunities are therefore the most effective safety nets against hunger and poverty.**

Access to technology and markets will shape Africa's agricultural future. Enhancing technological capability and bridging the growing technological, gender and genetic divides are urgent tasks. Technology development and delivery have to receive equal

attention. Farmer Participatory Knowledge Systems will be needed for this purpose. Such FPKS systems can help to convert generic information (e.g., those relating to weather forecasts and market conditions) into location-specific action points.

Research, education and extension should have organic linkages. Advanced centers on the one hand, and **techniracy** (i.e., learning by doing) on the other, are needed. Personnel policies which can help to attract and retain **youth in farming** are important. Both on-farm and non-farm employment need attention.

Strengthening the ecological foundations essential for sustainable agriculture, i.e., improving productivity in perpetuity without associated ecological harm or an ever-green revolution is the need of the hour.

Ecosystems which need special attention:

- Land: Anti-desertification measures
- Seawater farming for coastal area prosperity
- Biodiversity: Agro-biodiversity sanctuaries
- Mountain ecosystems
- Crop-livestock integrated production systems

Technologies that can help to improve productivity, profitability, stability and sustainability of farming systems need to be developed locally. Marker assisted selection, genetic engineering, functional genomics, proteomics, information and communication technology, space technology and nanotechnology will also play an increasingly important role. Precision farming techniques will have to be adapted to local conditions. Animal husbandry, inland and marine fisheries offer scope for improvement. Seawater farming can help to enhance coastal area prosperity. **Social prestige and recognition are vital to build the morale of farm scientists and to foster scientific excellence and social relevance in their efforts.** African Nations could select an eminent scientist from their respective countries to head a Scientific Advisory Committee to the Head of State or Government.

Africa is diverse politically, socially, ecologically and economically. Hence a “one-size fits all” prescription will be disastrous, as has become clear from many top-down programs. We need to reverse the science strategy paradigm and begin planning in

consultation with farm women and men. Participatory research for developing location-specific technologies and participatory knowledge management systems are vital for bridging the gap between potential and actual yields with the technologies already available in the numerous international, regional and national research institutions in various parts of Africa.

Technologies should aim at 3 time dimensions –

- *Immediate*: Technologies already developed and available for immediate dissemination.
- *Medium-term*: Technologies in the pipeline which need testing, incubation and adaptation.
- *Long-term*: Strategic research aimed to develop new technologies through the use of the new genetics and other areas of frontier science and technology. Anticipatory research is also needed to meet potential changes in climate, particularly temperature and precipitation.

Science and Technology are not magic wands with which hunger and poverty can be removed. However, they are the catalysts of change and progress. Technology has been the prime-mover of economic progress in the industrialized world and hence technological empowerment of farm women and men is essential for moving agriculture forward. As stressed earlier, the tools of science and technology have to be tailored to solving the problems of –

- *endemic hunger*, caused by poverty and lack of access to balanced diets
- *hidden hunger*, caused by the deficiency of micronutrients in the diet
- *transient hunger*, caused by natural calamities or ethnic conflicts

Peace and security are essential for progress. However, in the African context, progress in improving farm productivity has been poor even in countries which have had peace and political stability. **Sustainable food security for all and for ever** has to be the vision for Africa. This has to be achieved through mobilizing science and technology supported by appropriate public policies for achieving sustainable intensification and diversification of farming systems and value addition to primary products. **Synergy between technology and public policy is vital to convert potential into production.**

XIII. Collapse of Cancun Trade Talks : Implications for pre-dominantly agricultural countries

The collapse of the Cancun session of WTO has been attributed to failure in reaching agreement between industrialised and developing nations in the fields of domestic support, export subsidies and market access in relation to farm commodities. The failure of the Cancun negotiations is both a blessing and a curse. The sad part of the collapse relates to the continuation of the unequal trade bargain entered into by developing countries at Marrakesh in 1994. Until further agreements are reached, the unfavourable trade bargain will continue to damage the interests of the farmers of the Third World. On the other hand, the Cancun fiasco provides a breathing space for Third World Countries to take steps to enhance their agricultural competitiveness. A mismatch between production and post harvest technologies persists and the infrastructure for handling perishable commodities continues to be poor. There has been hardly any systematic effort to spread genetic, quality and trade literacy among small farm families. This is true in many countries in Asia and Africa.

The breathing spell provided by the delay in arriving at an agreement designed to make trade in agriculture both free and fair should be utilised for building the infrastructure for a highly efficient and quality conscious farming ethos.

1. Road to Free and Fair Trade

First, all boxes (grey, green and amber) may be abolished and the do's and don'ts with reference to trade distortion and unfair trade practices may be spelt out in clear and unambiguous terms. This will help all countries to decide on the pattern of support to be extended to farmers, which will be non-trade distorting.

Second, as an alternative, **a fourth box relating to Sustainable Livelihoods** (Livelihood Security Box) may be introduced, which will empower developing nations facing the challenge of providing livelihoods to the rural population to place restrictions on imports, where there is convincing evidence that such imports will erode job/livelihood opportunities in their countries. Since over 66% of the population of many developing countries including India depend upon agriculture (crop and animal husbandry, fisheries, forestry and agro-forestry and agro-processing) for their livelihoods, trade which leads to

the destruction of rural jobs/livelihoods will further enhance poverty and hunger. The result will be social disintegration because of a further increase in rich-poor divide. Globally, the continuation of the present situation where a few million farm families in industrialised countries, supported by heavy inputs of technology, capital and subsidy, compete with over a billion small farmers, having little access to technology, credit and adequate post-harvest infrastructure, will not help to make free trade an instrument of poverty eradication. **The percentage of population dependant on agriculture for their livelihoods should be the major criterion for eligibility for using the provisions of the proposed Livelihood Security Box. The minimum could be 50% of the population.**

XIV. Ending Hunger : Reaching the final milestone:

The following steps will help to achieve the human quest for a hunger-free world.

- Define food security for operational purposes as “physical, economic, social and ecological access to balanced diets and clean drinking water to every individual” and make access to food and drinking water fundamental human rights in the national constitution
- Adopt a whole life cycle approach ranging from pregnant women to old and infirm persons, by bringing about convergence and synergy among numerous on-going vertically structured food safety net programmes
- Take steps to bridge the prevailing gap between the potential and actual productivity of major farming systems through mutually reinforcing packages of technology, services and public policies based on an inter-disciplinary constraints analysis
- Promote Farmer-participatory research and knowledge systems and reach the unreached in information and skill empowerment.
- Strengthen livelihoods through an integrated approach to on-farm and off-farm employment and bring about a paradigm shift from unskilled to skilled work through greater attention to post-harvest technology.
- Foster community centred gene, seed, water and food banks. Give priority to the establishment of community food and feed banks in the hunger hot spots and to enlarging the food basket through the inclusion of underutilized crops
- Pay concurrent attention to nutritional as well as non-nutritional factors like sanitation, health care and education.
- Facilitate trade in farm commodities on fair and equitable terms, ie provide a level playing field to developing countries.
- Recognise the critical role of women in both food production and hunger elimination and take priority steps to empower them socially, legally, economically and technologically.
- Strengthen the World Food Program by enabling it to effectively address chronic and hidden hunger, in addition to transient hunger or emergencies

- Establish a Global Virtual Academy for Food Security to spread information on hunger bright spots like the Zero Hunger Program of Brazil, Agenda 2007 – Hunger-free India movement and similar efforts around the world, so as to enlarge the sphere of hope and political commitment.

In the short run, UN World Food Programme can be assisted to organise an “International Bank for Nutrition for All” for the purpose of launching an integrated attack on hunger in all the hunger hot spots of the world. Such a Bank will need an initial allocation of 100 million tonnes of food grains. This is not beyond the capacity of grain surplus rations.

Nearly 92% of hunger related deaths are caused by chronic under-nutrition. Only 8% are caused by famines. The chronic hunger, in turn, is related to lack of sustainable livelihood opportunities to the poor. Global trade, economic, political and philanthropic institutions should therefore keep “jobs / livelihoods for all” as the bottom line of their national and international policies. The on-going micro-credit supported micro-enterprise revolution in countries like Bangladesh, India, China and several other developing countries should be allowed to succeed. It is only by overcoming the famine of employment opportunities at the national level, that the famine of food at the household level can be overcome.

Above all, the critical role of women in all aspects of the food production-processing-marketing chain needs explicit recognition. In South Asia and sub-saharan Africa, the two major hunger hot spots of the world, women play even a greater role in food production and in fetching drinking water, than many other areas in the developing world. In sub-saharan Africa, for example, women own only 1% of the land and receive 7% of the farm extension services and less than 10% of the credit given to small scale farmers. Yet, they produce 80% of the food and do the vast majority of the work to process, transport, store and market them. **No hunger elimination strategy will succeed, if adequate attention is not paid to the social, legal, economic and technological empowerment of women.** The highest priority should go to reducing the number of hours of work and enhancing the economic value of each hour of work in the case of rural women, through knowledge and skill empowerment. Hunger elimination is the first step towards a world characterised by gender equity and justice.

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