SUSTAINABLE AGRICULTURE AND ECONOMIC GROWTH

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Abstract

Globally now, economic growth is directed towards sustainable development goals (SDGs). Agriculture being the primary economic activity can be a natural model in this regard. Agriculture – even in the high tech era – should not be at the cost of the environment. Farm and farmers lives should be nurtured and supported with ecological balance. Taking into consideration the slogan, "think globally and act locally", we examine the philosophy and practice of sustainable agriculture in India, We also briefly touch upon Goa, a state that is finally taking agriculture seriously. The paper discusses crucial problems and critical policy imperatives for sustainable agriculture such as organic farming and other possible actions. We emphasize on the term "RUrban" to highlight how some places in Goa require a sustainable integration of rural and urban communities too. Presently the state's agriculture in being increasingly threatened by lopsided development of other activities, chiefly, tourism. It is necessary, therefore to execute policies and programmes that are not only financially viable and technically feasible, but also ecologically sustainable. On the basis of the findings of our study we suggest an integrated farming system (micro, innovative and inclusive) approach for the state's agricultural sector.

Keywords: Agriculture, Goa, India, organic, sustainable

1. Introduction

It is hard to exaggerate the role that agriculture plays in human development. It makes multi-faceted contributions of the global food system and to many pillars of sustainable development. Still agriculture faces many challenges, making it more and more difficult to achieve its primary objective – feeding the world – each year. Population growth and changes in diet associated with rising incomes drive greater demand for food and other agricultural products, while global food systems are increasingly threatened by land degradation, climate change, and other stressors. Uncertainties exist about regional and local impacts of climate change, but the overall global pattern suggests that the stability of the food system will be at greater risk due to short-term variability in food supply. Agriculture must change to meet the

rising demand, to contribute more effectively to the reduction of poverty and malnutrition, and to become ecologically more sustainable. This transformation will be crucial for achieving many of the post-2015 Sustainable Development Goals (SDGs). The new agenda should also have a goal that explicitly focuses on improving agricultural systems and addresses rural development in an integrated manner.

The main aim of any agricultural programme must be to maintain sustainable growth in agricultural production for ensuring food security to the growing population and also to generate adequate surplus for exports. This seems like a daunting challenge to many. But it is feasible. The overarching motive for this report is to encourage people to act, despite the enormous challenges, or as John F. Kennedy said: "By defining our goal more clearly, by making it seem more manageable and less remote, we can help all people to see it, to draw hope from it, and to move irresistibly towards it."[1]

Sustainable agricultural development seeks not only to preserve and maintain natural resources, but also to develop them because future generations would have much more demand for agricultural and food products both quantity-wise and quality-wise. It is predicted that by 2050, the world will have nine billion mouths to feed. The real challenges will be facing drought, floods and changing rainfall patterns, and dishing up enough servings to meet growing demand. India, the emerging economic superpower, paradoxically tops the global hunger chart with more than 27% of the world's undernourished population.

India has been witnessing a blinding pace of growth and development in recent times. Experts are now calling for "sustainable development" and the term has gained currency in the last few years. In spite of fast growth in various sectors, agriculture remains the backbone of the Indian economy. This paper attempts to tackle and explore the issue of sustainable development in agriculture in India. The objective of this study was therefore to discuss the challenges facing sustainable agricultural development in India.

Agriculture occupies the most important position in Indian economy. The role of agricultural sector in Indian economy can be seen during its contribution to GDP (Gross domestic Product) and employment. In the state of Goa agriculture is one of the most important

1 Sustainable Development solutions Network, Solutions for Sustainable Agriculture and Food Systems, Technical Report for the Post – 2015 Development Agenda, 18 September 2013.

economic activities. However even though one fourth of the population is sustained by agriculture in Goa, it contributes to only 15-16% to the income of the state. Due to rapid urbanisation the availability of agricultural land is reducing.

Although for a country like India, increasing productivity is more important than the rest of the two. This is simply because of increasing urbanisation, industrialisation and the limited land size of the country. The productivity can be increased by two ways: (i) increasing output by efficient utilisation of available resources; (ii) increasing output by variation of input. The first system is better with respect to productivity and sustainability. But due to increasing population, this system cannot provide a permanent solution. Thus we can go for the second system which may potentially cause environmental degradation in the economy and affect its sustainability. Therefore there is need for tackling the issues related to sustainable agriculture development.

2. Agriculture and Sustainable Development

Agriculture plays important roles in sustainable development and in hunger and poverty eradication. The challenges faced by agriculture in sustainable development lies in working out ways of bringing about a society that is materially sufficient, socially equitable, and ecologically sustainable and one that is not obsessed by growth only, but motivated by satisfying human needs and equity in resource allocation and use. Primarily sustainable agriculture needs to protect the natural resource base. It should prevent the degradation of soil and water; conserve biodiversity; contribute to the economic and social well-being of all; ensure a safe and high-quality supply of agricultural products; and safeguard the livelihood and well-being of agricultural workers and their families. The main tools towards sustainable agriculture therefore are policy and agrarian reform, participation, income diversification, land conservation and improved management of inputs. This policy framework could be an effort to identify the strategies, guidelines and practices that constitute the Indian concept of sustainable agriculture. This has to be done in order to clarify the research agenda and priorities thereof, as well as to suggest practical steps that may be appropriate for moving towards sustainable agriculture.

Some tend to confuse sustainable agriculture with organic farming. But both are very different form each other. Organic farming is essentially a soil-building mechanism; to keep the soil ‘alive’, make the soil ‘live’ and sustain fertility. Building ‘live’ soil is the primary concern of all organic farming. In organic farming, soil - and not the crop - is fed. Sustainable

agriculture means not only the withdrawal of synthetic chemicals, hybrid-genetically modified seeds and heavy agricultural implements (as in organic farming); it also tries to simulate the conditions found in nature. If this is followed then there is no reason why agriculture cannot be an economically viable activity in addition to being environmentally sustainable.

2.1 Ecological Sustainability

Most of the traditional and conventional farm practices are not ecologically sustainable. They abuse natural resources, reducing soil fertility causing soil erosion and contributing to global climatic change. But sustainable agriculture has some major advantages over traditional practices:

Soil Fertility: Continuous fall in soil fertility is one of the main problems in many parts of India. Sustainable agriculture improves fertility and soil structure.

Water: Irrigation is the largest consumer of fresh water, and fertiliser and pesticides contaminate both surface and ground water. Sustainable agriculture raises the organic matter content of the top soil, thus raising its ability to maintain and store water that falls as rain.

Biodiversity: Sustainable agriculture practices involve mixed cropping, thus increasing the diversity of crops produced and raise the diversity of insects and other animals and plants in and around the fields.

Health & Pollution: Chemicals, pesticides and fertilisers faultily affect the local ecology as well as the population. Indiscriminate utilise of pesticides, improper storage etc. may lead to health problems. Sustainable agriculture reduces the use of hazardous chemical and control pests.

Climate: Conventional agriculture contributes to the production of greenhouse gases in various ways like reducing the amount of carbon stored in the soil and in vegetation, during the production of Methane in irrigated field and production of artificial fertilisers etc. By adopting sustainable agriculture system, one can easily overcome this problem.

2.2 Economic Sustainability

For agriculture to be sustainable it must be economically viable over the long term. Conventional agriculture involves new economic risk than sustainable agriculture in the long

term. At times governments are inclined to view export-oriented production systems as more important than supply domestic demands. This is not right. Cheap foreign food may sweep into the national market, leaving Indian farmers without a market. The main source of employment for rural people is farming. Trends to specialisation and mechanisation can increase narrowly measured "efficiency", but they decrease employment on the land. Sustainable agriculture, with its emphasis on small-scale, labour-intensive performance, helps overcome these problems.

2.3 Social Sustainability

Social sustainability in farming techniques is related to the data of social acceptability and justice. Having robust method of social sustainability can bridge the gap between “haves” and “have-nots”. Many new technologies fail to become applicable in agriculture sector due to lack of acceptability by the local society. Sustainable agriculture practices are useful because it is based on local social customs, traditions and norms etc. Sustainable agriculture practices are based on traditional know-how and local innovation. While conventional farming focus on a few commodities, sustainable agriculture improves food security by improving quality and nutritional value of food, and also by producing better range of products throughout the years. Traditional farming was too driven by the caste and wealth oriented people. The rich and higher castes benefitted extra, while the poor and lower castes are left out. Madhoo Pavaskar and others write that ‘If truth were to be told, the government has neglected agriculture and only paid lip service to its importance and the well-being of the poor and marginal farmers’. Sustainable agriculture attempts to ensure equal participation.

3. Resource Endowment and Sustainable Agriculture

Since a variety of viable patterns of farm development exists related to farm resource endowment and farmer's strategy, model-based explorations should be able to capture the existing variation in resource endowment and strategies in order to have impact on strategic farm management. In India, the close link between land ownership and poverty is reflected by the fact that landless and semi-landless households account for nearly 42% of the rural poor in India. This phenomenon is further supported by the fact that rural casual workers, a majority of whom are landless, have the highest poverty ratio among all categories of rural workers (and also non-workers).

4. Environment and Agriculture in India

Agriculture development should not be at the cost of the environment. Admittedly the Green Revolution in India has achieved self-sufficiency in food production. However, in several states this has resulted in continuous environmental degradation, particularly of soil, vegetation and water resources. The total cultivable land of the country is about 144 million hectares of which 56% (80.6 million hectares) is degraded due to faulty agricultural practices. The dense forest cover has been reduced to 11% (36.2 million hectares) of the total geographical area. Watershed areas, river corridors and rangelands have been extensively disturbed. Situation is frequently worsening that even cessation of abuse may no longer lead to self-restoration of biological diversity, stability and productivity of the ecosystems.

Since 1980s, the water table has risen more. In 2015 a NASA study the Indus Basin, which accounts for a significant share of India's population and food production, was declared to be the second most overstressed aquifer in the world. Apart from affecting agricultural crops, a high water table causes floods even when rains are slight due to the reduced storage capacity of the soil. Such ecological impacts are making farmers to reduce fertiliser and pesticides use. It is noticed that there is an increased investment in alternative technology and products including an interest in Integrated Pest Management.

5. Food Security and Agriculture in India

One of the most significant features that highlight the importance of the agriculture sector is the idea of 'food security'. Thanks to the sharp rise in food grain production during India's Green Revolution of the 1970s enabled the country to achieve self-sufficiency in food grains and stave off the threat of famine. Agricultural intensification in the 1970s to 1980s witnessed an increased demand for rural labour that raised rural wages and led to the decline in food prices and rural poverty. Since then, however, the slowdown in agricultural growth has become a major cause of concern. India's rice yields are one-third of China's and about half of those in Vietnam and Indonesia. With the exception of sugarcane, potato and tea, the same is true for most other agricultural commodities.

Despite its rising economic power, India is struggling to adequately feed its population. No wonder the 2016 Food Sustainability Index scores India last out of 25 countries, largely because of challenges regarding nutrition and agricultural sustainability. The country's approach to food loss and waste is, however, more positive.

India ranks last among the 25 countries that were ranked according to their food system, as per a report by the Barilla Centre for Food and Nutrition and the Economist Intelligence Unit. The report also indicates that uneven access to adequate nutrition, resource depletion and other environmental challenges necessitate an urgent rethink on food production and consumption.

Nutrition continues to be the main challenge. India has a very high prevalence of undernourishment and micronutrient deficiency, for which it is placed at the bottom and second from the bottom, respectively (after Ethiopia).

6. Agrarian Crisis in India

Through there has been a substantial increase in agricultural productivity over the past two decades, the incremental growth has been declining. The compound annual growth rates of productivity of all the crop groups have declined drastically between the period 1980-90 and 1990-2000. This has had a serious impact on the poverty level as also on food and nutritional security in the country.

At the same time, urban groundwater is threatened by untreated effluent and a dearth of sewage treatment facilities. Growing indebtedness among farmers has resulted in distress and suicide phenomenon on the rise.

7. Goan Scenario

After Goa's liberation (1961) in 1961 there was a rapid shift from the dominance of the primary to that of the tertiary sector in the economic structure. The smallness of the state, the strength of the demonstration effect arising from the high visibility of those engaged in the tertiary sector, and the desire to cross class lines all created pressures toward moving out of agriculture. While Goa was moving into tertiary gear, the rest of the country was increasing the productivity in agriculture and industrial development. Even the land reforms of 70s were so complicated that it reduced incentives to small owners of land and resulted in pressures to move out of agriculture and orchard land, which created a source of supply of land for tourism.

Overemphasis on tourism despite natural and financial advantages has led to unsustainable economy in Goa. Decline of land under agriculture, increase in fallow land, decline in

vegetation cover and area under mangroves, and increase in wastes and plantation, overcrowding of beaches etc. are sure signs threats to Goan environment.

While it's pretty simple to criticise what is happening to agriculture in Goa, we believe that this can be constructive only when it is accompanied by reasonable alternatives. Researchers recommend 'RUrbanism': integrating the urban with the rural – so that there is a co-evolution of the countryside and of the city that is embedded within it. Diversity with quality must be the motto given the trends of transformation in Goa. The state must set the focus on urban agriculture to bring quality to food production – the fields around the cities of Goa (for example, in Taleigao) must be preserved and aggressively developed for agriculture. This reduces the costs and logistics required for growing and also dramatically improves the quality and freshness of the produce applicable to its citizens (as well as farmers' access to markets). A special policy that encourages and supports market gardens for growing vegetables and fruits is the key to this, along with setting up spaces for farmers' markets. Also exploit the triple advantage of organic farming: local affinity, tourist market, and proximity to outside urban centres like Bengaluru and Pune.

8. Policy Issues

What should be the policy frameworks for sustainable agriculture? Undeniable fact is that sustainable development requires policy changes in many sectors and coherence between them. Broadly it entails balancing the economic, social and environmental objectives of society – the three pillars of sustainable development – integrating them wherever possible, through mutually supportive policies and practices, and making trade-offs where it is not possible. The policy options presented below are cross cutting, yet emphasising the interwoven nature of human, economic and natural resource considerations. These are:

8.1 Addressing Social Issues (People)

In addressing the wide range of social challenges it is important that focus be placed on food security, poverty, unemployment, health and equity.

8.1.1Food Security

Study shows that agricultural productivity growth can bring about swift and sustainable reductions in hunger and poverty. Therefore increasing agricultural productivity remains one of the most effective ways to combat hunger and poverty.

Strategies:

- Ensure that agricultural, food security and nutritional objectives are integrated into broader national development policies, plans and strategies;
- Increasing the food and feed value of staple crops grown by the poor;
- Enhancing food security, agricultural productivity, as well as income generation;
- Improving access to production resources like land, finance, agricultural inputs, and information and technology to a broader section of the population; and
- Reducing post-harvest losses.

8.1.2 Poverty

Agriculture can make significant contributions to reduction of poverty levels in India. It is the sector from which most of the rural poor derive their livelihoods, and both rural and urban people obtain most of their food and jobs.

Strategies:

- Develop policies that are aimed at avoiding destabilising food prices;
- Develop programmes geared towards facilitating market access for small-holder and emerging farmers; and
- Develop programmes for providing poor people with opportunities for generating income.

8.1.3Health

Adequate nutrition is indispensable to attaining good health and productivity. An adequate supply of food is a key determinant of adequate nutrition.

Strategies:

- Develop education and awareness programmes on food safety and health management;
- Promote the production and consumption of indigenous foods;

- Facilitate development of awareness programmes on nutrition; and
- Promote good practices with regard to handling and utilisation of pesticides, herbicides, fertilisers, vaccines and other agro-chemicals.

8.1.4 Unemployment

Creating the opportunities to allow the poor to escape from poverty and hunger through sustainable agricultural development is one important intervention in the fight against high unemployment currently experienced in rural areas of this country. Intra and inter sectoral diversification in the rural economy could unlock new potential and expand rural economies.

Strategies:

- Improve private and public partnerships in supporting rural agricultural entrepreneurial development, through agro-processing and other value adding initiatives for niche, rural products;
- Promote programmes that encourage innovative entrepreneurial development for rural agricultural produce, by creation of market opportunities and availability of information;
- Transfer sustainable technologies for agricultural entrepreneurial development to rural communities through strong national agricultural research programmes;
- Develop programmes aimed at increasing employment options for rural people;
- Facilitate the creation of new employment opportunities for off-farm employment, through both backward and forward linkages;
- Promote value addition of primary agricultural products in rural areas; both to create employment opportunities and to reduce harvest losses; and
- Develop programmes aimed at promoting the development and support of agricultural based SMMEs.

8.1.5 Equity

There is a need to increase the participation of the broad society in agricultural sector ensuring people's participation in sustainable growth.

Strategies for policy development

- Develop programmes aimed at empowering women, youth and the disabled; and supporting their active and full participation in the agricultural industry;
- Ensure that policies and programmes promote women's equal access, to and full participation in decision-making at all levels, mainstreaming gender perspectives in all policies and strategies. The status of women should be improved in agricultural development – policy and decision-making matters;
- Facilitate equitable access to public information to support decision-making related to agricultural development and resource management;
- Integrate communities and local groups in sustainable management of resources for agricultural production;
- Empower communities and allow them to make informed decisions in meeting essential food, water and energy needs while conserving the resources and environment;
- Ensure that policy formulation and implementation are guided by principles of accountability, transparency and broad-based public participation to promote the empowerment of people living in poverty and their organisations.
- Develop programmes aimed at the marginalised and enable them to increase access to productive resources and public services and institutions;
- Facilitate equitable access to technology and its transfer in appropriate language, level of communication, and transfer medium in order to align it with the needs of targeted communities and their levels of understanding;
- Enhance access of agricultural produce of all farmers, to existing markets and develop new markets, in order to promote their incorporation into the economic mainstream;
- Facilitate access to an open, equitable, predictable and non-discriminatory multilateral trading and financial and credit support system that benefits all farmers;

- Promote participation of previously disadvantaged groups, including women, youth and the disabled, in facets of plant production sector thus ensuring sustainability and food security for all.

8.2 Addressing Environmental Issues (Planet)

The availability and optimal utilisation of land, water and biodiversity are central to development, food security and poverty reduction. The sustainable utilisation of the natural resources is regarded as a prerequisite for development and needs to form the basis for policy interventions for people and area development.

8.2.1 Management of Soil Resources

Effective soil management is needed to minimise and reverse significant soil structural degradation, as well as salinity or acidity problems that exist in many parts of India. It is also important to enhance the production capacity of soil by addressing the decline in soil organic matter through the promotion of conservation tillage practices, and combating nutrient depletion through appropriate inputs, best practice cultivation, and on farm training.

Strategies:

- Encourage implementation of land management plans that are based on sustainable use of renewable resources and on integrated assessments of socio-economic, infrastructural and environmental potential;
- Develop and promote an integrated approach in land use planning and management to maintain the integrity of ecosystems;
- Promote the principles of ecological agriculture to help conserve ecological processes that support life by recycling essential elements, cleansing water, regenerating soils, etc.;
- Ensure effective and efficient use of soil fertility improvement practices with minimal or no damage to the environment;
- Promote conservation tillage practices to address the decline in soil organic matter;

- Adopt integrated approaches combining increased use of organic manure, mineral fertilisers, hybrid seeds, irrigation or mechanisation for optimal productivity rather than each applied in isolation;
- Combat desertification in order to arrest land degradation, including access to information to improve monitoring and early warning related to desertification and drought;
- Promote best practices by establishing networks and disseminate successful technologies on land conservation and rehabilitation;
- Ensure full participation and involvement of communities, especially women and youth, in sustainable management of land resources; and
- Adopt indigenous conservation and rehabilitation practices and farming systems; and
- Adopt the Land care ethos in the country.

8.2.2 Water Use Efficiency

Sustainable use of water in agriculture should be accompanied by better husbandry of soils, fertilisers, improved plant varieties, protection etc. There must be more crop per drop of water. Increasing the efficiency of water use in agriculture and improving irrigation system performance in a sustainable manner is a key goal for agricultural development. Economies/efficiencies can be improved through a combination of both technical and managerial means.

Strategies:

- Enhance the productivity of land and the efficient use of water resources in agriculture, and aquaculture, especially through indigenous and local community-based approaches;
- Prevent water pollution to reduce health hazards and protect ecosystems through effective irrigation technologies and mitigation of the effects of groundwater contamination;

- Improve prevention and protection measures to promote sustainable water use and to address water shortages through integrated water resources management and water efficiency plans, including water harvesting under rain-fed conditions;
- Integrate river basin, watershed and groundwater management, and introduce measures to improve the efficiency of water infrastructure to reduce losses and increase recycling of water and water harvesting;
- Promote scientific understanding of the sustainable use, protection and management of water resources to farmers and encourage knowledge sharing and integration with indigenous knowledge systems, to advance long-term sustainability of water resources;
- Promote and create incentives and awareness programmes for agricultural enterprises and farmers to monitor and manage water use and quality, inter alia, by applying such methods as small-scale irrigation and wastewater recycling and reuse;
- Expand agro-forestry to minimise the impacts of salinity and high water tables;
- Expand small-scale irrigation schemes through policy, institutional framework, external and national public funding and enabling conditions for private sector investments;
- Encourage re-vitalisation, upgrading and maintenance of irrigated land through irrigation development programmes;
- Promote development of drought resistant crops through genetic engineering;
- Develop and promote appropriate water harvesting technologies especially for dry land production; and
- Improving the efficiency and effectiveness of water use in agriculture.

8.2.3 Biodiversity and Genetic Resources for Food and Agriculture

The preservation and sustainable management of biodiversity is crucial for supporting all life forms, including national food security and development of new crop varieties, plants of medicinal value and preservation of cultural integrity of our people for future generations.

Improving crops, livestock and feeds; increasing soil fertility; and controlling pests and diseases often depend on these resources.

Strategies:

- Initiate, improve and integrate strategies for the conservation and the sustainable use of genetic resources for food and agriculture into national programmes and policies;
- Develop education and awareness programmes on the importance of genetic resources for food and agriculture;
- Create incentives to support breeders and targeted indigenous practitioners for the development of plant breeding strategies that maintain and enhance genetic diversity in a manner that will foster adoption by farmers;
- Strengthen financial and technical support, for capacity-building targeted specifically at the youth and women in order to enhance indigenous and community-based conservation efforts of genetic resources for food and agriculture;
- Encourage the use of genetic resources of value to sustain agricultural productivity in a conservative manner and guard against complete depletion and extinction; and
- Develop and implement programmes to re-train extension officers on the importance of genetic resources for food and agriculture.

8.3 Addressing the Economic Issues

Local and global economic issues should be addressed in a holistic manner. Value addition should be considered. For example, using green infrastructure in construction and increasing vegetation and tree cover can increase property values, benefiting both developers and homeowners. Environmental evaluation must be given due importance.

8.3.1 Global Competitiveness

Globalisation has brought about increased competition for agricultural products in both local and on export markets. Major adjustments are needed to develop measures to enhance competitiveness of the Indian agricultural sector.

Strategies:

- ✓ Develop coordinated, effective and targeted trade-related technical assistance and capacity-building programmes, to take advantage of existing and future market access opportunities;
- ✓ Strengthen mechanisms of government service delivery and enforcement of regulations to enhance profitability and competitiveness in the agriculture sector;
- ✓ Develop and implement effective risk management strategies to ensure that the viability of agricultural development is maintained despite volatility;
- ✓ Support trade opportunities for poor rural communities;
- ✓ Provide adequate financial and technical support to poor farmers and micro enterprises to optimise production and value adding;
- ✓ Step up the use of information and communication technologies for improving agricultural development through access to accurate information and advice;
- ✓ Enhance the capacities to benefit from liberalised trade opportunities, through measures aimed at improving productivity, commodity diversification and competitiveness, community based entrepreneurial capacity, and infrastructure development;
- ✓ Unlock the full potential of all people involved in agriculture through capacity and support programmes;
- ✓ Enhance industrial development by promoting the development of micro, small and medium size enterprises, with special focus on agro-industry as a provider of livelihoods for rural communities;
- ✓ increase productivity and profitability by using best agricultural practices;

- ✓ Develop and implement effective market intelligence system to take advantage of niche markets as well as minimise risks;
- ✓ Increase market access, with a particular focus on the emerging and small scale farmers;
- ✓ Reduce high costs to market access by poor and small producers;
- ✓ Strengthen capacities to participate in multilateral trade negotiations;
- ✓ Mitigate the negative impacts of globalisation on poor and vulnerable groups, through, for example, the provision of social safety nets;
- ✓ Strengthen capacities related to the assessment, adaptation and implementation of relevant international policy and regulatory frameworks related to agriculture, food security and food safety;
- ✓ Expand public and private investments and partnerships in rural infrastructure, such as building and maintaining rural roads and bridges, small-scale irrigation systems, post-harvest facilities, processing and market facilities and so on;
- ✓ Strengthen capacities for improving food safety and quality;
- ✓ Improve access to rural financial services for small-scale farmers and rural entrepreneurs, and build viable and sustainable rural financing schemes and banking services; and
- ✓ Provide access to agricultural resources for those living in poverty.

8.4 Addressing Technical and Managerial Issues

Technical and systemic aspects should be effectively dealt with. Traditional conservation-minded methods combined with modern technology can reduce farmers' dependence on possibly dangerous chemicals.

8.4.1 Biotechnology

It is important to dispel all myths and fear that surround biotechnology, particularly its impact on human health and biodiversity.

Strategies:

- ✓ Maximise the benefits of biotechnology for agricultural development;
- ✓ Spread benefits and opportunities offered by biotechnology to the rural poor by acceleration of technology acquisition, transfer and adaptation to support activities that promote food security and poverty alleviation;
- ✓ Improve or strengthen current legislation to ensure that biotechnologies are safe and accountable;
- ✓ Improve risk assessment tests for transgenic material imported from other countries, to safeguard the environment; and
- ✓ Develop and implement an effective and transparent framework for access to the results and benefits arising from biotechnologies based on genetic resources.

8.4.2 Production Systems

Production systems need to ensure sustainable use of natural resources. Sustainable production practices can improve agricultural productivity while conserving biodiversity, soil fertility and efficiency of water use and while reducing the pressure to clear forests and over-fish the seas. Ecological balance should not be sacrificed.

8.4.2.1 Plant Production Practices

Important factors that impact on sustainable plant production are topography, soil characteristics, climate, pests, availability of inputs and the individual farmer's goals..

Strategies:

- ✓ Promote integrated production systems, incorporating both plants and animals;
- ✓ Develop and adopt where appropriate, alternative crops and cropping systems suitable to the circumstances of farmers and climatic and soil conditions of a particular area;
- ✓ Promote the integrated management of pests, diseases, and weeds;
- ✓ Encourage the reduction of dependence on inorganic fertilisers and agrochemicals through the increased use of organic alternatives;

- ✓ Address nutrient depletion, especially in communal/sensitive areas, through appropriate interventions, like liming, promotion of the use of organic manures, etc.;
- ✓ Encourage innovative approaches including cover crops, minimum tillage, crop rotation, inter-cropping and incorporation of agricultural by-products and residues to increase soil organic matter;
- ✓ Minimise pre- and post-harvest losses through technical assistance, capacity building, provision of appropriate information, etc.;
- ✓ Develop effective local storage and distribution systems especially in rural areas; Improve capacity to manage both climatic and market risks;
- ✓ Develop environmentally friendly technologies in crop production that will use less land, water, supplemental plant nutrients and pesticides;
- ✓ Promote the establishment of niche markets, including organic production of products;
- ✓ Facilitate training in appropriate best practice in crop production methods;
- ✓ Support and promote the utilisation of indigenous knowledge in crop production, natural resource management and plant protection;
- ✓ Develop new crop varieties that are capable of higher yields, can adapt to Indian conditions and are tolerant to adverse conditions, pests, and diseases; and
- ✓ Develop new crops from indigenous crops for niche markets.

8.4.2.2 Animal Production Practices

Sustainable animal production involves breed selection, grazing (or feed supply), health, adaptability, nutrition, reproduction and welfare.

Strategies:

- ✓ Encourage selection of animals appropriate to the available resources, feed and forage sources, landscape, climate and management capacity;

- ✓ Develop an understanding of the nutritional requirements of animals, including seasonal variations in feed and forage quality;
- ✓ Optimise the use of farm-generated by-products in diversified farming systems;
- ✓ Ensure the adoption of well-planned animal health programmes to ensure sustainability;
- ✓ Promote the use of quality germplasm, where appropriate, to enhance herd performance;
- ✓ Promote animal health, welfare and environmentally acceptable waste disposal under conditions of intensified animal production;
- ✓ Promote best practices for grazing management, including awareness of carrying capacity, forage sources and fenced camps;
- ✓ Investigate alternative livestock management systems, such as improved fallow, unpalatable cover crops and living fences, for communal farmers;
- ✓ Ensure a participatory approach to animal production, including women, the youth and the disabled thus contributing to food security and sustainability;
- ✓ Promote best management practices, including the development of calendars of operations, stock flows, forage flows, labour needs, production records and land use plans in order to monitor progress towards attainment of goals; and
- ✓ Develop programmes aimed at promoting the use and improvement of indigenous animal species.

8.4.2.3 Management of Pests, Weeds and Diseases

Integrated management approach, which combines biological control, host plant resistance, physical control, good farming practices and chemical control, is viewed as one of the best options for dealing with these problems.

Strategies:

- ✓ Promote programmes of integrated pest-management to put them within the reach of farmers through farmer networks, extension services and research institutions;
- ✓ Develop and adopt efficient management systems to control and monitor the

incidence of pests and disease in agriculture;

- ✓ Develop and adopt efficient management systems to control the distribution and use of pesticides;
- ✓ Develop and implement economic incentives with regulations in order to ease reliance on regulatory authorities that are challenged with high costs and capacities;
- ✓ Encourage research and development into pesticides that are target-specific and readily degrade into harmless constituent parts after use.
- ✓ Disseminate information on biological control agents and organic pesticides, as well as on traditional and other relevant knowledge and skills regarding alternative non-chemical and healthy ways of controlling pests.
- ✓ Strengthen interdisciplinary projects and establish integrated pest management (IPM) networks to demonstrate the social, economic and environmental benefits of IPM for food and cash crops in agriculture.
- ✓ Promote the training of extension agents and involve farmers and women's groups in crop health and alternative, stable non-chemical ways of controlling pests in agriculture.
- ✓ Strengthen regulatory services by 'polluter-pays-principles' in the control of usage of pesticides and the transfer of technology for integrated pest management; and
- ✓ Promote the use of indigenous knowledge systems with regard to the control of pests, diseases, and weeds, etc.

8.4.2.4 Sustainable Energy Management

In sustainable agricultural systems, there is reduced reliance on non-renewable energy sources and a substitution of renewable sources or labour to the extent that is economically feasible. The key is not eliminating energy use from agriculture but increasing the efficiency of its 24 use and minimising its negative impacts on the natural resource base on which sustainable agriculture depends. Energy-Farming synergy should be maintained.

Strategies

- ✓ Promote sustainable use of biomass and, other renewable energies through improvement of current patterns of their use. Decrease the depletion of non-renewable energy resources i.e. oil, gas, coal and promote methods extending their 'life' through recycling, using less or switching to renewable substitutes;
- ✓ Develop and implement programmes that would combine, more efficiently, and as appropriate, the use of traditional, renewable energy resources, and cleaner fossil fuel technologies, which could meet the growing need for energy services in the longer term to achieve sustainable development;
- ✓ Provide support for the development of safe low-cost technologies that provide or conserve fuel for cooking and water heating;
- ✓ Intensify research and the development, diversification and conservation of energy, taking into account the need for efficient use and environmentally sound technology; and
- ✓ Develop programmes aimed at promoting the production of crops needed for manufacturing of biofuels.

8.4.2.5 Agricultural Research Systems

Indian agriculture needs a well-developed research system. Research will have to be publicly funded where its outputs are such that people who have not paid for them cannot be stopped from enjoying their benefits. Examples include integrated pest management (IPM) practices, measures to raise the organic matter content of soils, biological nitrogen fixation to improve fertiliser use efficiency and genetic resource conservation. Principles of non-exclusion, indivisibility etc. should be taken care of.

The private sector can be expected to focus on areas where research outputs can be protected or are profitable or both. A particularly key example is Biotechnology development– it has important potential contributions, such as in combating drought stress in plants, etc. Similarly, saving farming after natural calamities like floods is the need of the.

Strategies:

- ✓ Improve public and private funding for research in sustainable agriculture and support efforts to strengthen agricultural research and natural resource management capacity and dissemination of research results to the farming communities;
- ✓ Integrate and strengthen national research and extension services and farmer organisations to trigger farmer-to-farmer exchange on good practices and information on environmentally sound, low-cost technologies, with the assistance of government and other stakeholders;
- ✓ Improve public and private finance in the research and development of genetic resources for food and agriculture;
- ✓ Facilitate capacity building among producer organisations to contract research and extension services and provide farmers with a menu of technology options. Promote research targeted at serving the needs of poor farmers with focus on such topics as improving drought tolerance and yield response to scarce plant nutrients and building pest and disease resistance;
- ✓ Develop research policies, which focus on identifying and removing constraints to the adoption of practices that promote optimal use of existing technologies, such as conservation agriculture and IPM;
- ✓ Develop programmes aimed at making agricultural extension, education and communication more responsive to farmers' needs; and
- ✓ Develop sound institutions for extension and promote investment in human capital, access to databases of best practices for technology generation and dissemination and the application of new information and communication technologies.

8.4.2.6 Infrastructure

Basic infrastructure in energy, water supply, sanitation, telecommunications and transport is needed to stimulate private-sector investment in food marketing, storage and processing. Good infrastructure will do much to enhance living standards and increase productivity. The public sector should focus on services that cannot be well provided by the private sector and should target interventions to the poorest regions and communities, and to the poorest of the

poor within these communities. High priority must go to the upgrading and development of rural roads and to ensuring their maintenance.

Strategies:

- ✓ Broaden access to infrastructure services and maintenance
- ✓ Promote private sector involvement in the production and financing of infrastructure investments; and
- ✓ Promote participation of a broad range of stakeholders in the provision and maintenance of rural infrastructure, including community organisations, local governments, non-governmental organisations (NGOs) and the private sector.

8.4.2.7 Developing Well-Functioning Markets

To help the rural poor participate in local and international markets, agricultural output must diversify, quality of produce must improve, and agro-based processing must add value to primary products. Rural agricultural communities must also obtain greater access to credit and insurance. Autonomous cooperatives provide a perfect linking mechanism, allowing farmers to collectively access the marketplace, both to market their crops and to access farm inputs at reasonable rates.

Strategies for policy development:

- ✓ Supporting agro-based processing and rural entrepreneurship;
- ✓ Strengthening local market organisations and institutions;
- ✓ Promoting agricultural services through cooperatives and rural agricultural education;
- ✓ Promoting access of farmers in developing countries to international markets; and
- ✓ Provision of reliable and up-to-date information on marketing opportunities and trends.

9. Recommended Policy Options

From section 7, it is clear that the policy options presented are inter-linked. Thus it is difficult to recommend one of them above the others. Which of these to prioritise would depend on

preferred focus areas and emerging programmes of the Agriculture Ministry, as well as on the priorities of different stakeholders, all in the national interest? These should emerge during the inclusive stakeholder participation and consultative processes envisaged for further development of this document. It should also be noted that the guiding principles to sustainable development should be people centred i.e. to improve the quality of human life by creating opportunities for people to realise their potential and fulfil their goals.

9.1 Implications

- **Institutional Implications**: The positioning of programmes and directorates within the Department of Agriculture) as also Rural Development) to address emerging policy on sustainable development is important. The maintenance and procurement of adequate capacity to plan and implement are also considered essential.
- **Financial Implications**: No major financial implications are anticipated, although some reallocation and shifting of funds along with accountability would be necessary. Provision should be made in the budgets of sub-sectors and individual directorates/divisions.
- **Communication Implications**: The document when finalised would be communicated as widely as possible.
- **Legislative and Regulatory Implications**: The principles and policy on agriculture in sustainable development should be internalised in appropriate policies, regulations and guidelines for action and outcome.

10. Suggestions

The "farm Problem" of India is a huge mountain, but it is surmountable. To address the challenges just presented, a number of attempts have been made by various actors to define objectives or priority areas for action. These broadly include the following:

- ✓ Increase agricultural productivity, close yield gaps, achieve maximum sustainable yield in farms and fisheries, and improve efficiency of resource use – e.g. more crop per kg of nutrients, more crop per drop of water, more crop per unit of energy, higher productivity per unit labour.
- ✓ Reduce the workforce dependent on agriculture for the sake of increased incomes for agricultural households and decent, diversified rural employment opportunities.

- ✓ Nurture -healthy, sustainable and productive ecosystems and support integrated evidence based planning and management of land and natural resources to reduce deforestation, land degradation, biodiversity loss, and the carbon footprint of agriculture and food systems.

- ✓ Increase supply, nutritional value and safety, availability- and distribution of- food through support to diversified, gender and nutrition sensitive, human rights based,

- ✓ Increase value addition of primary- commodities and develop inclusive agri-food value chains, which reduce post harvest losses and waste and ensure that agricultural commodity prices reflect social and environmental costs.

- ✓ Make food production systems more resilient to shocks and changes, promote food security concerns in trade regimes and trade policies, and revisit agricultural policies to promote local and regional agricultural markets.

- ✓ Recognise indigenous and local knowledge in the design and implementation of national and regional agricultural policies. Facilitate participation of a wide range of stakeholders in an inclusive manner in sustainable food system

- ✓ Identifying and designing measures to achieve more sustainable agriculture and food promote secure, equitable, and long-term- land tenure arrangements, particularly for women, to create incentives for (and de risk) responsible agricultural investment.

- ✓ Strengthen provision of public goods in support of sustainable agriculture.

- ✓ Strengthen sustainability considerations and incentives in public planning, especially for hard (physical), natural (ecosystem) and soft (policy, regulation) infrastructure investments.

- ✓ Build robust knowledge and improve monitoring, early- detection and forecasting in agriculture, including- through increased use of space derived geospatial data, for informed decision making on aspects related to yield prediction, weather forecasting, biodiversity, fisheries, water availability and environmental impacts of agricultural land management.

- ✓ Adopt an integrated approach-- to natural resource management,- including-consideration of the food energy water nexus, through cross sector decision making mechanisms.

- ✓ Support sustainable consumption and production through market development, including use of international standards and certification as well as policy and-regulatory measures, giving due consideration to women's empowerment and gender equitable participation.

- ✓ Expand payments for biodiversity and ecosystem services in agricultural landscapes, based on improved management of the resource base; promote improved valuation of the services provided; improve measurement, reporting and verification of these; slow down and ultimately stop the expansion of agriculture into sensitive ecosystems.

- ✓ Stop unsustainable withdrawal of water resources, land degradation, biodiversity loss, and soil nutrient depletion and establish frameworks for sustainable production systems.

- ✓ Support universal access to renewable energy services, including a shift to renewable forms

of energy and more efficient use of energy for sustainable agriculture.

- ✓ Strengthen international and national governance for sustainable resource use, with particular emphasis on the capacity of -developing countries to participate
- ✓ Avoid recourse to and eliminate trade distorting support policies and protectionism in adopting national measures to achieve the goal of sustainable agriculture.
- ✓ Establish accountability mechanisms for damage to the environment and/or human rights violations and to provide remedies for those rights that are violated.

11. Conclusion

The conditions for development of sustainable agriculture are becoming more and more favourable. New opportunities are opening the eyes of farmers, development workers; researchers and policy makers like agree related businesses, dairy farming, poultry farming castle farming and fisheries. Most farmers are open-minded for agribusiness and to be connected to the value chain of farm to fork. Government's recent initiatives like direct benefit transfer to the farmer-buyer are laudable. The Indian agricultural sector is facing a crisis. Free trade has not been free from problems. Farming and farming community are waiting for a fair treatment even as many of them have lost interest or lives. The whole world knows what Indian farmers desired, deserved and derived from globalisation. There can be no better time than now – the period of second generation reforms – for a critical study of this vital sector of the Indian economy and for ensuring a second green revolution in the near future. A long term vision is needed for inclusive growth of farming and farmers. We must develop Indian agriculture into a vibrant sector contributing substantially to the growth of New Age Indian economy and for its sustainable development.

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