

## Sustaining Power Of Rural & Agrarian Sector For Overall Growth Of India's Human Development Index

Dr. Susil Kumar Sarangi\*

Corresponding Author: Dr. Susil Kumar Sarangi

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**ABSTRACT:** *Managing the linkages between agriculture, poverty and nutrition areas are as critical as we look towards providing with an opportunity to reach their full potential especially to children. The new agenda of sustainability should also have a goal that explicitly focuses on improving agricultural systems and addresses rural development in an integrated manner. These features of sustainable agriculture should be delivered as a package, and no single feature should predominate over the others. Economic challenges to sustainable development include slow economic growth, globalization, mechanization, excessive reliance on foreign direct investment, job losses, and inequitable distribution of wealth etc. Many rural areas in developing countries like in India often lack agricultural extension services, processing capacity, credit, roads, irrigation, transportation, energy, and storage infrastructure. For urban and rural populations alike, the lack of adequate income is one of the main obstructions to overcoming hunger. This is particularly true for women whose challenges are exacerbated by less access to land, scarce credit, and lower levels of education. Chronic hunger is fundamentally not an issue of just more food; sometimes it is an issue of access. India, for example, is a net exporter of food with millions of tons of grain in storehouses but 47% of its children are still malnourished. India is not unique; the situation is similar in a number of countries. So, while increasing production is an important part of the strategy for keeping food prices reasonable, hunger often has more to do with access and poverty and sometimes with politics.*

*The agricultural sector is different from other economic sectors in a number of ways. Here activities are generally located in isolated areas with low population density and poor infrastructure. This in many cases dependent on weather and production cycles; income is seasonal and monetary income is limited. Agricultural prices are notoriously volatile and few farmers can offer guarantees that are legally or financial acceptable. Moreover, as microfinance is increasingly integrating into conventional financial markets, the sector has no choice but to apply cost-covering interest rates. Such rates often contradict the expansion of rural coverage and agricultural finance due to the low profitability of the activities financed. All these factors explain the relative lack of interest in agriculture on the part of urban and semi-urban zones. The complexity of the Gramya Banks and other such schemes needs to be reduced in order to lessen the expense associated with such schemes, and their long term viability can be ensured by linking the project early with existing credit unions or rural banks. There is some evidence to suggest that the community benefits economically, educationally and socially from the presence of MFIs. Moreover, as microfinance is increasingly integrating into conventional financial markets, improved resource management through the use of information technologies permits more efficient use of inputs for the same level of crop yields, thus reduces the deterioration of natural resource quality. Whereas the green revolution technologies led to quantum jumps in crop yields, the new biotechnologies and information technologies, as well as the indigenous technologies and knowledge, are tools for achieving incremental advances in yields and maintaining the yields in a sustainable fashion. The demand for relatively high priced organic products reflects consumer interests now a day.*

*International and national standards for organic products have been established and a certification system for organic food is now used in many countries. So it is now necessary to maximize the positive effect of this movement using consumer signals effectively. To improve reliability of certification on specialized products, including organic food, it is important to develop a reliable certification system. Beyond facilitating transfers from regions of surplus to regions of deficit – important in particular in light of increased extreme climatic events, such as droughts and floods, a reformed, non-distorted agricultural system is considered of paramount importance for opening markets for developing country exporters and contributing to improved rural livelihoods.*

*Globally, corporate power has grown to easily rival the influence and effect of the state, in changing the dynamics of local and global food systems. This private power, while seeking profits, is also increasingly under pressure to work towards sustainable modes of production and processing as concerns about resources and supply availability increase and consumers are ever more aware of corporate roles and their impact on food and agriculture. Several of the world's leading food companies have made strong public commitments to*

sourcing products that are independently certified to be in compliance with public and private sustainability standards for contributing higher Human Development Index. This can be tried in India also.

**KEY WORD:** Linkage, Microfinance, Organic Product, Integration, Food Prices, Certification.

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## I. INTRODUCTION

The development and growth of agriculture is essential for the rise and survival of all civilizations. Increases in the world's population from 800 million at the start of the industrial revolution in 1790 to over 7 billion today and the prospect that the human population to grow up to around 9.3 billion in 2050 have created new concerns about our ability to feed & develop the world in a sustainable manner. The farming community has had tremendous success in increasing food production over the past five decades and making food more affordable for the majority of the world's population, despite doubling in the population. Global production of main grains such as rice, wheat and maize has roughly tripled since 1960, resulting in corresponding decreases in food prices. New estimates show that investments in crop improvement that led to unprecedented yield increases during the Green Revolution saving an estimated 18--27 million hectares of natural ecosystems from being converted to agriculture. The transformation of cultivation benefited from technological innovations and inexpensive fossil fuels to raise agricultural productivity in many world regions, but it also left others behind. So the new determinants of a sustainable development path for agriculture and food systems are:

1. Shifting towards healthier and hygienic diets;
2. Ensuring the supply of safe, nutritious food to all by increasing agricultural productivity on existing crop and pasture land and making it more resilient to climatic extremes;
3. Preserving the environment through systems management principles that increase resource efficiency, reducing net carbon emissions and other pollutants associated with agriculture, and improving soils and conserve natural resources;
4. Reducing food losses and waste;
5. New visions and business models for small farm holder and rural development that create economic and job opportunities and make rural areas more attractive places to live.
6. Empowering women along the value chain;
7. Coherent and consistent policies at all levels that stimulate behavior change, provide secure rights to land and other resources and incentivize solutions for sustainable intensification of agriculture and food systems that take advantage of rapid advances in science and technology.
8. Clear goals, targets and indicators that address critical areas of food production and consumption, motivate people and provide a structured approach to guide countries in designing their own development paths for agriculture;

### HUMAN DEVELOPMENT IN INDIA

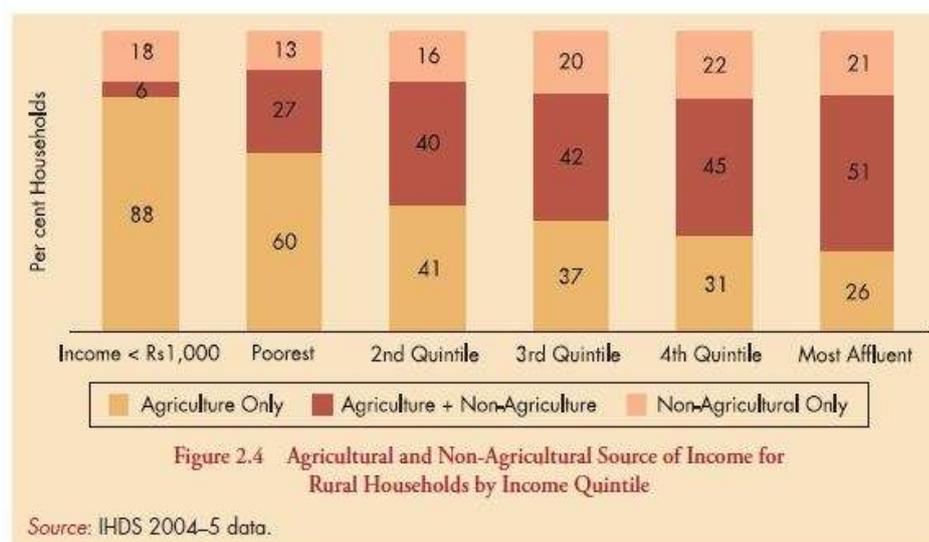


Table 1

**Vulnerabilities of Agricultural Households in Indian Human Development Index (IHDI):** Inequalities in household income are presented in Appendix Table 1. This table documents substantial inequalities by urban/rural residence, household education, and social group. Rural residents, not surprisingly, depend more on cultivation for their incomes than do urban residents. This over reliance is partly to blame for the lower incomes in rural areas as agriculture usually provides lower incomes. However, villages which are more developed, with better infrastructure and transportation, appear to depend less on cultivation.

### **Agricultural Income**

Notably, one of the most striking features of the IHDI 2016 is the low incomes reported by agricultural households. Farmers rarely maintain accounts of expenditures on various farm inputs and, consequently, farm incomes remain subject to substantial measurement error. Nonetheless, most researchers involved in rural data collection came away from the interviewing process with a keen appreciation for low incomes and uncertainties faced by the farm households they studied. Fifty per cent of rural agricultural households earned Rs 8,475 or less from the crops and animals they raised. But some households earned much more. So the average (mean) farm earnings were Rs 21,609. Analysis not included here shows that about 11 per cent of farms reported higher expenses than gross farm income and, thus, suffered a net loss in agriculture for the year. Farm income depends on land and water. Large farms have good incomes. Irrigation typically doubles a farm's income mainly because irrigated farms are more often with multiple cropped (80 per cent) than un-irrigated farms. The benefits from irrigation are even greater for large farmers. Almost all types of farm incomes increase with land size and irrigation. Crop, crop residue, animal, and rental incomes all grow with more land and greater access to water. Expenses, also, are greater in large irrigated farms, but these are generally offset by the larger gross incomes. Yields per hectare, however decline with farm size. Small farms—especially small, irrigated farms—are more intensively cultivated. Farm size and access to irrigation vary across India farm incomes show enormous state wise variations. As well known, farms in Punjab and Haryana are more prosperous than elsewhere in India. The typical farm in Punjab or Haryana earns four to six times the national median. Farmers in Jharkhand and Odisha and more surprisingly in Andhra Pradesh and Karnataka are far less prosperous. The advantaged groups have higher agricultural incomes. The average farm with a college graduate adult has earnings three times from agriculture than a farm with only illiterate adults earns. The different ways in which a variety of inequalities such as in access to land, irrigation, mechanization, and geographic location contribute to large inequalities in agricultural incomes between different social groups.

### **Animal Husbandry**

Most rural farming households (80 per cent) own animals. Quarters (24 per cent) of rural households those do not cultivate any land. These people keep animals that produce income with milch cows or buffaloes dominate animal ownership. The importance of animals for farm production varies widely across India. Animal ownership is almost universal on cultivation in the hill states of the north. These farmers earn better than average income from animals, so animal income makes a significant portion of agricultural incomes. The rich states of Punjab and Haryana also have high rates of animal ownership. They earn extremely high returns on these animals, but as agriculture is productive there, the proportion of animal income is only slightly above average. Rajasthan has only slightly lower rates of animal ownership and average animal incomes, as the crop production is lower there. Here also animal income is important for Rajasthan farms. In contrast to the north-west, animal production is less common in the south. Returns here are very modest, so animal husbandry is relatively unimportant for farm incomes. In the east, animal ownership is fairly common, but returns from it are very low, so animal production is a small part of agricultural incomes.

### **Farm Inputs**

Now more Indian farmers are using modern farm inputs than ever before. More than half use chemical herbicides and a quarter have irrigation pumps. Tractors are still uncommon (4 per cent of Indian farms) but in Punjab almost half (43 per cent) of the farms own their own tractor. The spread of these modern inputs is very uneven. Large farmers are far more likely to use these modern inputs than ever before. Large farmers are far more likely to use these modern inputs than small farms. Moreover, farmers that have irrigation also appear to have access to other modern inputs. For example, two-thirds of irrigated farmers use herbicides, compared with only 28 per cent of no irrigated land. Over half (54 per cent) of farmers greater than five hectares own their own diesel or electric pump while only 8 per cent of farmers with less than a quarter hectare do. Consequently, the distribution of these inputs follows all the well established social and economic hierarchy. Wealthy farmers with educated adults, especially forward caste farmers or farmers belonging to households from minority religions are far more likely to use these modern inputs. All inputs are more common in Punjab. The typical cultivator in Jharkhand is unlikely to have any of these benefits. A higher level of village development seems to offer more opportunities for salaried work as well as work in business. While the need for a paradigmatic shift in the

growth strategy is well recognized, the transition from input intensive to sustainable farming has to address certain related issues such as (a) effects on productivity; (b) increased requirement for labour, skill and other inputs; and (c) effects on cost and return and hence on farmer's produce prices. In India the basic constraints are connected to cost of conversion, potential yield reduction and institutional support. In India the organic-conversion consequences could have serious repercussions for food security, livelihoods of marginal and small farmers as well as labour.

Among the various approaches to sustainable agriculture, is organic farming, which incorporates a holistic set of environmentally beneficial practices including the omission of synthetic chemicals, has received considerable attention now a day. In fact, today consumers are increasingly demanding 'environmentally-friendly' and healthy food. A survey of about 200 projects in developing countries in which contemporary organic practices were introduced showed increase in average yield between 5 to 10 percent in irrigated crops and 50 to 100 percent in rain fed crops (Pretty and Hine 2001). Studies have shown that organic farms are less sensitive to climate fluctuations than conventional farms (Welsh, 1999; Drinkwater et al., 1998), and organic cropping reduces the variability in net returns (Helmert et al. 1986). Since organic farms are usually as profitable as conventional farming and less sensitive to climatic variability, the need for insurance payments should be reduced.

## II. THE CURRENT INDIAN PROSPECTIVE

The Indian government's policies have always been on emphasized food grain self-sufficiency, which has not necessarily coincided with agricultural sustainability. The growth of agricultural production and productivity, which had risen significantly during 1970s and 1980s, declined during 1990s. These slowdowns have worsened since 2000; again overall agricultural production and food grains production have shown negative growth rates in 2000-01 to 2002-03 periods (GoI 2002). Decline in the growth rates of farm production and productivity is a serious issue considering the questions of food security, livelihood, and environmental sustainability.

**Land degradation:** Land degradation is one of the major impediments for Indian agriculture. By the early 1980s approximately 53 percent (173.6 million hectares) of India's geographical area had been considered degraded according to the Ministry of Agriculture (GoI, 2001a). Water logging affected about 6 percent of the cultivated area, while alkali and acidic soils both affected about 3 percent of country land. The major process of land degradation is soil erosion (due to water and wind erosion) that contributes to over 71 percent of the land degradation (GoI 2001a). Data compiled by the National Remote Sensing Agency (NRSA) indicated that 15 percent of India's total geographical land was comprised of degraded cultivatable wasteland (NRSA 2000). One third of this land was degraded by human activities, while nearly one half was degraded by a combination of human and natural causes (NRSA 2000). Chadha et al. (2004) found a negative and more significant relationship between land degradation and food grain productivity in both the 1980s and 1990s. Cultivation through irrigation, accounted for 83 percent of the total water use in the country during 1990 (Vyas 2003). During the Green Revolution period water consumption in agriculture rose sharply as the net irrigated area increased from 31.1 to 54.68 million hectares between 1970-71 and 2000-01, as the area irrigated more than once per year increased from 7.09 million to 20.46 million hectares during the same period. Groundwater, one of the India's major sources for irrigation, is being seriously depleted. The number of dark blocks (taluk or mandals), where groundwater extraction is more than 85 percent of the availability, increased from 253 to 428 out of over 5700 blocks between 1984-85 and 1998-99 (GoI 2002). The problem of groundwater depletion has also been reported from rain fed states like Andhra Pradesh, Karnataka, Rajasthan, Madhya Pradesh, Chhattisgarh and Gujarat.

### Fertilizer Application

The use of Fertilizer rose more than five-fold between 1970 and 2002 to 17360 thousand tonnes. Imbalanced proportioning of chemical nutrients is a major problem associated with fertilizer application in India. Pesticide consumption increased from 24.32 million tonnes in 1970-71 to 46.2 million tonnes in 1999-00, with a peak application of 75.42 million tonnes during 1988-89 (CSE 1999). High yielding seed varieties have lead to mono-cropping of certain grains reducing farmers' cropping flexibility and reducing farm biodiversity. Many farmers have shifted to organic farming either on their own accord or with support from NGOs and civil society groups. Farmers' motivations for shifting from intensive practices to organic practices are many. A survey conducted in Gujarat and Karnataka revealed that three factors influenced farmers' conversion to organic farming: (1) Environmental problems associated with intensive agriculture; (2) Institutional factors, such as NGOs intervention (3) Own initiatives by farmers owing to philosophical influence (Puttaswamaiah 2005).

### **Organic Farming**

Few empirical farm-level studies have been done in India to examine the productivity and profitability of organic farming as compared to “organic by default” or input-intensive conventional cultivation. In terms of cotton farming, field trials have been done by the Central Institute for Cotton Research (CICR), Nagpur. That suggest that during the first one or two years following conversion, yields were much smaller than control group non-organic yields; but in subsequent years yields were similar and even higher than non-organic yields (CICR 2000). The CICR report (2000) says that organic cultivation improved soil health, reduced environmental pollution and the cost of cultivation. The growth of organic farming is dependent on both international and domestic market development. Currently most of the Indian organic productions are sent for export. The domestic market consumes only 7.5 percent of the organic production (Garibay and Jyoti, 2003). However, the projected domestic organic market will increase by 49 percent by 2006-07 (1568 tonnes) over 2002 (1050 tonnes) (Garibay and Jyoti, 2003). The most important motivator for encouraging organic farming is to capitalize on the burgeoning global organic market, which was estimated at US\$ 23 billion in 2002, which is expected to grow over the medium term from 10 to 30 percent (Yussefi and Willer 2002, as quoted in Garibay and Jyoti 2003). There is a huge gap between the supply and demand of various organic products. The vast market opportunity, combined with high price premiums of organic products over conventional products, has attracted many developing countries, including India, to encourage organic farming.

### **Current partnership dynamics available**

Overall we require new partnerships revolve more around innovative processes than innovative products in Agricultural Sector. They are emerging at different levels of operation (Workshop 2 and Guérin, Plenary 2), they are as follows,

a) Financial services: funding, guarantees and dissemination whether a peasant organization or MFI, guarantees are necessary to access financial markets. The FOGAL (Fonds de Garanties pour l'Amérique Latine) was created precisely to meet this need (Necochea, Workshop 2). As created with support from the Belgian cooperation agency and European Commission, the fund is invested in a European bank and guarantees loans taken by actors in Bolivia, Equator and Peru, can be attempted in India also.

b) Non-financial services: technical assistance, information

The effectiveness of financial services sometimes depends on the non-financial services offered to improve agricultural production. One successful way to better support rural and agricultural populations is to create alliances with other actors (NGOs, governmental entities, peasant organizations, etc.) to set up complementary and supporting services like training and technical assistance (TA).

Training possibilities are endless, starting from management or financial advisory services to farmers to capacity building for elected representatives of MFIs. The agricultural package model of DECSI (Debit Credit and Savings Institution) applied in Ethiopia is an example of an institution offering TA, market information and producer networking services along with its financial services. The approach federates a variety of actors to help boost the development of activities financed. (Kiros, Workshop 2). This model can be adopted in India also.

c) Market access: processing and distribution channels

In recent years, linkages between the microfinance and agro-industrial sectors have become increasingly common, to consolidate the comparative advantages of each and encourage exchange.

· MFIs have the expertise, systems and technology required to sustainably provide a range of financial products for the farmers.

· Agro-industrial firms know the end-consumers, culture, prices, markets and production constraints. Sometimes, they already have input distribution networks in place (involving credit) with farmers.

Several initiatives aiming to strengthen interaction between these two sectors are underway. The objective is to build long-term relationships and reduce risk for the different actors: producers, borrowers, buyers and processors.

These partnerships come in different forms.

· Some focus on one link in the value chain like the partnerships between MFIs and storage facilities or MFIs and exporters.

· Others address the chain as a whole like Danone's business model in Bangladesh.

· Partnerships can be direct or indirect, i.e.: incited by a third party, such as an NGO, who plays the role of catalyst, facilitator and sometimes service provider.

There are recent examples of value chain actors are also playing the limited role of “virtual guarantor”, in which case a producer's mere association with a large buyer or processor, for instance, used as a sign of creditworthiness in the eyes of financial institutions. The value chain actor can also be directly involved in financial transactions, providing producers credit services, a more traditional approach (Gonzales-Vega, 2006) in India.

This approach was pioneered by the Caisse d'Épargne et de Crédit (CECO) of Côte d'Ivoire, MFI created in 1991 as on date with more than 5000 members. To limit its risks while guaranteeing rice and cashew nut producers' access to inputs and markets, CECO adopted the following strategy. The institution selects partners from profitable agricultural value chains that can contribute to the system and lend it credibility (input suppliers, service providers, processors, etc.). Borrowers need not have direct access to credit but any services and inputs provided by the partners are directly billed to CECO, which in turn reimburses the provider once the harvest is sold (Touré, Plenary 2) in this integrated production and commercialization model. The Grameen Danone Foods Ltd. Project in Bangladesh is an example of partnership between Grameen Bank and Danone (Ardouin, Plenary 2), designed to produce and distribute yogurt locally, and incite local consumption of the product. Danone is responsible for building the factory and producing the yogurt. The MFI, Grameen Bank, facilitates financial access at two levels:

- Upstream, with milk producers who supply the factory, there by guaranteeing a stable supply for Danone, and downstream, with the women in charge of distributing (retail sales) of the product and creating a new commercial niche.

Access to credit by women is still a problem in India. Legal barriers and cultural norms may prevent them from holding bank accounts or entering into financial contracts, and they often control fewer assets normally required as loan collateral. Discrimination by lending institutions sometimes rations them out of the market or provides them with smaller loans than granted to men. This problem is exacerbated by women being overly represented in economic activities perceived to yield low profits or marketable surpluses in conditions like India.

### **Fair trade**

The fair trade model offers producers not only viable and predictable commercial channels for selling produce at reasonable prices that cover production costs (investment and labor), but also financial support. However, according to Cécile Lapenu (Plenary 1), this support does not fully satisfy the financial needs of fair trade producers: volumes are low, guarantees are insufficient, and management problems in peasant organizations are also recurrent. An alliance with the microfinance sector could help improve the supply of financial services to peasant organizations and their members. Coordination with MFIs can guarantee importers good management, enable a diversification of funding sources and help finance needs not covered in the fair trade relationship.

### **III. PROFESSIONAL AGRICULTURAL ORGANIZATIONS (PAOS)**

Strengthening partnerships between PAOs and MFIs is required. Here both parties to overcome a certain number of challenges, major are determining the type of governance structure to set up, given the diversity of actors involved. Regardless of the approach (territorial or according to activity), the challenge for MFIs is to adopt a governance style that enables all the stakeholders to meet on common ground. This needs an understanding of the differences between each group of stakeholders. PAOs and MFIs work with populations whose expectations and capacities differ. Moreover, within a group of PAOs, there are variations in terms of capacity to negotiate, interact with an MFI. Similarly, MFIs do not constitute a homogeneous group. It is also important that the governing stakeholders in these partnerships fully understand the risk of mission drift and find ways to ensure the MFI's long-term commitment to serving small producers. In this respect, a well-designed governance structure can help avoid abuse or infringement of the different stakeholders' rights.

Nevertheless, this "new" alliance is not taking the place of peasant organizations when it comes to providing agricultural finance. Some MFIs want to realize economies of scale by expanding into new markets. Improved efficiency can produce a win-win situation in which MFIs benefit through lower costs, higher profits and greater financial sustainability while clients benefit through lower interest rates, greater access for the poor who borrow small loans, and more access for rural clients located in distant locations. It has been difficult, however, to verify economies of scale in empirical studies. For example, Qayyum and Ahmad (no date) found there exist evidence of MFI economies of scale in Bangladesh, India and Pakistan. Zacharias (2008) studied the 2006 MIX Market database and concluded that on average larger MFIs appear to be more efficient. MFIs may obtain larger portfolios by making larger loans but this may conflict with their social mission and cause. On the other hand, Gonzalez (2007) studied a larger sample in the MIX database and found that scale explained cost differences for MFIs smaller than 2000 borrowers, but surprisingly not for larger MFIs. This suggested that the impact of loan size on decreasing operating costs may decrease as loan sizes grow. MFIs should evaluate their opportunities for improving costs and efficiency by making larger loans in existing urban markets versus expanding into new rural markets.

### **Awareness**

Equally important is the creation of awareness among the stakeholders. Risk mitigating mechanisms are required to deal with the systematic risks incurred in agricultural lending. Some experiments with weather index-based crop and livestock insurance are found promising but much support is needed to test and analyze alternative designs. Major investments are to be put to expand networks of weather stations, analyze the data collected, and develop actuarially sound insurance products.

### **Donor Support**

Branchless banking though has not proved to be a magic bullet; donor support for experimentation with alternative models may sometimes create innovations to effectively reduce the costs and risks of agricultural microcredit. Donor projects such as those of USAID in the Philippines and Columbia have been successful by 1) providing training and advisory support to regulatory authorities and governments to promote an understanding of and to build support for regulatory reforms needed for branchless banking, 2) jointly working with partner financial institutions to incorporate branchless banking within broader financial inclusion strategies, and 3) bringing together core elements from political, regulatory, financial and telecom sectors responsible for implementation of branchless banking initiatives (Stephens, 2011). Although MFIs conduct a great deal of monitoring and reporting, there is surprisingly needed robust evaluation of financial services. Recent studies using random control trials have stimulated soul searching by suggesting that previous evaluations tend to overstate the contribution of microcredit. Many fundamental questions remained unsolved such as client demand for and the appropriate design of services and products to meet demand.

Studying these questions requires thorough analysis. A larger proportion of the funds that international agencies spend on improving access to financial services need to be allocated to rigorous research about the relationship between finance and production, income distribution, empowerment and welfare.

## **IV. SUSTAINABLE AGRICULTURE**

Because sustainable agriculture cannot be achieved overnight, institution building takes on added significance. Many developing countries still do not have detailed information on the resource base; so the, data bases must be developed and techniques instituted to monitor resources. Likewise, a cadre of highly trained professionals backed by adequate facilities is needed to conduct effective resource inventories. Equally important is the creation of awareness. Sustainable agro-ecological practices tend to be relatively intensive in the use of labour. A full analysis of the economic attractiveness of sustainable technologies considering prospects for factor substitution requires reliance on cultivator household modeling (FHM). Farm household models explicitly consider complementarities between inputs and provide an analytical framework for simultaneous evaluation of production and substitution effects. Further extensions towards village-wide models also include market linkages and general equilibrium effects. FHM offers useful procedures for policy simulation, assessing farmers' supply response to different types of economic incentives.

### **Solution: Sustainable Development**

Sustainable development is an issue of social justice and social balance. It relates to intergenerational equity—the freedoms of future generations and those of present. The human development approach thus considers sustainability to be a matter of distributional equity, both within and across generations of the country. Rural infrastructure, especially roads and electricity, is another area in India. Building rural roads thus reduces transport costs, connects rural farmers to markets, allows workers to move more freely and promotes access to schools and health care clinics. Electrification in rural communities as in Guatemala and South Africa has helped increase employment among marginalized groups, same can implemented here.

Aspects of risk management should also be included in programming models and econometric procedures. Explicit appraisal of farmers' risk behaviour and coping strategies requires a separate treatment. Therefore, portfolio analysis should be used to assess the variability amongst different household income categories (farm, off-farm, and non-farm) and to identify major strategies for consumption smoothing. Consequently, due attention is to be given to linkages with non-agricultural sectors, and differences in supply response between food deficit and food surplus households can be accounted for.

Finally, for a comprehensive analysis of the sustainability implications of production technologies, bio-economic modeling can be recommended. Bio-economic models enable an appraisal of both current and alternative (more sustainable) technologies and their contribution to farmers' welfare and agro-ecological sustainability everywhere. Trade-offs between both objectives is to be established and policy instruments to enhance the adoption of sustainable practices should be identified. Reduced use of synthetic chemical inputs, biological pest control, use of organic manures, soil and water conservation practices, crop rotations, biological nitrogen fixation, etc., are all to be considered relevant and important technological components of sustainable

agriculture. But central to the concept of sustainability is the integration of these components as a systems framework at specified levels and to meet specified objectives.

Key elements of this new paradigm includes a broadened view of rural finance to include farming and rural non-farm activities, recognition of the importance of savings, plus a belief that market discipline is reinforced through market interest rates for both savings and credit. The focus of lending to be shifted from meeting supply targets to responding to demand, and the evaluation of financial institutions switched from loan disbursements to viability and sustainability. Here the success in finance depends upon favorable macroeconomic, agricultural and financial sector policies as well as appropriate legal frameworks. In India informal finance was accepted as complementary rather than usurious and harmful.

Because sustainable agriculture cannot be achieved overnight, institution building takes on added significance. Many developing countries like India still do not have accurate information on the resource base; consequently, data bases must be developed and techniques instituted to monitor resources. Likewise, a cadre of highly trained professionals backstopped by adequate facilities is needed to conduct effective resource inventories.

Although effective technologies that prevent or reduce farmers' land degradation either exist or are being developed, their application is still constrained by institutional and societal barriers. Lasting solutions should be rooted as much in social and economic reform as in effective technologies. In the article, the current prospects for institutionalizing development strategies for sustainable agriculture are unique challenges awaiting creative and committed solutions.

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