Sustainable Agricultural Development and Environment: Conflicts and Contradictions in the context of the Rwandan Agriculture.

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Abstract:

Sustainable agriculture involves not only the identification and application of improved technologies but the incorporation of ecological and socio-economic considerations. Inevitably conflicts and contradictions arise. This paper focuses on the inherent conflicts and contradictions which come in the way of operationalising the concept of sustainable development in the context of Rwandan agriculture. The importance of this paper emerges from the backdrop of the state, politics and society in Rwanda. As it is well known, conflicts in Rwandan society had its roots in agrarian issues. This paper, therefore, deals with the aspects of productivity and stability, sustainability and equitability. It is intended to stress upon the need for institutional changes that would take into account the organizational lapses in managing agribusiness in Rwanda. Self-help Groups and Co-operatives are found to be the most appropriate rural organizations in Rwanda as they can venture into an area where private sector and state are afraid of. Unless people's awareness, attitudes and perceptions towards environment are changed, sustainable agricultural practices as conceived in the present form appear to be a distant dream. The main factors that may be instrumental in changing the perceptions of the people towards environment and achieving the objectives of sustainable agricultural development are (i) literacy, (ii) market forces, (iii) technologies and (iv) institutional changes in terms of agrarian reforms.

Résumé

Une agriculture viable implique non seulement l'identification et l'application des technologies améliorées mais aussi l'intégration des considérations écologiques et socio-économiques. Néanmoins, des conflits et des contradictions surgissent inévitablement. Ce travail se concentre sur les conflicts et contradicttions inhérents qui surgissent au moment de l'application du concept du développement durable dans le contexte de l'agriculture au Rwanda. Il est bien connu que dans la société rwandaise, les conflits ont leurs racines dans les problèmes agraires Ce travail traite donc des aspects de productivité at de stabilité, de durabilité et d'équité. Il a pour objectif d'insister sur le besoin du changement institutionnel qui tiendrait compte des fautes d'organisation de la gestion de l'agribusiness. Des groupes et des coopératives de débrouillardise s'avèrent les organismes ruraux les plus appropriés au Rwanda d'autant plus qu'ils peuvent oser *s'aventurer dans un secteur où le secteur privé et l'état ont peur* d'aller. *À moins que la conscience, les attitudes et les perceptions des personnes envers l'environnement soient changées, les pratiques agricoles durables comme conçues sous forme actuelle semblent être un rêve. Les facteurs importants pouvant conduire au changement des perceptions des personnes sur l'environnement et dans le but d'atteindre les objectifs du développement agricole soutenable sont : (i) éducation, (ii) des forces du marché, (iii) des technologies agricoles (iv) des changements institutionnels en termes de réformes agraires.*

1. Introduction

Agricultural sector is often at the centre of discussions due to the obvious environmental problems associated with farming activities apart from being the dominant sector in the developing countries. In recent years in Rwanda the concern for environment is widely expressed. However, the spurt in the environmental awareness in Rwanda is partly induced by donor agencies from developed countries but mainly through local NGOs. At the same time the government in Rwanda is continuously under pressure to work towards poverty alleviation and struggling to grapple with the problem of trade off between development and environment. Though environmental protection and economic development are compatible on a theoretical plain, in practice a trade off exists between them which is more so in the context of Rwanda which is presently striving to achieve high growth rates in order to attain better standards of living. The sustainable development paradigm is expected to be not only economically viable but also environmentally friendly (as it argues in favour of low energy, low input intensive production process). The popular definition of sustainable development has been the one adopted by World Commission on Environment and Development (WCED). According to this definition "sustainable development is development that meets the needs of present without compromising the ability of future generations to meet their own needs" (Bruntland G.H 1987). Thus, the paradigm of sustainable development incorporates environmental sustainability on the one hand and economic sustainability on the other. But one needs to understand the meaning of sustainable development in the context of Rwanda as the level of socio-political and economic development differs widely in this country. Unless these dimensions are taken into account, the weaknesses and contradictions of sustainable development come into force. The major obstacle in this regard is time span i.e., gestation period, required to alleviate poverty and unemployment through sustainable development in an agriculturally dominant country like Rwanda. The low input sustainable agriculture is less productive and less profitable compared to conventional technologies (i.e., high chemical fertilizer intensive technology). Hence, further improvements are needed to make non-conventional technologies more competitive and more adoptable. The pertinent question is whether Rwanda can afford to neglect the present demands of the poor in pursuance of better future. *Prima facie* the political economy of Rwanda does not allow this. However, Rwanda should not be oblivious to its own environmental degradation.

The lopsided development policies of the past have resulted in degraded soils, depletion of water tables, increased floods, water-logging and salinity, loss of bio- diversity etc. The environmental problems of Rwanda include high population density, declining soil fertility, over-grazing, increasing soil erosion, limited fuel-wood supplies, droughts and loss of

protected areas. The post-genocide social issues of mass resettlement of displaced people and returnees, and a high population growth rate compound all of these problems (DFID 2000). The route out of poverty envisaged by the Poverty Reduction Strategy Paper (PRSP) includes the intensification and commercialisation of agriculture, and its extensification into the few remaining areas of undeveloped land such as the marshlands in the numerous valley bottoms. The planned intensification of agriculture (introduction of pesticides and inorganic fertilizers) will put further pressure on land resources and the broader environment. It is therefore vital that the PRSP should reflect this delicate situation and emphasise the need for sustainability of development (DFID 2000).

The recovery of agriculture after 1995 was uneven, as farmers returned to their lands; legal conflicts were partially resolved and labour migration revived. However, the problem of post-conflict rehabilitation, and agricultural policy more generally, was not merely one of restoring production levels and institutions to their pre-war status quo. Long-term solutions require a reorganization of the entire agricultural production system. That conflict tends to be closely associated with low levels of development combined with inequity and competition over scarce resources points to an obvious conclusion: Rwanda should seek to promote growth that is both rapid and inclusive. If the bases for growth are to be created through measures aimed at macroeconomic stabilization and reform, the challenge is to manage such measures in a manner that contains social stress and reduces, or at least does not accentuate, inequities. Sustainable agriculture involves not only the identification and application of improved technologies but also the incorporation of ecological and socio-economic considerations. Inevitably conflicts and contradictions arise. This paper focuses on the inherent conflicts and contradictions that come in the way of operationalising the concept of sustainable development in the context of Rwandan Agriculture. Data for this paper was drawn mainly from a national study conducted by OSSREA Rwanda Chapter (of which the present author was a member) on PRSP (Republic of Rwanda 2001b). Both primary and secondary data are used in addition to author's personal observations and perceptions. In the following section the concept of sustainable agriculture as perceived in this paper is presented.

2. Properties of sustainable agro-eco systems.

The objectives of sustainable agricultural development can be grouped as under (Conway et al. 1987):

1. *Productivity* enhancement in terms of yields or net earnings.
2. *Stability* measured in terms of variability around average yield or net income.
3. *Equitability* assessed in terms of income distribution.
4. *Sustainability,* which is difficult to measure in quantity terms.

These properties of sustainable development cannot be maintained at an equal scale and often lead to trade off between these objectives. For instance, productivity or stability can be achieved while sustainability or equitability may not at the same time and vice versa. The intensive agricultural technologies appear to answer food security but they are associated with low sustainability and low equitability (Redclift 1992). If one goes for equitability then he has to forgo productivity. If one forgoes productivity it fails to tackle the short-run food requirements in Rwanda. Even if food requirements are taken care of by imports sacrificing productivity does not come easily without interventions in social dynamics. For example, the grass roots level adoptability of the low input sustainable agriculture technologies largely depends on economics of technology and this implies that all the objectives of sustainability cannot be achieved simultaneously as a rule and hence trade-offs are inescapable (Tisdell 1988).

It is noted that the increase in agricultural production in many areas was due to increase in fertilizer consumption with increasing soil salinisation and pollution. Many countries claiming green revolution (e.g. India) had this trade-off. Often development and ecological concern are viewed as conflicting goals. Unfortunately, many of Rwanda's poorest small holders live in relatively remote areas, poorly served by infrastructure, financial institutions, or public services and faced with poor terms of trade. As Reardon et al. pointed out in their (farmer's) daily struggle against food insecurity and poverty, the capital-led path to sustainable agricultural intensification remains inaccessible, often leading to a vicious circle of immiseration and environmental degradation (Reardon et al. 1999). Besides social dynamics, agrarian structure, technologies etc. are not given due consideration in the debate of sustainable agriculture development in Rwanda. As Clay and Reardon observed the triple challenge of rapid population growth, declining agricultural productivity, and natural resource degradation are not isolated from one another; they are intimately related (Clay, and Reardon 1998). The issues that need further discussion in this context include (i) awareness and attitudes of the people at the grass root level towards environment and sustainability, (ii) sustainability within agriculturally developed regions vis-à-vis fragile resource regions, and (iii) role of technology and its relevance in working towards environmental protection and sustainable agriculture. This paper is organized on the lines of properties of sustainable agro-eco systems suggested by Conway. Accordingly, the sections that follow deal with the aspects of productivity and stability, sustainability and equitability. Following that a section on the arguments in favour of self-help groups/ co-operatives for sustainable agriculture and agri-business development in Rwanda is presented. Some policy implications are stated in the concluding section. Before making an attempt to these a brief picture of the current status of

Rwanda's agriculture and environment is presented in the following section.

3. Status of Rwanda's agriculture and agricultural environment

Rwandan agriculture is essentially a rain-fed one. The rain-fed agriculture of Rwanda has been largely neglected over the years. This has resulted in aggravating inequalities and contributed to conflicts in the country. Besides this population explosion in the country has further increased pressure on natural resources like forests, mangroves, etc. Over and above, the failure to realize the link between poverty and environmental sustenance has further aggravated the problem. All these factors snowballed into major environmental problems like decline in forest cover, increased soil erosion, silting of reservoirs and lakes, decline in bio-diversity, etc.(See for a detailed account in Clay et al. 1995).

A survey by National Poverty Reduction Programme in Rwanda found that 90% of the working population in Rwanda are mainly employed in agriculture, including 23% of those working in urban areas, and that 89% of the working population are classified as self-employed or unpaid (typically family members working on the family farm). However, there is little recent evidence on what secondary activities are undertaken (Govt of Rwanda 2002).

The National Poverty Assessment (NPA) done in Rwanda under the auspices of National Poverty Reduction Programme found that people experienced low agricultural productivity, a lack of small and large livestock and therefore a lack of manure. A decline in soil fertility is widely reported. Agricultural extension and veterinary services are felt to be absent. The commercialisation of agriculture and the development of non-farm employment are felt to be restrained by the absence of market centres, price fluctuations, lack of credit, high bank interest rates, and absence of small and medium-scale enterprises (Govt. of Rwanda 2002). One of the main reasons why incomes in Rwanda have fallen since the mid-1980s is the decline in agricultural productivity (See Table 1). Whilst production of the main crops has largely been rising, the yields have often been falling. This implies that much of the production increases have been through expansion of cultivated area rather than through increased productivity.

Table 1: Trends in agricultural productivity and yields in Rwanda.

	1984	1989	1990	2000	1984	1989	1990	2000
	Prod	Prod	Prod	Prod	Yields	Yields	Yields	Yields
	(tons)	(tons)	(tons)	(tons)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)
Bananas	1.00	1.13	1.06	0.82	1.00	0.89	0.81	0.72
Beans	1.00	0.82	0.80	0.84	1.00	0.92	0.82	0.71
Peas	1.00	0.93	0.65	0.82	1.00	0.77	0.57	1.35
Peanuts	1.00	0.67	0.57	1.04	1.00	0.47	0.47	0.89
Soya	1.00	2.07	4.62	1.58	1.00	0.69	1.14	0.40
Sorghum	1.00	0.74	0.83	0.91	1.00	0.84	1.07	0.79
Maize	1.00	0.84	0.86	0.56	1.00	1.02	0.94	0.80
Cassava	1.00	0.96	1.23	2.51	1.00	0.82	0.64	2.35
Potato	1.00	0.95	1.13	3.80	1.00	0.89	0.84	1.26
Sweet Potato	1.00	1.06	1.12	1.40	1.00	0.82	0.79	1.06
Coffee	1.00	0.76	1.15	0.45	1.00	0.62	0.88	n/a

SOURCE: Government of Rwanda. 2002. *Poverty Reduction Strategy Paper*, National Poverty Reduction Programme, Ministry of Finance and Economic Planning, June. Annex 2- Table 2.5

In order to transform their productivity, farmers need to have access to inputs. A recent study in Ruhengeri and Gisenyi provinces of Rwanda found that in four of the five zones covered, the availability of fertilisers was a constraint to agricultural productivity. The proportion of farmers using chemical fertilisers or lime fell from 7% to 5% between 1990 and 2000. A major constraint to the use of fertiliser is lack of knowledge: not that farmers do not know that fertiliser could be useful, but that they are not sure how to use it (Govt of Rwanda 2002).

The productivity of agricultural labour and incomes is also likely to be affected by HIV/AIDS as it is the active adult population, with the highest levels of farming skills, that is the most affected. (See Table 2 which presents selected indicators of living conditions in Rwanda). Recent data from the Household Living Conditions Survey (EICV) presents a picture of low levels of commercialisation in rural areas. Data on the imputed value of home consumption as a percentage of total household food consumption suggest that close to 2/3 of the monetary value of total food consumption in rural areas does not pass through markets.

Table 2: Selected indicators of living conditions in Rwanda

Indicators	Without land	< 0.2 hectares of land	Net primary enrolment	Distance from potable water source	Sick/injured in 2 weeks proceeding EICV	Days of sickness in 2 weeks proceeding EICV	Incidence of food poverty	Incidence of extreme poverty	Incidence of poverty	Gini co-efficient
Average for the country	11.5%	28.9%	72.6%	703m	25.5%	8.3	67.8%	41.6%	60.3%	0.451

SOURCE: Government of Rwanda. 2002. Poverty *Reduction Strategy Paper,* National Poverty Reduction Programme, Ministry of Finance and Economic Planning. June. Table-2.5.
Note: EICV= Household living conditions survey 2001

In addition to food crops, coffee and tea are grown by a significant number of households. The 1999 Census of producers shows that coffee is produced by about 400,000 small farmers (only 60% of the number before 1994); mostly in small stands of trees of which 20-25% is over 30 years old. Donovan et al. points out that Rwandan farmer has made radical shifts among crops between 1990 and 2001 as they observed greatest decrease in coffee and bananas while Irish-potatoes and cassava surged. They are of the opinion that the farmers are responding to pressure created by reduced availability of land per-capita, reduced prices and yields of selected crops, and availability of improved inputs and varieties in other crops (Donovan, Mpyisi, and Loveridge 2002). This indicates that if better systems to support agriculture are put to place, the farmers will respond with greater productivity.

In some cases, producers have received very low prices because of marketing problems. For instance potatoes, and more recently vegetables, in the northwest have exhibited serious price collapses. It is also likely that the poor state of the roads in some areas restricts competition, increases transporters' costs, and reduces producer prices. The EICV collected the data on producer prices and found substantial regional variation given the small size of the country. The closure of warehouses belonging to the public distribution company OPROVIA may be a factor for reducing the marketing potential of storable crops.

The most important asset for a poor rural household is land and the size and fertility of land holdings was one of the most important factors determining the categories of poverty into which households were classified in the NPA. Most, but not all, of the population have access to land, but in very limited amounts. The CWIQ (the Core Welfare Indicators Questionnaire) survey finds that 85% of rural households report that they own land, but the average holding is just 0.71 hectares and 95% of farmers farm 2 hectares or less (Govt. of Rwanda 2002). Rwanda has the lowest land to person ratio in the sub-Saharan Africa.

In addition to land, the primary importance of housing and livestock as assets and determinants of poverty is notable. There are a significant number of households without adequate housing. Livestock levels also fell dramatically during the genocide. The distribution of cattle also changed, with some larger herds entering the country in the north. The food security studies conducted by Save the Children Fund found that most households in all the areas they surveyed had lost much of their livestock. This is extremely serious for the farming system, because the use of manure is essential for preserving the fertility of the soil, and for preparing the soil structure for the use of chemical fertiliser. The use of organic inputs in farming declined from 95% to 69% of farmers, and from 70% to 57% of area, between 1990 and 2000 (Govt. of Rwanda 2002).

Environmental investments are declining in Rwanda. In addition to the reduction in the use of modern and traditional inputs, environmental practices also declined during the 1990s. The proportion of farms in the crop survey using conservation investments fell from 93% in 1990 to 65% in 2000, and the area covered by such investments fell from 76% to 65% (Govt of Rwanda 2002). Rwandan farmers are not following scientific practices in cultivation which leads to soil loss as identified by Clay and Lewis in their nation wide study (Clay, and Lewis 1996).

In Rwanda, the tradable sector that is immediately ready to expand is agriculture. Rwanda's agricultural growth was 0.5% in the 1980s and –3.9% in the 1990s. While the 1990s figure is affected by the genocide, these figures make it clear that slow agricultural growth was at the heart of the inadequate economic performance of the 1980s. This slow economic growth reflected a tight resource base, declining soil fertility and exceptionally low use of modern inputs. In order to reverse the decline, it is necessary to encourage changes in production techniques, including more use of inputs. The increased and better use of fertiliser is expected to contribute 4 percentage points of growth to the agricultural sector, resulting in an overall growth of 5.3 percent for the sector (Mellor 2001).

Agricultural investments and input use have not yet attained their pre-war levels. Without major increases in anti-erosion investments and use of fertilizers (both organic and inorganic), soil erosion and decline in soil fertility will continue to be major problems. The consequences are clear– low agricultural productivity, low rural incomes, and increased food insecurity throughout Rwanda. Results from the 2000A season agricultural survey suggest that post-war policies and investments have not yet resulted in measurable progress from a subsistence-based to a commercially oriented agricultural sector (Valerie et al. 2001)

In the light of their pre-war study findings Clay et al. concluded that the premier challenge facing parents, communities and government officials today will be to overcome inequalities rooted in the distribution of

landholdings by providing the nation's less endowed young men and women with the skills, access to credit, guidance and employment opportunities necessary to build a future beyond the encroaching hedgerows of their family inheritance (Clay, and Kampayana 1997). A recent study by NPA reaffirms increasing inequalities, since the mid-1980s, in the income distribution in Rwanda as the Gini-coefficient increasing from 0.27 to 0.455 (see Table 2).

It is important to incorporate the regional nature of agricultural production into any analysis of environment-conflict links in Rwanda. Farmers in the northwest were able to maintain higher productivity and to grow high value crops. Consequently, the situation in the northwest was less critical than that in the southern portion of the country (Percival, Homer-Dixon 1995). As Homer-Dixon argues the social effects of environmental scarcity like decreased agricultural potential, regional economic decline, population displacement, and the disruption of legitimized and authoritative institutions and social relations can produce and exacerbate conflict between groups (Homer-Dixon 1991). Therefore, an agriculture development policy which is not contributing to sustainable intensification of agriculture will in no way minimize the issues that confront the Rwandan economy. Having seen a brief picture of Rwandan agricultural environment, let us proceed to the specific issues/conflicts of sustainability within the Rwandan context.

4. Productivity and stability

Despite the fact that environmental protection/sustainability of agriculture and economic development are compatible on a theoretical plain, in practice a trade-off exists between them. This is more so in the context of developing countries, which are predominantly agricultural economies and are presently striving to achieve high growth rates in order to attain basic standards of living. The Rwandan agriculture has never been attempted to the high-tech agriculture by way of applying the HYV chemical fertilizer centred technology in a big way. The high-input technology did not, therefore, affect the environment as in some other developing countries. The Rwandan agriculture was basically subsistence agriculture in all these years and the efforts were not sufficient enough to break this low productivity syndrome. However, with the emphasis on pushing the new technology, as stated in the PRSP of the Govt. of Rwanda, the country's regional disparity may worsen further as the farmers in the less-endowed regions in the country may not be able to cope with that. They are constrained by market price distortions for both inputs and outputs, lack of public incentives (like public capital like roads, private capital like animal traction equipment, or community capital like small-scale irrigation), and their access to cash and information sources to purchase

inputs and acquire knowledge for the application of new technologies (like credit, extension etc).

But what then made the ecological havoc in the country? There are many answers to this question from different standpoints. However, one answer seems to be more prominent i.e. population explosion in the country increased the pressure on natural resources like forests, and other CPRs. While examining the impact of population pressure on poverty the following points need to be kept in mind. Even as population growth did contribute to the extension of area under cultivation, it is difficult to subscribe to an oversimplified view about the relationship between population growth and ecological degradation. If population growth had been anticipated and public investments could be stepped up to cope up with the consequences by augmenting the yield potential of the land resources already under the plough, eco-degradation would have been substantially less than what has been observed. On the other hand, if population growth could be contained substantially, there would have been a significant increase in per-capita income, and since the demand for milk, meat and timber etc is highly income elastic, the total demand for such products would have persisted resulting in eco-degradation in the absence of countervailing measures. With slower population growth, the area under plough would probably have been less but it is unlikely that this by itself would have made a notable difference to the overall state of environmental degradation. Eco-degradation should, therefore, be seen essentially as a consequential result of the failure to cope with the rising demand for food, fodder, fuel-wood and other forest products through necessary investments, technological changes and institutional arrangements for managing the resources.

In Rwanda where the growth of crop output has been less than or barely kept pace with population growth, the incomes of the poor would have not increased as bulk of the poor depend on subsistence cultivation. The persistence of rural poverty in Rwanda has exerted pressure on forest resources on two counts. Since the price of fuel-wood has been rising in the urban and semi urban areas, felling of trees became an attractive source of income for the rural poor. The only cost of felling the trees for them is the family labour time spent. In many cases the contractors and the middlemen protect them. Also, the persistence of poverty has reduced the opportunity cost of labour. In such situation they become a cheaper source of exploitation for the contractors who employ them for illegal felling of tress as well as their transportation.

The degradation of Rwandan rural environment arises from one major source- from deforestation and degradation of land on account of the loss of vegetative cover, resulting in low water table and loss of topsoil. These have a direct bearing on the productivity of soil, its vulnerability to rainfall

variations, scarcities of drinking water, fodder and fuel-wood causing hardships to the rural poor, particularly women and children. Another major source of environmental degradation which is not relevant at present in rural Rwanda, but relevant in many other countries where intensive cultivation is prominent, is the misapplication of yield increasing input like water, chemical fertilizers and pesticides, causing water-logging and salinity and pollution of drinking water, loss of fish etc. Of these two major sources, viz. deforestation and 'chemicalisation' of agriculture, the former constitutes a real threat to rural ecology in Rwanda. This is because Rwandan agriculture has been operating at the extensive margin and is far from reaching the intensive margin.

The link between poverty and environmental sustenance has further aggravated the problem. The development strategies pursued in Rwanda over the decades failed to reduce poverty to a significant extent. Over and above, the war and conflicts in 1990s worsened the situation. Without significant reduction in poverty there is no way of controlling the depleting the natural resources. This, in turn results in declining productivity and stability. The link between development and poverty alleviation portends the development dilemma. For, it is argued that a five to ten fold increase in economic activity, (i.e. growth rate required for poverty eradication), may impose an impossible burden on the eco-sphere. On the other hand, with out significant reduction in poverty there is no way of controlling the depleting natural resources (Roumasset 1990). Given the backwardness of Rwanda in terms of standards of living it is neither appropriate nor adequate to recommend a lower rate of growth. Though the growth strategies pursued presently are proving to be environmentally costly, the costs seem to be less important when compared to the immediate concerns of meeting the basic needs given the socio-political conditions in the Rwanda. All the same, the overriding conflict between poverty and environment appears to be somewhat overemphasized. For, the level of environmental degradation appears to be universal irrespective of the level of poverty and economic development. The only difference is the nature of environmental degradation- in some regions (developed countries) it is conspicuous in terms of industry and life style induced degradation in others (less developed countries) it is more in terms of natural resources depletion.

To the extent that agricultural stability is concerned, climatic factors also play an important role. The threat to agricultural sustainability is more obvious in Rwanda where rainfall is erratic. It may be noted that irrigation facilities are not yet all developed in Rwanda as only 0.4 percent of the cropland is irrigated (Republic of Rwanda 2001c).

In Rwanda the role of technology in the process of sustainable agricultural development (in terms on enhanced productivity and stability) is often been sidelined in the entire debate. The traditional technologies are

conducive for sustainable resource management under low pressure of demand, but they are becoming increasingly unfeasible and ineffective in the context of rising pressure on fragile land resources. The need for appropriate technologies for sustainable agricultural development ought to be analyzed from two angles. One is that the feasibility of the technologies at the operational level and other is regarding the relevance of high productive technologies for sustainable agriculture. At present the technologies that are most talked about for agricultural sustainability are low input intensive agriculture, organic farming or natural farming. Research elsewhere suggests that the low input sustainable agriculture is less productive and less profitable compared to conventional technologies (i.e. high chemical fertilizer intensive). Therefore, the feasibility of these farming practices depends on profitability at the farmer's level. In the prevailing conditions in Rwanda, the low input intensive farming system conflicts with other environmental aspects like afforestation. While ecological concerns require the conservation of forest lands, the low input sustainable agriculture technologies demand extensive cultivation practices in the light of increasing population pressure and resulting food demands. The new science and technology-based interventions have capacity to raise the intensity and productivity of land but they are generally indifferent to conservation considerations. Bio-technology, when developed to its full extent, may be of vital importance for sustainable agriculture in terms of productivity, stability and sustainability of the agro-systems.

It is seen that the conflicts and contradictions associated with productivity and stability aspects need to be addressed at the policy as well as technology levels. Environmental concerns have to find ample place in policy planning. It is important to realize that poverty and unemployment are not solely responsible for the current environmental problems and long run solutions can be sought by following environmentally sustainable path. Incorporation of ecological aspects into policy planning would largely depend on the awareness and attitudes of the people towards environment. As far as technologies are concerned, development of economically viable and environmentally friendly technologies would go a long way in achieving the objectives of productivity and stability.

5. Sustainability

Sustainable agriculture has been defined and interpreted in a number of ways. Even at the conceptual level it is difficult to avoid the conflicts between the present and future generation's interests. While needs are conceived differently from one environment and culture to another in the same generation, how future generations will conceive of their needs may be well beyond our imagination, although calculations may be based on some fixed standards involving what at present are conceived of basic human needs. As far as the sustainability aspect is concerned the debate

on sustainable agricultural development has often sidelined the two important aspects, namely, (i) the long-run (inter-generational) vis-à-vis short-run (intra-generational) impact of sustainable agricultural development, and (ii) the inter-regional variations in the level and process of sustainability and thus missing on socio ecological interactions.

The concept of sustainability has been under confusion with respect to the present day Rwandan society is concerned as it is very difficult to circumvent the conflicts between the present and future generation's interest. The basic needs of the majority Rwandese are not met; therefore the issues are of short run nature rather than of a long run nature. The issue is how we can look at sustainable agriculture when majority are living under sustainable livelihood. For an average Rwandese it is his daily bread and butter that is more important than to think of intergenerational issue of sustainability. Chambers (1987) argues that sustainable development can be achieved by securing livelihoods for the critical group of the very poor, which would result in stabilizing environment, enhancing productivity and establishing dynamic equilibrium of population and resources. According to him a solution is sought not through unproductive conservation but through development with a positive impact on livelihoods which, in turn, later sustainable. Short-term improvements in living thus create conditions later livelihood-intensive and sustainable human use of environment. These solutions hold good for the resource poor regions where majority of the population lives below the sustainable livelihood line. But what happens once the critical populations cross the sustainable livelihood line? Do they still continue to safeguard the long run sustainability of the system because they know very well that their survival depends on the sustenance of the agro-system? Or do they act in the fashion akin to their counterparts in the endowed regions, e.g., over-exploitation and misuse of natural resources which is prevalent in the developed regions. The experience indicates that they would go more in the way of their counterparts. In other words once livelihoods are stabilized in terms of soil rejuvenation, ground water replenishment etc. people tend to over exploit the natural system in order to reap the benefits in the short run.

Likewise, the environmental impact and sustainability question in the developed regions goes beyond attaining sustainable livelihoods. These regions are also facing severe environmental problems despite the fact that they have achieved higher and stabilized livelihoods. Also higher income levels are positively associated with environmental degradation even in poor countries like Rwanda. Therefore the question arises whether the improved livelihood patterns are sustainable in the long run once people cross the sustainable livelihood line? This is a contradiction in the broader context of intergenerational equity of the sustainable development paradigm.

The standing of various environments-physical, economic, social and policy- prevalent in Rwanda along with their level and process of sustainability is presented in Table 3.

Environmental problems are obvious in Rwanda. The rising population pressure has led to increasing dependence on land resulting in their degradation, denuded forests and depleted water sources. One finds in Rwanda that people's attitudes towards land to be caring mainly arise out of their high dependency on it. For, lack of irrigation and farm technologies makes them more vulnerable with very less control on the agro-eco system. However, once the country, which has great potential for conservation oriented technology and harnessing local resources judiciously, is equipped with appropriate technologies and gain control over year to year climatic variations with protective irrigation, it is unlikely that it would strive for long run (inter-generational) sustainability. Therefore, the vital link between livelihood patterns and development on one hand and environment and sustainability on the other is the awareness and attitudes of the people. These two factors cannot be achieved easily without other economic and institutional factors work for effective sustainable development. Awareness building among people and policy makers is an immediate requirement in Rwanda.

It is also important to recognize that the awareness generated through external forces like NGOs may not be sustainable and have limited influence given the gigantic nature of the problem. Therefore, there is a need for strengthening formal literacy programmes. In order to have effective impact the literacy programmes should be fostered with state policies with regard to market as well as non-market interventions. The market interventions include pricing policies, policies on subsidies etc. Unless pricing policies reflect the environmental concerns, it is difficult to change people's attitude towards environment. At the institutional level, the interventions are equally important in removing the distortions in land, labour and capital markets. For, agrarian structure and factor market distortions are observed to be the root causes of unsustainable development.

6. Equitable Sustainable development:

In Rwanda environmental scarcities became acute in the 1980s as an effect of soil degradation, continuing high population pressure, and inequitable land distribution. The resulting scarcity of arable land led to a high rate of rural unemployment, leading to dissatisfaction among the rural peasantry. It is pointed out that environmental scarcities not only influenced the strategies and tactics of political and military actors but also amplified the political violence (EDC 2001). The equity issues are often found conflicting with the development strategies and never been built with the policies or technologies in Rwanda.

Table 3: Status and process of sustainable agriculture in Rwanda

Physical Environment:
1. Degraded soil and salination.
2. Depleting natural resources like forests, marshland, CPRs due to population pressure.
3. Low input intensity in agriculture production (including irrigation).
4. Mountainous nature of the land is more prone to soil erosion as the country depends solely on rains for cultivation.
5. Lack of vegetation and in-situ moisture
Economic Environment:
1. Subsistence agriculture and low value crops.
2. Stagnant growth rates.
3. High level of un/underemployment
4. Low resource base of the rural community.
5. Product and factor market imperfections.
6. Low marketable surplus and low profits.
7. Low levels of living standards.
8. Poor provision of Basic Minimum Services and higher cost of acquiring them..
Social Environment:
1. Low level of social consumption like literacy, health, sanitation, drinking water etc.
2. Low level of political awareness.
3. Priority for survival in the short run.
4. Low level of environmental awareness.
Policy Environment:
1. Past policy makers neglected conservation oriented technologies.
2. Neglect and alienation by past rulers of local institutions like participatory process, community management etc. and local knowledge.
3. Lopsided development policies of the past with inappropriate technologies.
4. Neglect of agriculture and integrated rural development
5. Of late there is a realization among policy makers about the importance of sustainable overall growth.
Level and process of sustainability:
1. Some of the regions are at the bottom of the Sustainability index.

2. Generating awareness through formal education is an urgent requirement.
3. Appropriate policies in terms of technologies and institutions are needed in-order to enhance sustainability.
4. Generally, the country is at the bottom of the sustainability index, how ever there is the possibility of sustained growth.

SOURCE: Assimilated from Republic of Rwanda. 2001. *Poverty reduction policies relevance test: report of the study*. Ministry of finance and economic planning, National poverty reduction programme, OSSREA Rwanda Chapter. August.

This is more so because of the existing agrarian structure than to the technologies. Thus Rwanda's development has been somewhat lopsided. Poverty persists, illiteracy remains and environmental stress is increasing. What should it do for a more equitable, sustainable development? In order to tackle the equity issues one has to tackle the distortions in the agrarian structure first. However, little attention is paid to the issue of agrarian structure in the overall context of sustainable agriculture. In the light of the new economic policies it is apprehended that small farmers may become unviable as the market-centred system may not be effective in addressing their needs. The state should provide safety nets for these sections in the initial stages of the liberalisation process. Unless production systems serve the needs of small farmers and land-less they would not be sustainable even in the short run. Moreover, the equity aspects perceived in this fashion (agrarian structure changes) would go a long way in addressing the issues of unemployment and poverty. Thus the role of agrarian structure remains paramount in addressing the equity aspects of sustainable development.

It is useful to understand what really leads to environmental stress, if we are to find effective policies to stop it. Environmental problems arise mainly due to externalities. A farmer who misuses fertilizer would pollute ground water and a neighbouring water body. But the costs of such pollution are not borne by him. In a sense environment belongs to all and therefore, it belongs to no one. No one cares for it as no one can by herself care for it. This tragedy of commons (Hardin 1968) describes many situations. Many environmental problems arise because the property rights over environmental resources are not clearly defined. It should be noted that even well defined property rights is no guarantee that environmental problems will not arise. For example, farmers who own their land, often follow practices that degrade it. Poverty and ignorance may explain such behaviour. On the other hand monopolistic ownership of resources can also lead to their misuse from the society's viewpoint. Thus what is needed is not just well defined but appropriate property rights. Policies for environmental protection should attend to these externalities and ill defined property rights that lead to environmental problems.

Policies should internalise these externalities so that environmental costs of ones actions are borne by one.

It is recognised that along with the production of many economic goods are associated some environmental bads. Brundtland Commissions masterly draft (Brundtland 1987) defined sustainable development, as "development that meets the needs of the present without compromising the ability of the future generations to meet their own needs" which is hard to improve upon. However, one needs to go beyond it, to give it some operational content to guide our actions and policies. Thus Rwanda should develop in a way that preserves its environmental resources for the next generation. It should preserve its air quality, its water quality, its soil quality and its forests. The immediate concern as far as Rwanda is concerned is managing the land quality. We need to undertake land development activities; for shaping, levelling, contour-bunding and water harvesting works on water-shed basis. Such works could be undertaken as a part of Employment Guarantee Schemes as done in some countries like India. Similarly for other common property resources, such as village wood or pastures can be planted, protected and turned into lush forests in just a few years through propagating democratic management structures (such as Tree Growers Cooperative Societies). In all these we need understanding participation of people. This requires above all an educated population. So in Rwanda we need education, for skills, for equity, for health, and for reducing fertility.

7. Self-Help Groups/Co-operatives for sustainable agriculture and agri-business development in Rwanda.

If the environmental problems in Rwanda are to be handled properly, the starting point has to be a poverty eradication strategy that aims at improving the livelihoods and production conditions of the poor. The Government of Rwanda has framed an agricultural development strategy as well as a PRSP (Republic of Rwanda 1998; Govt. of Rwanda 2002). As far as the agricultural sector strategy is concerned (as envisaged in both the documents), it is a clear shift from the past approach of food self sufficiency towards greater market-orientation, underpinned by intensification in input use, diversification in agricultural production. This transformation is intended to be achieved by households operating small areas of land, but only if they are supported by energetic public action. Basically the Governments strategy thrust upon supply-side measures such as raising the average farm size, decreasing the person-to-land ratio, promoting access to fertilizer etc. However, the strategy is not that clear on two accounts. First, the demand-side factors did not get adequate attention as how to bring out increased market orientation by the millions of subsistence oriented peasants. Secondly, the operationalisation of the strategy calls for 'public action' which is not clear in its details (for a critique of Rwandan strategy for agricultural development see Jose 2001).

From the point of view of sustainable agriculture as perceived in this paper- productivity, stability, equitability and sustainability- the Government strategy has to be strengthened in its 'managerial' aspects as it is quite vague how to achieve the intended transformation in Rwandan agriculture. It is attempted in this section to suggest an approach to the operationalisation of the strategy.

The need for local institutions, and that too sustainable ones, has become increasingly important in the new environment of diminishing states and expanding markets, both locally, as well as, at the meso and macro levels. The local institutions are important for sustainable development as they not only mobilize local resources and regulate their use in the most efficient and sustainable manner, but also encourage people to take a longer term view by creating common expectations and a basis of cooperation that goes beyond individual interest (Uphoff 1992). The institutional issues of Rwandan agriculture are yet to address clearly as Bingen and Munyankusi observed in their recent study on farmer associations and decentralisation (Bingen, and Munyankusi 2002). Another study on Co-operatives in Rwanda by Rao and Ndagijimana ardently argue for revitalising the co-operative movement in the country as a panacea for poverty alleviation (Rao, and Ndagijimana 2001). Thus the following line of thinking, in tune with the success stories of agricultural co-operatives in Japan and South Korea, Sugar, Dairy and Credit co-operatives in India, is of relevance to Rwanda too. Recently the Ministry of local government and social affairs also understood the importance of revitalising community associations in the country (Republic of Rwanda 2001a). The action planning process initiated by the ministry aims to strengthen the concepts of local governance, accountability, transparency and empowerment at the community level. Its Butare pilot project highlights people's capacity at the grass roots level for problem analysis and strategy formulation and implementation if the appropriate environment is created through support and incentives.

The concepts of self-help groups and co-operatives are not new to development planners. It is the search for suitable organisations for doing agri-business in Rwandan rural areas, in the environment of diminishing state, leads one to think of emulating the success models from elsewhere. As at present no other mechanism found to be effective to get away from the subsistence agricultural practices in Rwanda. A SWOT analysis of the self-help groups/co-operatives (SHGs/CO-OPs) presented in Table 4 gives a brief idea of the present position of such organisations in Rwanda. It is seen that SHGs/CO-OPs have lot of opportunities in Rwanda especially in entrepreneurial development and in ushering 'green revolution' in Rwanda.

A self-help group can be defined as a set of persons with common interest and having interpersonal relations who agree to share risks and benefits

through self designed rules and reciprocity in behaviour. This implies that self-help groups can be formal or informal co-operative, a self evolved group or non-government organisation promoted group. Two most common self-help institutions, which are member based, are co-operatives and voluntary organisations. Which kind of local institution is the most desirable for sustainable development in Rwanda depends on factors like entrepreneurial traditions, extent of conflict with-in the group etc. The difference between the CBOs (community groups as visualised in the *community development policy* of the Republic of Rwanda 2001) and SHGs/CO-OPs as highlighted in the Appendix: Chart 1, is that SHGs/CO-OPs are viewed here in a holistic fashion doing integrated agri-businesses and community development with horizontal and vertical integration at all levels. As shown in the chart a multi-purpose co-operative on the one hand undertakes production, enables value-addition to the product produced, looks after marketing; and on the other hand takes care of household living by way of looking after all the basic minimum services that the rural household in need of. Business planning at enterprise level and service orientation at member level are only two sides of the same coin. Of course, these primary level societies organised at district level would have to have their vertical integration at province and at national level. At international level there are many co-operative support organisations led by International co-operative alliance so as to facilitate the growth of co-operatives.

However, the following factors are having substantial impact on group formation and sustainability as identified by Singh and Gain in their study on SHGs (Singh, and Gain 1997): (i). Some *felt need* for group formation and identification with the objective of group formation. (ii). Some sort of *homogeneity* among the members. (iii). Feeling *solidarity* among group members. (iv). Existence and evolution of *by-laws* rules and regulations and their *enforcement* by members themselves. (v). P*articipation* of all members and *democracy* in group functioning. (vi). Quality of *leadership,* and *transparency* in operations and functioning of groups. (vii). Substantial private net *benefits* from collective action vis-à-vis individual action.

To sum up, for sustainable development, the rural sector needs viable organisations that can blend new technology with local skills and resources. Only through developing appropriate integrated structures, value addition in rural produce could take place. Voluntary agencies like SHGs and CO-OPs have a definite edge over other forms of organisations in respect of equitable distribution of surplus. They ensure peoples' participation in decision making and arouse group consciousness towards activities that are key inputs to stimulate rural development process.

8. Conclusions

The conflict between economic development and environmental concerns seems to be crucial in the context of agricultural sustainability in Rwanda. Rwanda's agriculture is known for its stagnancy in terms of technology and limited in terms of resources. Lack of comprehensive or integrated understanding of these aspects both at the conceptual and operational levels makes the question of agricultural sustainability ambiguous. Unless people's awareness, attitudes and perception towards environment are changed, sustainable agricultural practices as conceived in the present form, appears to be a distant dream. The conservationist approach, which is being propagated presently, does not seem to appeal much at the operational level**.** The main factors that may be instrumental in changing the perceptions of the people towards environment and achieving the objectives of sustainable agricultural development are (i) literacy, (ii) market forces, (iii) technologies, and (iv) institutional changes in terms of agrarian reforms. Needless to say, conscious and concerted efforts should be made to incorporate environmental concerns into formal education.

Table 4: SWOT analysis of Self-help groups/Co-operatives under poverty reduction strategy programme in Rwanda.

Strengths	Weaknesses	Opportunities	Threats
• Strong values in tune with Rwandan ethos • The concept of economic democracy would make Rwandan democracy stronger • SHGs/CO-OPs have a predominant share in many segments. • Existence of wide net-work of NGOs for support. • Strong Governmental support	• Unsystematic functioning • Non-adherence of co-operative principles • Weak structure and poor resources • Member apathy • Absence of professionalism • Lack of innovation and enterprising in approach • Absence of horizontal and vertical linkages • Weak co-operative support/apex organisations • Use of obsolete technology and lack of value addition	• With strong values SHGs/CO-OPs can act as vehicle for socio-economic change • Entrepreneurship development • SHGs/CO-OPs can motivate for adoption of science and technology • SHGs/CO-OPs can manage natural resources for sustainable development • SHGs/CO-OPs can demonstrate concern for the environment • Breaking subsistence agricultural practices • Prospect for subsidiary employment generation • Persons with limited means can seek support of SHGs/CO-OPs • Fair distribution of economic power • SHGs/CO-OPs can influence market forces • Consumer protection • International co-operation and support	• Systemic and operational weaknesses • Lack of leadership • Legacy of war and Conflict. • Phobia about the success of co-operative.

This in turn helps in influencing the perception of political leaders and policy makers. Unless initiatives come from within the system environmental programmes promoted by donor agencies and some NGOs may not be sustainable. If not resources are valued/priced according to their real scarcity value, it would be unrealistic to think that individual rationality would go beyond households, let alone societies and nations. Another potential area that needs more concentration is the development of environment friendly and economically viable technologies. The available technologies at present seem to be missing on either productivity aspects or equity aspects. While the organic farming concept is unacceptable in Rwanda where meeting basic needs is on top of the agenda, the modern bio-technology is against the basic aspirations of equity concept. However, the later technologies can be altered and operationalised with the help of the required institutional changes. For, the inequities in the distribution of gains are attributed mainly to the existing agrarian structure, imperfect labour and capital markets. Unless these distortions are corrected equity cannot be addressed effectively under any circumstances be it new technology or strategies. Besides, the equity issues are directly related with people's awareness (education) which would bring the equity considerations into fore in development planning. Therefore, to recapitulate, human resource development should occupy the centre stage in the overall development. Here comes the importance of appropriate grass root level people's organisations like SHGs and CO-OPs as a panacea for managing sustainable development in Rwanda.

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Appendix: Chart 1. Model activities of a multi-purpose agri-business co-operative society