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PURSUIT OF SUSTAINABLE DEVELOPMENT: GLOBAL DEBATES AND LOCAL AGRICULTURAL MANAGEMENT SYSTEMS IN AFRICA

by

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PURSUIT OF SUSTAINABLE DEVELOPMENT: GLOBAL DEBATES AND LOCAL AGRICULTURAL MANAGEMENT SYSTEMS IN AFRICA'

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Concerns about sustainability have acquired center stage in the debate on economic development. Depending on the precise nature of the concern, sustainability issues are typically discussed either at the local or the global level. Yet interrelationships between global, national and local levels help define the problem more accurately and to identify solutions with regard to sustainability. Deliberations about systems for the management of sustainable agriculture in Africa must therefore be informed by the larger and at times cantankerous international debate on sustainability.

The Bruntland Commission's definition that development is sustainable when it meets the needs of the present generation without compromising the ability of the future generations to meet their needs is now universally accepted (see for instance FAO). Bequests to future generations have thus acquired importance (Norgaard). With high living standards in the industrial world, utility of income to current generations has declined relative to that of the environmental quality. In developing countries where incomes are low, understandably, the objective of survival and improving living standards receives greater weight. While some believe that sustainability will remain the major theme for several decades into the 21st century, others more skeptical (including

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some environmentalists) fear that sustainability will be "so abused as to be meaningless, as a device to straddle the ideological conflicts that pervade contemporary environmentalism."

This paper first considers the different ecological and economic views of sustainable development, and then examines those views in the context of Africa. Then, it explores their implications for government and donor policies. It stresses the central importance of increasing smallholder agricultural productivity for achieving sustainable development and makes a plea to (once again) give agriculture the importance that it requires.

Factors Influencing Global Debates and Donor Influences

The importance attached to sustainability does not only differ between countries at different income levels, but varies among and within disciplines. Physicists argue that the laws of thermodynamics impose real and foreseeable limits to growth resulting from absolute scarcities of factors of production. These laws place limits on the capacity of the environment to assimilate waste residuals from human activity (Batie). According to this view, laws of nature are more powerful than those of human beings. Knowledge cannot indefinitely expand the domain of human material progress at the expense of natural environments. Energy can neither be created nor destroyed. All consumption and production ultimately increases entropy and irrevocably diminishes future ability to use resources. This ecological view of irreversibility and instability of global systems is consistent with the views of classical economists at the local level. Malthus and Ricardo had stressed the consequences of fixed land and diminishing returns to agriculture in

' **As** quoted in E. T. York.

form of growing immizerisation of agricultural households. Malthus argued that population would tend to stabilize at a level natural resources could sustain. The classical economic view provided the intellectual basis for the industrial revolution in Europe and led early development economists (e.g., W. Arthur Lewis) to emphasize industrialization in developing countries as a way to grow out of the Matthusian trap. Ecologists fear (as classical economists did then) the consequences of rapid population growth.

Neoclassical economists on the other hand believe in unlimited scope for technical change to raise productivity of conventional factors of production. They argue that factor scarcities cause changes in relative factor prices. Furthermore, through human ingenuity, accumulation of knowledge, technical progress and the development of institutions, price changes continuously result in the search for new technologies and institutions (Schultz, Hayami and Ruttan). In the neoclassical view, population growth canbeanasse1prompting technical change, e.g. through the scarcity of land relative to labor. Population growth also fosters the development of factor and product markets there by causing economic growth (Boserup). Physicists spurn this neoclassical economic view as naive, They argue that it (inadvertently) leads to continued modes of behavior justified by greed (P. Smith). Elsewhere I have argued that induced technical change prompted by actor scarcities which neo classisists enshrine is not rapid enough in Africa to more than compensate for the adverse effects of population growth. A strong public policy is needed by African governments to foster the development and adoption of modern technology in agriculture, a public good in least developed countries (Lele and Stone),All too often research policy is not effective. Neoclassical economists have few explanations for the pervasive failure of the state to provide public goods.

Global concerns about sustainability influence donor views, aid levels and police conditionality with respect to developing countries. They thereby indirectly Influence developing country policies, investments and institutions. Nearly 70 to 80 percent o government expenditures in several African countries come from external aid (Lele). How donors view sustainability in the particular context of Africa therefore has an important influence on African policies and the rate of technical change in African agriculture as well as providing a new, refreshing input into the global debate. Africa is not only highly dependent on foreign aid; that dependence has been growing in the last decade with the (increased incidence of chronic hunger, frequent famines, high rates of infant and child mortality and low life expectancy. All these factors lend great urgency to the survival of the present generation as a way to ensure future sustainability.

National Policy and Local Development

Because environment, poverty and population growth are linked in least developed countries national policies and local initiatives and capability are equally important. They determine growth and equity outcomes as well as determining the quality of the environment, and the size and quality of the population. The African continent has been experiencing decline in per capita incomes for two successive decades, in part due to the failure of its agricultural sectors. Rapid population growth has caused the extension of production into marginal (forestry and pasture) lands unsuited to cultivation, leading to a reduction in the fallow period, increasing deforestation, reducing soil fertility and causing diminishing returns a la Malthus.

Interrelations of Energy Use. Income Level, and Sustainability

Environmental degradation is also directly related to the nature and level of energy use which is related to income level per capita. Countries at high and low levels of per capita income use very different levels of energy per capita and cause different forms of environmental degradation. Per capita energy use in the United States is 40 times that in India or Africa (K. Smith). Thus a small proportional dedine in the use of energy in the industrial world means a large absolute decline in the total world energy use. By commanding greater use of energy, the industrial world also contributes proportionately more to the emission of carbon dioxide believed to cause global warming. Kirk Smith points out that the rapid economic growth in the U.S. over the past several decades has resulted in a large natural debt (K. Smith). This global distributional dimension of the growth of energy use in developing countries is frequently overlooked by some ecologists in the industrial world who exercise influence on public opinion and indirectly the content of foreign aid (see for instance arguments contained in Avery, P. Smith).

Unlike in the U.S., populations in developing countries rely largely on biomass rather than fossil fuels for their energy requirements, making demands on the plant and forestry resources for food and fuel wood, contributing further to deforestation, soi erosion and the loss of soil fertility, despite their low level of energy use. Only 3% of the overall energy use in the world is estimated to be deployed in the agricultural sector (Mudahar and Hignett). Since developing countries use far less energy input in agriculture than their developed counterparts, the developing country share of the energy use in the total agricultural sector is thus minuscule, and Africa's share is smaller still.

Moreover, moving up what Kirk Smith terms the "energy ladder", i.e., from renewable to other cleaner forms of is inevitable for them in the course of their economic

economic development. The environmental issues in the agriculture of developing countries therefore relate primarily to shifting patterns of energy consumption, increasing agriculture productivity and incomes and bringing down the rate of growth of population. In contrast Issues at the center stage in developed countries Include preservation of biodiversity containment of the greenhouse gases to reverse the trend in global warming, ,protection of water quality and marine life from run-offs of chemicals, pesticides, and animal waste associated with the high input/high output agriculture, and conservation of resources such as coal and oil. With industrialization, urbanization and increased use of capital also arise a different set of modem risks, e.g. the growing incidence of cancer (K .Smith). Transposition of such developed country environmental problems to

developing countries is a pervasive problem in the international environmental debate

The extreme and growing disparities in energy use on the other hand explain in part the different weights attached by developed and developing countries to the issues of income growth and environmental protection referred to earlier. To acknowledge the difference in the level of energy use is not to deny that developing countries are a majo contributor to the reduction of biodiversity, nor that they face problems of inadequate handling of the growing use of chemicals and pesticides. Rather these latter problems are often a symptom of rapid population growth, slow or no growth in factor productivity and incomes, inadequate development of human and organizational capital, and lack of regulatory mechanisms to deal with risks of modernization. Moreover, a lack of alternative technologies to increase productivity and incomes makes it often both tempting and expeditious for developing countries to follow the conventional route to economic development as we will show below, with profound implications for organization and application of research and technology.

Productivity and Sustainability

It is now important to explore the relationship between productivity and sustainability. Rapid growth in agricultural productivity reduces the amount of land needed to generate food and allows a regeneration of forests and pastures. For instance, in the western world land has reverted to forests due to the increased productivity of agriculture, and reduction in the population engaged in agriculture. Through effective public policy, Asian countries too have modernized their agriculture by the increased use of chemical fertilizers (the use of which increased tenfold from 1975 to 1985), irrigation and high-yielding varieties. Increase in food production eliminated widespread hunger and famine and relieved population pressure on the land, although more effective public policies would have enabled greater effect of the Green Revolution on reducing poverty, decelerating population growth and improving the environment in South Asia than occurred.

Productivity and income growth cause a demographic transition, i.e. it reduces human fertility rates via the positive effects on the health of women, and on infant and child survival. Without income increases, absence of a demographic transition further raises the danger of the ecological disaster which some ecologists fear (see Avery, P. Smith). To generate productivity increase, however, requires greater use of energy per capita, e.g., in the form of chemical fertilizers and transportation. It also means a shift from wood energy to fossil fuels

Environmental concerns in the industrial world, however, undermine the popular support for increased energy use in the developing world, for example, the increased use of chemical fertilizers. Where as aid could finance fertilizer imports in developing countries strapped for foreign exchange, resistance to such financing arises notwithstanding low

energy input in developing country agriculture, as well as the low level of energy used in the production of some plant nutrients. For example, phosphorous and potash fertilizers and other micro nutrients often needed in African soils, use much less energy in their production compared to nitrogenous fertilizers (Mudahar and Hignett).

Potential for Sustainable African Solutions

Concerns for Productivity Growth

While there is strong agreement in general terms on the need to increase factor productivity in least developed countries, there is little agreement on the prospects or the means to achieve it in Africa, including especially intertemporal trade-offs between productivity growth, population growth, and protection of the environment: issues on which donors exercise an important influence.

To illustrate, in its long-term perspective study on Africa, the World Bank has projected that the rate of growth of agricultural production would need to increase from the present 2.5% to 4% annually, simply to maintain the present low levels of per capita incomes in view of the rapidly growing population. Considerable concern, however, exists among experts on African agriculture as to whether this rate of growth of production is achievable at present levels of technology for arid and semi- arid areas (See for instance FAO and Lele, Christiansen and Kadiresan). Notwithstanding some structural adjustment since the early 80s, the policy, institutional, organizational and human capital base is simply too weak in Africa to engineer an overall long-term 4% rate of growth in agricultural production, although improvement can occur in selected areas of high physical potential.

Unlike in the case of the Green Revolution in Asia which had an overall impact on food productivity and supply, dramatic new technologies do not exist to accelerate the rate of growth of food production in Africa.

Role of Research. Investment In Human Capital and Productivity Growth

The problem of productivity growth is further complicated in Africa by the fact that whereas in India and elsewhere in Asia the relationship of use of modern chemical inputs to production was well established through sound empirical research, such information in typically lacking in Africa. In India, local information helped to fine-tune technical packages, to establish priorities for fertilizer and other input distribution, and to assess the response of rural households to the introduction of modern technology. Major productivity increases are typically brought about by injection of scientific knowledge from outside the local system, requiring considerable centralized investment in scientific research together with a keen knowledge of local growing circumstances. Modern research requires a large overhead of institutional and human capital of a nature and scale local organizations are unable to finance. Research is a classic public good. However, it is often woefully missing in Africa, especially when quality rather than the quantity of financial resources expended is considered (Leie and Goldsmith).

In their enthusiasm for increasing the adaptive nature of research, (for example through farming systems research), donors and governments have frequently overlooked the scientific content of the adaptive research. Adaptive research is often relegated toll-suited and ill-equipped agricultural extension systems, which are under ever more pressure to generate "new" technical packages based on old local practices.

African Research and Data

It should not be surprising that under these circumstances the data and information on local resources and responses to the use of modern inputs are often weak and unreliable in Africa. Yet, climatic variability and antecedent high risks place particularly high demands on the precision and probability distribution of the responses as well as on the human and organizational capacity to obtain it, capacity which is frequently lacking. A substantial review of the existing data on response coefficients by agencies such as the FAO, IFDC, the World Bank and the national and regional research systems carried ou tas part of the MADIA study led researchers to conclude that "unfortunately these sources often fail to specify the production function, so it is difficult to ascertain whether a coefficient is a marginal or an average value, the sources do not provide a probability distribution of the benefits of fertilizer use in an environment of high inter and intra-year rainfall variability, or rarely specify the variety of seeds used or the soil types and do not consider the implications of the gap between on-station and on-farm conditions such as the practice of sole vs. mixed cropping, the quality of land preparation, the extent of weeding, the type, mix or rate of fertilizer application or the timeliness of planting. Therefore it is often difficult to interpret the available data" (Lele, Christiansen and Kadiresan, pp. 36-7)

African Input Use

In addition to these problems of research and data, an even more serious problem is that the very approach to accelerating agricultural production through scientific research and the use of modern (biological, chemical and hydrological) technology, which constituted the foundation of the agricultural revolutions in Asia and earlier in Europe and

North America) has been brought into question by concerns about environmental sustainability. Popular resistance to conventional plant breeding technologies which Asian countries experienced earlier now also extends to the use of biotechnology Environmentalists decry the growth of nutrient use associated with the Green Revolution technology in Asia (Avery). Promoters of biotechnology argue that it can save use of chemicals by introducing insect and disease resistance among plants and animals (Collison and Wright, Herdt).

Reflecting the technology pessimism, the application of nutrients per ha. was only 20 kg in Africa compared to 226 kg in Western Europe and 85 kg per ha. in North America and Asia (Table 1). Whereas the per ha. use of nutrients more than tripled in Asia between 1970 and 1985 it only doubled in Africa. Thus Africa's share of nutrient use declined over time from its already low level. It is likely that this use has declined further since 1985 as a result of structural adjustment.

Table 1 Fertilizer Use Per Hectare of Arable Land

Region	1970	1975	1980	1985
	Kilogram* of nutrient/hectare			
Africa	**10**	**13**	**18**	**20**
Latin America	**20**	**29**	**44**	**41**
Oceanic	**34**	**29**	**36**	**32**
Developing Countries	**18**	**27**	**49**	**58**
Asia	**26**	**37**	**68**	**85**
North America	**70**	**87**	**99**	**85**
Western Europe	**176**	**188**	**221**	**226**
World	**49**	**63**	**80**	**87**

Sourer: FAO, Fertilizer Yearbook, 1866.

Whereas macroeconomic reforms are essential to resuscitate growth, in the short run devaluations and reduction of subsidies have increased the price of imported fertilizers and reduced consumption. Continued high level of protection of agriculture in industrial countries results in overapplication of inputs beyond levels that would be economically optimum at undistorted world market prices. Opposite is the case in developing countries. If protectionist policies continue in OECD countries, together with liberalization

in developing countries, it will cause immizerisation of developing countries through continued dumping of products from industrial countries as well as by unfair competition in third markets. In several developing countries, abolition of the public distribution agencies has already caused a collapse of the input distribution systems. Privatization has not proceeded at the pace expected. Small and undeveloped markets for nutrients and variability in the demand for inputs increases risks to the private suppliers. Elsewhere I have documented the inability of low income rural households to afford fertilizers, stressing the need for the use of selective subsidies and public distribution systems targeted specifically to these households to address the problems of food security. Colleagues and I have also stressed the need for long-term import support for fertilizers by donors as a way of increasing the use of modern inputs in African agriculture and accompanying it with a carefully devised technology development and dissemination program such as that provided to India in the mid-1960s (Lele, Christiansen, Kadiresan; Lele and Goldsmith). Without a consistent long-term agricultural development strategy, it is unlikely that programs addressed to a single set of concerns, e.g. sustainability, will solve the problem.

The Allocation of Limited Resources

Another important issue with regard to sustainable management systems of agriculture relates to regional priorities in the promotion of agricultural production as it should and does in practice relate to regional comparative advantage. Concerns about regional equity have led African governments and their donor supporters to overlook the fact that physical potential to achieve production and productivity growth is greater in some regions than in others. Physical resources and transportation costs jointly determine economic advantage. Whereas for welfare and political reasons it might be justifiable to expend investment resources in a given region, that region would not necessarily be the priority if the objective is to increase production based on technological and economic considerations. Investment in transportation in Africa could further change the internal comparative advantage by reducing transport costs. This would make the African production more competitive vis-a-vis OECD countries. Yet in their war on poverty in the 1970s donors tended to finance projects in areas where there was little physical or economic scope for increasing agricultural production without an overall long-term development strategy. This approach contributed little to productivity growth and (inadvertently) placed greater burden on the environment (Lele). Strong national policies are needed to achieve productivity growth in the regions where it is physically and economically possible, together with social welfare, distribution and migration policies for regions where resources cannot sustain larger populations. This requires investment in transport, communications, organization and human capital to integrate regions of high and low agricultural potential as well as pricing, subsidy and food distribution policies to achieve growth while ensuring distribution. Without a strong

increase in productivity other development goals of increasing access to education, nutrition and village water supply are not economically sustainable as the example of Tanzania in the 1970s illustrates well.

By the same token resource-poor regions in Africa do not have to be economically poor provided appropriate macro policies are pursued, Including investment in human capital. The examples of Switzerland and Japan demonstrate that, even with few natural resources, it is possible to achieve high incomes with abundant human capital and good economic policies.

Policy Questions

Has Productivity Suffered at the Hands of Sustainability?

Achieving the objectives of growth, distribution and environmental sustainability requires strong political, economic and technological consensus and a political and administrative commitment to implement policies, including in particular achieving a balance between national policies and local developmental concerns.

Several influential analysts and policy advisors to the international donor community on the agricultural and rural scene have noted, however, that increasing the productivity of smallholder agriculture (defined in the broadest sense to include livestock, forestry and fisheries in addition to crops) has become a subsidiary priority among donors, (Paarlberg and Upton, Schuh) in relation to other objectives including the environment. Notwith-standing the rhetorical support being accorded to agriculture donors are not helping African countries to make the necessary investments in the agricultural and rural sectors and to form long-term strategies to achieve rapid and sustainable development (Lele). Fearful of losing support of their constituencies which determine the size and allocation

of external aid, donor agencies have avoided exploring the amorphous concepts of sustainable agriculture and especially the intertemporal trade-offs among the different objectives of productivity growth, population growth and environmental sustainability, and their implications for aid policy. A bandwagon effect has been in operation on aid to Africa with wide swings from basic needs, to macro policy reform, to women in development, social dimensions of adjustment, food security, privatization, export promotion, capacity building, governance, and on and on.

Exploration of these issues is critical, but strategic priorities will have to be established to achieve technological investment, organization and human capital development needed to develop sustainable systems of agricultural management in Africa Without strategic priorities it is unlikely that prospects for sustainable agriculture will improve.

The need to establish strategic priorities must not be lost sight of in the preoccupation with the adverse consequences of macroeconomic policies on the misallocation of factors of production. These are by now well recognized and not elaborated here. For example, overvalued exchange rates and other implicit and expliciit forms of taxation of agriculture depresses production. Indiscriminate subsidies on fertilizers result in their overuse and inappropriate application, etc. Similarly, land policies biased in favor of large farmers in some countries are leading to the crowding of the population on a limited amount of land, increasing poverty and reducing the ability of pool households to bear the risk associated with innovation with modern technology, etc (Lele).

Can Economic Sustainability be Ecologically Sustalnable?

Since ecologists fear the infeasibility of extending the current high levels of per capita energy use in developed countries to developing countries on grounds of global Sustainability, the controversial question about the so-called "alternative agriculture" is nowworth exploring. Alternative agriculture is a phrase often used to describe low input and presumably high output agriculture involving the whole farm (or the farming systems) approach compared to the denigrated conventional high input/high output commodity based agriculture. The prestigious National Research Council of the National Academy of Sciences published a report in 1989 on alternative agriculture suggesting that widespread adoption of proven alternative systems would result "in even greater" economic benefits to farmers. A former member of the CGIAR's equally prestigious Technical Advisory Committee (TAC) has, however, called it a highly controversial report because "it is based on little more than anecdotal evidence involving whole farm experiences" (York). The NRC Report acknowledges that "the data bases and economic research on the profitability of alternative systems are minimal. The Committee's case studies and reviews of available data illustrate that the sample is too small and unrepresentative to justify conclusions about the precise economic effects of widespread adoption of specific practices or systems." A reputable natural resource research organization, Resources for the Future, has argued that the NRC report "gives an inaccurate and too optimistic view of both the environmental and economic benefits of alternative agriculture" (as quoted in York). The Potash and Phosphate Institute severely criticized the report arguing that "it was biased, misleading, filled with contradictions and generally unscientific" (York). There are others who concur with these criticisms. Moreover a recent report by two reputed agricultural economists on the research

of the CGIAR concludes that notwithstanding much farming systems research examples of "successful" farming systems are still too sparse to provide much basis for a view that they increase productivity (Anderson, Herat and Scobie).

Implications for Policy and Further Research

What are the implications of the global debate and its consequences to date for Africa in terms of improvement in future international responses to sustainable systems of agricultural management in Africa?

It is clear that a multidisciplinary approach involving physical, biological and social scientists is urgently needed for research and applications at all levels, since increasing productivity of smallholder agriculture on a broad basis must once again become a goal of highest priority as the only way to improve the environment and to bring the rate of population growth under control. Multidisciplinary research on farming systems has not been well grounded in the rigors of specific disciplines, however, and therefore there is often skepticism about such an approach. Multidisciplinary research is all the more complex as individual disciplines advance rapidly and become highly specialized, yet multiple social objectives make problem-solving impossible without an interdisciplinary approach. This often explains the shrill debate between, for example, environmentalists and economists. Increasing agricultural productivity and production would require the use of modern chemical and biological inputs based on much more scientific multidisciplinary research to take into account the physical and other diversity of local conditions. Because such research and application are highly intensive of trained personnel, investments in human capital and the national and local organizational

capacity for research and extension would need to be augmented. Pricing, subsidy land and transportation policies, and investments would have to improve. The fact that structure adjustment may not be sufficient to improve the lot of the poor households would need to be recognized through actions going beyond rhetorical acknowledgement. Finally, the need for developing countries to increase their share of energy consumption from present relatively minuscule levels of energy use would need to be recognized.

To transpose the perceptions of environmental problems encountered in developed countries to developing countries is a tragedy. Donors must invest resources to understand the precise constraints developing countries face and to alleviate them. The conference of the Royal Tropical Institute is a nobel effort in support of this goal.

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