PART II

Consultation Documents

- The benefits of Investment in Land and Water
- Funding Investment in Land and Water
- Investment in Land and Water in the Context of Special Programme on Food Security
- Enhanced Commitment and Innovation in Financing Agriculture and Food Security
- Estimating Needs for Agricultural Land and Water Development in Africa

THE BENEFITS OF INVESTMENT IN LAND AND WATER

Introduction

Agriculture and the rural sector remain vital to pursuing the related goals of food security, poverty alleviation and sustainable development.

Increased agricultural output will have to come mainly from intensified rather than extensive production as per caput land and water resources diminish. This implies continued productivity gains in the use of these two primary resources and factors of production.

Such increases in productivity will require increased investment in agriculture, and especially in land and water development. However, investment in these areas is decreasing or at best stagnating. Governments, authorities and development practitioners are thus facing the paradox of having agreed to development goals requiring increased production with diminishing per caput resources, but without the concomitant investment to do this.

This paper examines this apparent contradiction from a perspective of land and water. It focuses on land and water as finite resources and factors of production on which productivity-increasing technology in agriculture depends. While dealing with land and water in parallel, it also recognizes their interrelationship and complementarity. The emphasis is on irrigation because of its prominent role in food production under intensive systems and because it is the largest consumer of water in agriculture and in overall water use. The paper also examines ways in which land and water interrelate under less-favoured rainfed conditions to improve productivity. The overall theme is that of why investment in land and water development is essential for food security, poverty alleviation and balanced development in developing countries.

Land and Water Availability

Together with labour and capital, land and water constitute the aggregate resource base for agricultural production. Their association with appropriate types and levels of labour, capital and technology enhances their productivity in agriculture. Thus, their availability is central to development, food security and poverty alleviation.

Land Availability

According to FAO estimates, about 30 percent of the world's land surface is suitable for rainfed agriculture. Of this area, some 2 800 million ha in developing countries have the potential for growing rainfed crops above an acceptable minimum level. With 960 million ha already cultivated, this leaves 1 800 million ha for further expansion (FAO, 2000a).

However, the utility of this reserve is limited as about 90 percent of it lies in seven Latin America and sub-Saharan countries. Furthermore, much of the land suffers from constraints such as ecological fragility, low fertility, toxicity and lack of infrastructure. Human induced land degradation such as soil erosion and salinization is also a factor.

The projected expansion of arable land for crop production in developing countries by 2030 is about 120 million ha, with the bulk of it in sub-Saharan Africa (57 million ha) and Latin America (41 million ha).

FAO estimates that between 1995/7 and 2030 about 80 percent of the projected growth in crop production in developing countries will come from intensification in the form of higher yields (69 percent) and cropping intensities (11 percent), with the remaining 20 percent coming from arable land expansion. The share due to intensification will exceed 90 percent in land-scarce parts of the Near East, North Africa and South Asia. In the preceding 34 years 76 percent of the growth in crop production was due to intensification (71 percent from higher yields and 5 percent from higher cropping intensity), and 24 percent from arable land expansion. Intensified production occurs mainly on land already under cultivation (FAO, 2000a).

Water Availability

The major problem with water is not its quantity but its uneven distribution in time and space. The combination of uneven distribution and expanding population is increasing the pressure on water resources in various countries, mainly in Africa and the Near East. In 1995, 29 countries with populations totalling 436 million experienced water stress or scarcity. By 2025 the corresponding figures will be about 48 countries and more than 1 400 million people, most of them in the least developed countries (World Bank, 2001). Moreover, such data do not show how countries with ample supplies of water relative still experience shortages in many localities, e.g. China and India.

Increasing water scarcity will result largely from rapidly growing demands for agricultural, industrial and household purposes. At the same time, the potential for expanding supplies in many countries and localities is diminishing. Deteriorating water quality and environmental conditions, degradation of irrigated land, insufficient river flow, upstream land degradation and seasonal flooding will aggravate water shortage problems. Unless there is prompt action, developing countries risk severe water shortages that could depress agricultural production and limit industrial and household use (IFAD, 2001).

The threat to agricultural production is particularly severe because this sector accounts for 80 percent or more of total water use in many developing countries (Yudelman, 1994). As irrigation is the largest user of water (often at highly subsidized rates), attention needs to focus on improving its generally low water use efficiency levels.

Irrigation

By ensuring a regular and timely supply of water, irrigation reduces the risk of crop losses from uncertain rainfall and enables production in areas or at times without rainfall. There are strong synergies between irrigation and other principal sources of agricultural growth such as fertilizer, improved plant varieties, better husbandry, upgraded infrastructure and better integration into markets. These encourage farmers to invest in land improvements and in other inputs.

Irrigation is difficult to analyse or to generalize about because irrigation systems are extremely diverse in terms of size, technological sophistication, crops produced, agronomic practices, economic and financial viability, reasons for existence, institutional organization and social context. However, their common denominator is that they all provide water to enable farmers to increase output per hectare.

In 1995/7, the total irrigated area in developing countries amounted to about 197 million ha (three-quarters of the world's irrigated area). Seventy-four percent of this irrigated land is in Asia, 14 percent in the Near East/North Africa, 9 percent in Latin America and 3 percent in

sub-Saharan Africa. In view of this and the fact that the annual growth of irrigated area in developed countries fell to 0.2 percent in 1990-97, it is reasonable to conclude that events in developing countries will continue to dominate the world irrigation scene (FAO, 2000a).

Contribution

Irrigation increases cropping intensity and contributes to expansion in cropped areas. It increases yields, stabilizes output, enables crop diversification, reduces risk and increases farm incomes and employment. Through its influence on agricultural incomes, irrigation has a multiplier effect on non-farm incomes. It contributes to food security and poverty alleviation. By improving agricultural productivity, irrigation contributes significantly to overall growth and development (Box 1).

Box 1

Agricultural productivity, growth and development

There is general agreement that increases in agricultural productivity are central to growth, income distribution, improved food security and poverty alleviation in rural economies. There is strong evidence that it is essential to accelerate agricultural growth if poverty is to decline rapidly.

Increased farm production improves farmers incomes, generates on-farm employment and lowers food prices, all of which reduce poverty as the poor typically spend 60-70 percent of their income on food. Recent studies suggest that an even more significant effect on rural poverty derives from increased farm incomes stimulating demand for the goods and services offered by the small-scale enterprise sector. Where labour is abundant, agricultural growth generates significant income and employment multipliers within the local non-farm economy. Where such large multipliers exist, technological change in agriculture has the potential to generate significant new non-farm earnings for the poor. Continued agricultural growth, and hence more water for irrigation, is essential if this subsector is to play its role in reducing poverty (Mellor, 2000; IFAD, 2001).

While determining the precise share of production gains attributable to irrigation is almost impossible, without the advances in irrigation technology and extraordinary investment in irrigation expansion by both public and private sectors, the Green Revolution would probably have had a much smaller impact (Barker and Van Hoppen, 1999). With the exception of the most favoured rainfed areas, the Green Revolution occurred only on irrigated land (Seckler, 1999).

The Green Revolution helped more than double the aggregate food supply in Asia over a 25-year period, with only a 4 percent increase in the net cropped area (Rosegrant and Hazzell, 1999). It also contributed to significant national economic growth and saved large areas of forests, hillsides and other environmentally fragile lands from conversion to agriculture.

Perhaps the greatest benefit of irrigation has been in keeping food affordable to the poor. Between the 1960s and the 1990s real grain prices fell by approximately 50 percent as production growth continued to exceed population growth. Although subsidization of food grain production by developed countries played a part, the Green Revolution was largely responsible for this decline (Barker and Van Hoppen, 1999).

The Green Revolution also sustained employment (IFAD, 2001). Where an area doubled grain yields in the 1970s, employment per hectare normally rose by 40 percent, with a further 30 percent due to extra-farm demand for rural non-farm products (Hazzell and Haggeblade, 1993). The incidence of poverty in affected rural areas fell, typically from 30-50 percent to 5-15 percent (IFAD, 2001). In the 1970s agriculture accounted for 25-40 percent of GDP in the Green Revolution countries, which contributed substantially to their GDP and consumption growth.

In India, the multiplier effect of higher incomes in agriculture creating off-farm employment opportunities helped decrease the number of people below the poverty line from 50 percent to approximately 35 percent between the mid-1970s and 1990 (Datt, 1998).

Irrigation has good distributional effects as most irrigation projects have targeted private farmers (mostly smallholders) and its benefits accrue mainly in rural areas. Two-thirds of the income of the rural poor comes from farming and most of the rest depends for growth on linkages to farming (IFAD, 2001).

In developing countries irrigation serves about one-fifth of all arable land, accounts for some 40 percent of all crop production and almost 60 percent of cereal production. Recent analyses suggest irrigated agriculture will account for 38 percent of the total increase in arable land and for more than 70 percent of the increase in cereal production between 1995/7 and 2030 (FAO, 2000a).

Expansion

Between 1961/63 and 1995/7 the irrigated area in developing countries increased at an annual rate of 1.9 percent to 197 million ha. Asia registered the largest increase: 70 million ha (mainly in India, Pakistan and China); while in sub-Saharan Africa the increase was 2 million ha. The prediction is for the area of irrigated land to increase by 0.6 percent per year to 242 million ha in 2030. Declining and insufficient investment in agriculture, the broader water sector and irrigation reflect this decrease in irrigation expansion.

In developing countries there are signs of underinvestment and underperformance in agriculture. When measured in constant 1995 prices, official development assistance from bilateral and multilateral donors is 8 percent below 1990 levels. Throughout the 1990s the flow of funds to primary agriculture declined while there was increasing attention on other areas, in particular environmental protection, rural development and infrastructure (FAO, 2000b). The proportion of sectorally allocable aid reaching agriculture, forestry and fisheries fell to 20 percent in 1987-89 and then to 12.5 percent in 1996-98. The real nature of net aid disbursed to agriculture in the late 1990s was 35 percent of its level in the late 1980s (IFAD, 2001). In financial year 2000, World Bank lending for agriculture and rural development was its lowest ever in both percentage terms and absolute amounts (World Bank, 2000).

Estimates of current annual investment in the water sector range from approximately US$60 000 million to US$80 000 million (DFID, 2000; Elz, 2000; World Bank, 2001). Of this amount approximately 90 percent comes from domestic resources and the rest from international donor aid and multilateral funders, of which the World Bank is the principal source (DFID, 2000; World Bank 2001). The World Commission on Water considers investment levels to be less than half of that needed (about US$180 million per year) to meet minimum water, sanitation and nutrition requirements, mostly in developing countries, by 2025. On a global level there is a substantial shortfall, both for capital investment and for the operation and maintenance (O&M) of existing infrastructure. The tendency is to allocate most money to new capital works with insufficient funding for operation, maintenance and system rehabilitation. Recent studies indicate that the amounts allocated for irrigation scheme O&M are typically less than 50 percent of those required (DFID, 2000).

From 1950 to 1993, 7 percent of World Bank lending went to irrigation, more than any other subsector (Jones, 1995), but fell to about 4 percent for the period 1990-1997 (DFID, 2000).

This decline in investment in agriculture and irrigation does not augur well for the anticipated increase in irrigated land between 1995/7 and 2030.

Paradox

The decline in investment in new irrigation projects is leading to a paradoxical situation where although meeting the increasing demand for food will require more irrigated land, the investments may not be forthcoming. Given the long lead time between planning and implementing irrigation projects, failure to reverse the downward trend in investments could soon lead to food shortages with direct consequences for many developing countries and particularly for the poor.

One way of starting to resolve this paradox is to examine the reasons and related circumstances for the reduced investments in irrigation and to place these factors into perspective within the challenges facing the agricultural and food sectors in developing countries.

Land Improvement in Less-Favoured Rainfed Areas

Agricultural development strategies emphasizing irrigated agriculture have increased food production and stimulated economic growth. At the same time large areas of less-favoured rainfed lands suffer from neglect and lag behind in their economic development. These lands are characterised by low agricultural potential, often because of poor soils, steep slopes, short growing seasons and lower and uncertain rainfall, but also because neglect has left them with limited infrastructure, weak institutions and poor access to markets. As population densities grow with no matching increases in production, food insecurity and poverty worsen and widespread degradation of soil and water resources tends to occur.

On development and environmental grounds alone, there will need to be a greater focus on less-favoured areas in setting priorities for policy and public investments. In some cases land expansion can contribute to increased agricultural production. However, in many less-favoured areas, social and environmental crises are already common sometimes soliciting more investment in crisis relief than in development from governments and donors. There is evidence that strategic investments in the economic development of less-favoured areas can be more cost effective than relief even in a relatively short period of time (Owens and Hoddinott, 1998). Increased public investment in technology and infrastructure in less-favoured areas may yield higher marginal returns than comparable additional investments in irrigated agriculture (Fan and Hazzell, 1997).

This does not mean that there should be less public investment in irrigated and high-potential rainfed areas in developing countries. It signifies that there should be a better investment balance between irrigated and less-favoured areas because reclamation and/or further development of the latter can benefit the large numbers of poor people living there. The amount of economically justifiable public investment in any locality should depend on the net social returns from productivity growth, poverty reduction and the containment of environmental degradation. The investment needs of less-favoured rural areas often involve improving health and education, infrastructure and agricultural production in different combinations and in an integrated manner. Farming systems in less-favoured areas typically include mixed farming and other practices that contribute to soil, nutrient and water conservation. Thus, while some types of commodity improvement are relevant for less-favoured areas there is growing consensus that major productivity improvements will have to come from improved natural resource management practices and technologies tailored to the ecological, social and economic circumstances of rural communities, e.g. conservation tillage and integrated watershed development.

Land Improvement Techniques

Conservation or minimum/zero tillage is a practice that replaces conventional ploughing with adapted planting equipment and appropriate crop rotation. By protecting soils from erosion, improving soil structure, raising soil fertility, increasing water retention on cropland and reducing land preparation costs, conservation tillage helps increase yields and profitability.

Following its successful application in the central and southern parts of Brazil (Box 2), parts of Paraguay adopted conservation tillage to counter widespread soil degradation and erosion. As the result of an almost threefold increase in net farm income and average rates of return on marginal investment in equipment of from 6 percent (medium farms) to 14 percent (large farms), conservation tillage spread to 250 000 ha (19 percent of land cultivated mechanically) between the late 1970s and 1995/96 (Sorrensen, 1997).

Box 2

Land improvement in Santa Catarina State, Brazil

Between 1991 and 1999 the World Bank provided a loan of US$33 million to Santa Catarina State to reverse ongoing land degradation and to increase agricultural production, productivity and farm incomes for some 81 000 mostly small-scale farmers in 520 of its 1 700 microcatchments.

The main thrust of the project was to develop and introduce conservation tillage. Accompanying elements were: the upgrading of extension and training adaptive research, control of erosion runoff from rural roads and an incentive programme to encourage the adoption of conservation practices.

Production of the main crops - maize, wheat and soybeans - increased by an estimated 20-35 percent. Farmers adopted improved land management practices including conservation tillage on some 400 000 ha in 434 assisted microcatchments. The project reached about 35 percent of the state's farmers and reduced soil loss by between 10 and 50 percent. Runoff water in streams contained fewer suspended solids, coliform bacteria and pesticide residues thus reducing silting and water treatment costs and lowering the incidence of water-borne diseases and pesticide poisoning.

The project's estimated rate of return at appraisal was 20 percent.

Various forms of land reclamation and development by means of manually and mechanically induced soil and water conservation have also proved successful. For example, in low rainfall areas of Senegal and Burkina Faso widely spaced small shallow basins, or furrow lines created with tractor drawn equipment captured sufficient runoff to establish islands or strips of tree and shrub species. This in turn led to more widespread improvement in soil physical characteristics and increased fodder production. Livestock carrying capacity improved and in some areas better soil moisture regimes nearly doubled the yields of millet and niébé (Dutraux and Keita, 1999). In another project in Burkina Faso and Niger a combination of small stone bunds and hand-dug holes filled with manure helped treble millet and sorghum yields and restore about 100 000 ha. Food availability in participating households rose by 20-40 percent. The average family using these technologies moved from an annual cereal deficit of 644 kg to a surplus of 153 kg (IFAD, 2001).

Integrated Watershed Development

Because of the interrelationships between ecological, social and economic factors that cause soil and water degradation and because of the need to include these factors when reclaiming and improving land and water, integrated watershed development has become the preferred

approach for developing rainfed areas in many countries. In general such projects have two major objectives:

- conservation - to slow and reverse the degradation of the natural environment in project areas through the development and use of appropriate soil and moisture conservation measures;
- development - to promote systems for the production of food, fodder, forest and livestock products that improve beneficiaries' incomes and well-being on a sustainable basis.

Typically, the largest component of such projects comprises physical investments in soil and water conservation technologies and practices which provide the basis for improved agricultural productivity. The second largest element is to establish and/or strengthen institutional arrangements and the human skills needed to ensure the implementation and sustainability of projects. Watersheds or sub-watersheds have proved to be practical units for the implementation of this type of project. Such projects usually achieve their conservation and production objectives. The key aspect is the institutional and financial sustainability of these and future investments. Experience points to a number of basic determinants for success in this regard. These include: the importance of ownership of the project by beneficiaries; the need for beneficiaries to realize some short-term benefits from project interventions; the need to provide integrated support services; and the importance of monitoring and feedback mechanisms to periodically evaluate progress and make any necessary corrections.

Three World Bank-funded integrated watershed development projects (representing some US$133 million in loans) implemented in India and Indonesia during the 1980s yielded economic rates of return at completion of 17, 14 and 13 percent respectively. These conservative calculations consider only quantifiable benefits such as increased crop yields and do not include non-quantified benefits such as reduced erosion, siltation and pollution.

The above indicates that agricultural intensification mainly through land and water development should be a key component of development strategies in less-favoured rainfed areas in certain countries. Such investments can yield acceptable economic rates of return with direct benefits for participants. Where the evaluation takes their social and environmental impacts fully into account their returns may exceed those of other agricultural investments. Nevertheless, because the shortage of water limits the production potential of most less-favoured areas, their contribution to overall food grain production and food security in most countries will remain relatively modest. High-potential areas with irrigation will continue to be the breadbaskets for most developing countries.

Impacts and Benefits Of Investment In Land And Water

Investment in developing land and water resource offers long-term benefits that may elude quantification by conventional analysis. Beyond a project's immediate rate of return, developing countries need to consider the wider benefits in terms of increased domestic production, enhanced food security, reduced market fluctuations, and foreign exchange savings. Moreover, such investments involve many interrelated factors with a range of potential direct and indirect effects. Although it may not be possible to legislate for successful investment, countries can pursue policies that are conducive to creating the conditions for greater market efficiency and higher farm-gate prices.

As the preceding chapter provides an indication of the returns and long-term benefits from investing in land development projects, the following sections concentrate on the impacts and benefits of investment in irrigation.

Returns on Investment

Returns on investment in irrigation are comparable to alternative investments (Carruthers, 1996). The most comprehensive evaluation of irrigation project performance is the World Bank study of 208 World Bank funded irrigation projects implemented and evaluated between 1950 and 1993. It also examined a further 614 projects with irrigation components, more than 100 irrigation projects at various stages of implementation and non-World Bank studies that enriched the exercise. World Bank lending for irrigation during the period was US$31 000 million (Jones, 1995).

Of 192 projects subjected to both appraisal and evaluation, 67 percent rated satisfactory and their average estimated economic internal rate of return (IRR) at evaluation was 15 percent. After allowing for inflation, this level of return is impressive especially as most projects require large initial investments and have a long gestation period before net benefits materialize. The comparable satisfactory rates for agriculture as a whole and the all-project average are 65 and 76 percent respectively. The IRR for agriculture as a whole is 13 percent and the all-project average is 16 percent. Weighting irrigation projects by size of area served raises their average IRR to 25 percent with 84 percent of the projects rating satisfactory.

These overall ratings are surprisingly good as typical irrigation projects are extremely complex. They involve engineering, agronomic, sociological and organizational changes which render implementation and sustainability difficult. A positive element is that irrigation projects have quantifiable objectives which facilitate establishing their degree of success or failure by measuring them against no-project situations. In addition, the projects achieved their average evaluation IRR of 15 percent in an era when overvalued exchange rates and a variety of indirect taxes or subsidies to competing urban interests penalized agriculture (Carruthers, 1996).

Implementation Completion Reports on 11 World Bank financed irrigation projects in Asia and Latin America (mainly in the 1990s) for a total loan amount of approximately US$1 973 million had an average economic rate of return at completion of 17 percent.

A strong indication that irrigation pays is the amount of private investment it attracts. Private investment provides all the financing for about 20 percent of the total area currently irrigated (about 264 million ha in 1995/7). The share of private investment in the remaining 80 percent is approximately half of the total investment. Furthermore, there is an estimated additional 70 million ha of land under informal private irrigation that falls outside government control.

This information indicates that it would not be rational to avoid investing in irrigation projects on the grounds of low investment returns.

Environmental and Social Impacts

Irrigation often has negative environmental impacts such as waterlogging and associated salinization of soils due to overirrigation and inadequate drainage. Overextraction of groundwater is also widespread in many developing countries. In some areas, particularly in the Near East/North Africa, irrigation draws on fossil aquifers that receive little or no recharge and is therefore not sustainable. The environmental and economic consequences of such practices are serious and will grow worse in the absence of appropriate responses (FAO, 2000a).

Because of its role in agricultural intensification, irrigation contributes to the pollution of surface and groundwater with nitrates, phosphates and ammonium compounds. The latter can cause excessive algal growth, proliferation of aquatic weeds and eutrophication in irrigation

canals and downstream waterways thereby damaging fragile ecosystems. Irrigation can contribute to the increased incidence of water-borne and water-related diseases, and to problems associated with the resettlement of displaced people.

However, irrigation also has very important and pervasive positive environmental impacts. For example, the high population absorptive capacity of irrigation limits the migration of growing populations to areas of greater environmental risk. If additional water for irrigation (17 percent by 2025) is not forthcoming, the increased burden on rainfed agriculture to meet demand will be enormous and detrimental to the environment, with far more land clearance than is currently the case (Elz, 2000).

Furthermore, there are technical, economic and social solutions for most of the negative effects of irrigation (Carruthers, 1996; FAO, 2000a). For example, there is major potential for meeting future agricultural and overall water needs by raising water use efficiency, thereby reducing environmental damage in many cases. It is possible to repair much of the damage already done and avoid similar problems in the future. Many of these solutions are likely to require a management rather than an investment approach.

Irrigation is a factor in global environmental issues such as climate change as irrigated rice production contributes about 20 percent of global methane emissions. This is causing increasing concern as methane is 20 times more powerful than carbon dioxide and atmospheric levels are rising fast. However, even with a projected expansion in the area under rice of about 6.5 percent by 2030, methane emissions could decrease as farmers grow more low-methane rice under controlled irrigation with better nutrient management (FAO, 2000a).

In addition, the potential exists to transform cultivated land from a net source to a major net sink of carbon. Any practice which improves plant cover and yields such as irrigation contributes to this process.

The fact that irrigation is facing a number of challenges is not a reason for withdrawing from it but rather a reason for engaging in a search for solutions (Carruthers, 1996).

Scheme Size

Little has damaged the image of irrigation as much as the negative impacts (land inundation, population displacement and ecological disruption) of large irrigation schemes, especially those with large dams. However, any balanced assessment should also include their positive effects (Seckler et al 1998). Moreover, much irrigation does not involve large dams, whose prime function tends to be more for electricity generation and flood control rather than for irrigation.

In many developing countries large-scale irrigation schemes remain essential for food production, employment generation and development (Elz, 2000; Gleick, 2000; IFAD, 2001; Seckler et al, 1998). The World Commission on Dams is evaluating dam projects using an objective approach to incorporate more accurate estimates of their true costs and benefits (Gleick, 2000; IFAD, 2001).

The evaluation of World Bank financed irrigation projects shows a strong correlation between project size and satisfactory performance: the larger the command area, the higher the likely economic returns. This is true for surface and groundwater projects and applies to all regions. The economies of scale stem from engineering and management efficiencies (Jones, 1995).

However, small-scale schemes do have definite advantages under particular circumstances. Because of their limited more cohesive membership and simple institutional arrangements, such member-controlled schemes generally enjoy more efficient and flexible distribution and

maintenance regimes. However, their limitations often include: no outside agency to bear risk; lack of financial or borrowing capacity; uneconomic irrigation design and management. Another problem is that negotiations with other upstream and downstream users to maintain equity of water use within watersheds or aquifers can be difficult (IFAD, 2001).

Water Use Efficiency

Irrigation accounts for 80 percent of freshwater withdrawals in developing countries. One way for such countries to expand their irrigation is by improving water use efficiency.

While the concept of efficient water use is complex (Box 3) and difficult to achieve in practice, improving the efficiency of irrigation water use can contribute significantly to meeting growing demands. (Seckler *et al.*, 1998) estimate that the amount of water saved by achieving an irrigation effectiveness of 70 percent in total gross irrigated area by 2025 could meet about one-half of the increased demand for additional water supplies in the 1990-2025 period. However, the conceptual and practical challenges to achieving such efficient water use are equally large because water has multiple users, uses and externalities. Better irrigation scheme organization and management and the rehabilitation and upgrading of existing schemes are generating real gains.

Box 3

Efficiency of water use

The concept of efficient water use in irrigation includes the conveyance efficiency, field efficiency, water use efficiency and economic efficiency of water (water productivity) amongst others. There is a tendency to consider water use and allocation in a holistic manner because of the highly integrated nature of water use systems involving different users. This entails establishing the water balance of river basins. This may require analysing systems' efficiency at different levels. Thus, measuring water use efficiency can be complex and the high degree of external effects may make it more difficult.

Technical report (FAO, 2000a) estimates the irrigation efficiency of a group of 93 developing countries to range from 26 percent in areas of abundant water (Latin America) to 50 percent in the Near East/North Africa region where water use calls for higher efficiencies. The forecast is for irrigation efficiency for these countries as a group to rise from 43 percent in 1995/7 to 50 percent by 2030.

Notwithstanding wide variations between regions and countries in the group, water withdrawal for irrigation accounted for about 7 percent of total water resources in 1995/7. The forecast is for water withdrawal to grow by 12 percent by 2030. Thus, there is sufficient water for future irrigation and other needs in these countries. Nevertheless, in most countries where irrigated agriculture is already important, water for expansion will have to come mainly from efficiency savings on existing schemes. Given the need to boost agricultural productivity and growth in these countries, the importance of investing in water saving technologies and practices is clear.

Rehabilitation and Upgrading

Given the need to use irrigation water more efficiently on existing schemes, it follows that the bulk of new investment should focus on rehabilitation and upgrading rather than on new schemes. Indeed, it is now often difficult to distinguish between new development and the extension of existing schemes. Projects are usually a combination of the above aspects. This is of little consequence providing that investments are economically viable and enhance scheme

functioning and sustainability. However, it is important to avoid misconstruing rehabilitation for deferred maintenance without correcting the problems causing unsustainable maintenance in the first place. If not, this could lead to repetitive funding of maintenance from external sources.

In order to maximize returns, scheme improvement should incorporate lessons from previous irrigation developments and not simply rehabilitate projects to old standards. Improving performance includes repairing and modifying structures and enhancing scheme management and associated institutional arrangements. Good planning and implementation are prerequisites for high investment returns. This is particularly relevant for complex, multi-dimensional irrigation schemes usually involving a number of interested parties. It is counterproductive to skimp on resources needed for the preparation, appraisal and implementation of such projects. Unforeseen problems that arise during implementation should be resolved promptly even at the expense of extending implementation. Confirmation comes from the evaluation of World Bank irrigation projects which showed that variations in implementation time (whether overall time or delay) had no effect on economic returns (Jones, 1995).

The emphasis on rehabilitation and upgrading can contribute to improving returns on new investments in irrigation in a number of ways. First, efficiency gains do not only make water available for new irrigation. By reducing overirrigation, efficiency gains also attenuate the principal causes of land degradation on irrigation schemes, i.e. waterlogging and salinization. This is important as waterlogging and salinization significantly reduce irrigation performance in some countries. Second, because a considerable part of the extensive investments in irrigation during past decades are now regarded as sunk costs, incremental investment in improving scheme performance will yield high rates of return. Confirmation of this comes from the competitive economic rates of return obtained with irrigation projects that include a substantial portion of rehabilitation. Third, increased productivity and growth resulting from improving schemes will reduce the urgency to develop new irrigation to meet growing food needs. This will provide more time to thoroughly appraise and plan new irrigation development that will become economically less attractive if development costs increase and the prices of agricultural commodities stagnate or decrease. It will also allow more time to incorporate lessons from existing projects into new development.

Another advantage of rehabilitation is that project unit costs are usually low, a fact which increases the likelihood of economic viability (Jones, 1995).

The need to fund rehabilitation from external sources reflects low economic returns from first generation projects. At the same time the large volumes of sunk costs in these schemes offers the opportunity to place them on a sound economic, social and environmental footing while assuring rates of return comparable to other investments.

Operation and Management

Inadequate operation and management of irrigation schemes is often a major cause of poor project performance and weak sustainability. Many governments have found it increasingly difficult to finance the costs of irrigation operation and management as well as being effective providers of water services to large numbers of small farmers. These factors have led to infrastructure deterioration, shrinkage of area irrigated, maldistribution and wastage of water, and advancing waterlogging and salinity.

Many governments are attempting to transfer management responsibility for irrigation systems from government agencies to farmers organized into water users associations

(WUAs) (IWMI, 2000). Consensus is emerging that operation and management problems, scheme maintenance, irrigators' ownership of their systems and cost recovery are interrelated. Evidence is accumulating that comprehensive yet pragmatic approaches that include the above aspects can overcome organization and management problems.

The keys to these unusually complex, interrelated problems reside in the principles of financial autonomy and irrigator participation in organization and management by means of viable WUAs. The most promising route to improvement lies in making irrigators responsible for their own organization and management and in providing them with the requisite technical support particularly regarding group formation and the skills needed for effective scheme management. There is a considerable amount of experience about the circumstances that encourage irrigators to create effective and durable groups (Ostrom, 1992). One clear lesson seems to be the importance of recognizing that group members have to bear costs as well as receive benefits.

One of the prerequisites of such an approach is government willingness to devolve. Global experience suggests that irrigation management transfer on a large scale has been most successful where: the irrigation system is central to a dynamic, wealth-creating agriculture; the average farm size is large enough for a typical or a significant proportion of the command area farmers to operate like agri-businessmen; backward linkages with input supply systems and forward linkages with output marketing systems are strong and well-developed; and the costs of self-managed irrigation are an insignificant part of the gross value farming output (IWMI, 2000). Mexico provides a successful example of irrigation management transfer (Box 4).

Box 4

Reform and irrigation management transfer in Mexico

Following a sharp decline both in public investment in irrigation and also in farmers' contributions to organization and management costs, and with irrigated crop production falling 0.4 percent per year, the Government of Mexico took decisive action. It opted to transform irrigation from an engineering driven, centrally managed and government funded sector to a more decentralized system based on transparent investment selection criteria and greater participation of beneficiaries in decision making and cost recovery. Moreover, it reduced agricultural price support to market related levels.

The outcome has been that water users have increased their funding of organization and management from 20 to 90 percent, organization and management costs have fallen about 40 percent, and water use efficiency and productivity is improving by about 3 percent per year. Government financial contributions to organization and management have almost disappeared. Due to increased water-fee collection and improved management, rehabilitation, deferred maintenance and upgrading are ahead of schedule. Water table problems, salinity and other unfavourable environmental effects are diminishing. Land values in rehabilitated saline areas have increased fourfold. Because of improvements in production efficiency and productivity and the elimination of price guarantees, the value of agricultural production is growing at 4.8 percent per year. Rising agricultural exports have had a favourable impact on terms of trade.

The estimated overall economic rate of return for the project at completion is 31.5 percent over 20 years.

Two important determinants of success for the project have been strong political support for the process and appropriate accompanying macroeconomic and agricultural policy reforms.

An important principle underlying the privatization of irrigation schemes is that of water as an economic good. While water is an economic good in most cases, (Perry *et al.*, 1997) point out that "the question is rather whether it is a purely private good that can reasonably be left to free market forces, or a public good that requires some amount of extra-market management to effectively and efficiently serve social objectives". The answer to this lies in value judgments and their application to different conditions of time and place. While privatizing water in the sense of giving farmers

and markets a greater role in both the financing and management of irrigation may be a promising approach, it is also necessary to satisfy basic needs criteria before optimizing economic returns in terms of consumers' sovereignty. (Perry *et al.*, 1997) propose a sequential set of preconditions for the beneficial introduction of market forces in water allocation and use.

The privatization of minor irrigation in Bangladesh illustrates how policy liberalization accompanied by technical support can promote increased smallholder investment in irrigation and thereby boost agricultural production, farm incomes and employment (Box 5).

The gradual and selective privatization of organization and management (and other aspects of irrigation) shows considerable promise as a way of improving scheme viability and sustainability. Investment in privatization measures has produced encouraging results.

Box 5

Enhanced agricultural growth through increased private sector investment in minor irrigation in Bangladesh

Implemented between 1991 and 1997, this project achieved its primary objective of faster growth in agriculture through increased private sector investment in minor irrigation by eliminating regulations, subsidies and other advantages which favoured public sector provision of minor irrigation based on deep tube-wells and pumped surface water irrigation.

The project facilitated the provision of equipment by agents and provided technical assistance for training and for strengthening support institutions. It also provided assistance for a range of project support services including: planning and implementation of minor irrigation, formation of WUAs, selection of equipment, assessment of irrigation growth, hydrological exploration, and trials for irrigation technologies and rehabilitation methods.

In the six-year period, the number of shallow tube-wells (STW) and the STW irrigation area increased at annual rates of 32 and 16 percent respectively. Liberalization of the sector led to: an increase in the number of equipment suppliers and equipment servicing facilities (rural workshops); a reduction in engine and other equipment prices; and an increase in the number of farmers owning tube-wells. The latter included a growing number of small farmers who gained access to irrigation benefits, thereby positively influencing the equity impact of the project. Annual farm income rose by 25 and 53 percent for STWs and deep tube-wells respectively. The project's estimated economic rate of return at completion was 16 percent.

The project successfully supported government in making important policy changes to liberalize the minor irrigation sector that promoted rapid development in minor irrigation and in services catering to this technology. The overall evaluation was that the project had significant positive effects on the economy of Bangladesh.

Conclusions

In the coming decades irrigation will become increasingly important as it will enable intensification to generate four-fifths of the growth in overall crop production and 70 percent of that in cereal production. While important, rainfed agriculture lacks the potential to replace irrigated agriculture in any significant way. Thus, irrigation is vital to developing countries' attempts to achieve food security and meet other growing needs and, as a whole, they do have sufficient land and water for its anticipated expansion.

Through its impact on agricultural productivity, irrigation has beneficial effects on rural incomes, rural employment, food security, poverty alleviation and overall growth and development. Moreover, it has had a significant effect in keeping food affordable to the poor. Without more irrigation many countries will not attain the agricultural and overall economic growth rates required to achieve food security and reduce poverty. Irrigation also has positive distributional effects because it mainly targets smallholders living in poor rural areas.

The financial returns on investments in irrigation are generally comparable to alternative investments. Indeed, most analyses may understate their true returns by failing to consider all the positive indirect social and environmental effects of irrigation. Future investments in irrigation will be mainly for rehabilitation and upgrading and will earn higher rates of return by benefiting from the large amount of sunk costs in existing schemes. Viewed differently, a failure to maintain and improve existing schemes would result in the loss of the benefits of the investment already made in irrigation. The large amount of private investment that irrigation attracts worldwide indicates that it does yield worthwhile returns.

Technical, economic, social and environmental solutions now exist to rectify and prevent most of the problems associated with irrigation. By adhering to sound guidelines, irrigation projects can be an environmental asset. Thus, it would be a mistake to allow a perceived negative image to constrain investment in irrigation.

Improvements in the current low level of water use efficiency in irrigation will release large volumes for expansion, and for use by other sectors. There has been considerable progress in using technological, operational and managerial methods to improve efficiency levels. The underlying principles at work are those of irrigator participation, financial autonomy, partial and progressive privatization and corresponding government withdrawal. Their practical application will enhance the viability of future investments in both existing schemes and in developing new ones.

In addition to investment in irrigation, there is also a need for more investment to reclaim, conserve and further develop the productivity of land and rainfed agriculture in less-favoured areas. Techniques such as conservation tillage and integrated watershed development have demonstrated that investment in these areas can yield acceptable returns while achieving the twin goals of productivity growth and poverty alleviation. Marginal returns to such investment in less-favoured areas can exceed those in irrigation. A proper balance between the two will help to develop the potential of less-favoured areas and satisfy the needs of the people living there.

Investing in a land or water development project is not just an investment in one item, it entails investing in a whole range of elements such as farming practices, plant varieties and nutrients, human resources, the broader infrastructure and conducive policies.

The international community is committed to development goals with pressing humanitarian implications. However, in order to enable the vital elements of land and water to make their full contribution to achieving these goals, it is necessary to increase their productivity. This will not happen without increased investment in land and water development.

Bibliography

Barker, R. & Van Hoppen, B. 1999. *Water scarcity and poverty*. IWMI Water Brief 3. Colombo, International Water Management Institute.

Carruthers, I. 1996. Economics of irrigation. *In* Pereira *et al.* (eds.) *Sustainability of irrigated agriculture.*

Chaturvedi, M.C. 2000. Water for food and rural development: developing countries. *Water International*, 25(1). International Water Resources Association.

Datt, G. 1998. *Poverty in India and Indian states: an update.* FCND Discussion Paper No. 47. Washington, DC, International Food Policy Research Institute

Dutraux, M. & Keita, M.N. 1999. *Etude d'impact du travail des charrues "Delfino" et "Treno" sur la recuperation des terres fortement degradees.* Accra, FAO.

DFID. 2000. *Addressing the water crisis - healthier and more productive lives for poor people.* Consultation document. London, DFID.

Elz, D. 2000. Is the world running out of water? *Quarterly Journal of International Agriculture,* 39, No.2. Frankfurt/M, Germany, DLG-Verlag.

Fan, S. & Hazzell, P. 1997. *Should India invest more in less-favoured areas*? EPTD Discussion Paper No.25. Washington, DC, International Food Policy Research Institute.

FAO. 1993. *The state of food and agriculture.* Rome.

FAO. 2000a. *Agriculture: towards 2015/30.* Technical Interim Report. Rome.

FAO. 2000b. *The state of food and agriculture.* Rome.

Gleick, P.H. 2000. The changing water paradigm: a look at twenty-first century water resources development. *Water International,* 25(1), International Water Resources Association.

Hazzell, P. & Haggeblade, S. 1993. Rural-urban growth linkages in India. *Indian Journal of Agricultural Economics,* 46(4).

IFAD. 2001. *Rural poverty report 2001: the challenge of ending rural poverty.* Rome, International Fund for Agricultural Development.

IWMI. 2000. Can poor farmers in South Africa shoulder the burden of irrigation management? *IWMI News.* Colombo, International Water Management Institute.

Jones, W.I. 1995. *The World Bank and irrigation.* Washington, DC, The World Bank,.

Mellor, J.W. 2000. Agricultural growth, rural employment and poverty reduction: non-tradables, public expenditure and balanced growth. Paper prepared for the World Bank Rural Week 2000, *Poverty or prosperity: rural people in a globalized economy.*

Ostrom, E. 1992. *Crafting institutions for self-governing irrigation systems.* San Francisco, the United States, Institute for Contemporary Press,.

Owens, T. & Hoddinott, J. 1998. *Investing in development or investing in relief: quantifying the poverty trade-offs using Zimbabwe household panel data.* Washington, DC, International Food Policy Research Institute,.

Perry, C.J., Rock, M. & Seckler, D. 1997. *Water as an economic good: a solution or a problem*? Research Report 14. Colombo, International Irrigation Management Institute.

Rosegrant, M. & Hazzell, P. 1999. *Transforming the rural Asian economy: the unfinished revolution.* Hong Kong, Oxford University Press for the Asian Development Bank.

Seckler, D. 1999. *Revisiting the "IWMI Paradigm": increasing the efficiency and productivity of water use.* IWMI Water Brief 2. Colombo, International Water Management Institute.

Seckler, D., Amarasinghe, U., Molden, D., De Silva, R. & Barker, R. 1998. *World water demand and supply, 1990 to 2025: scenarios and issues.* Colombo, International Water Management Institute.

Sorrensen, J.W. 1997. *Financial and economic implications of no-tillage and crop rotations compared to conventional cropping systems*. Rome, Investment Centre Division, FAO.

World Bank. 2000. *Reaching the rural poor: framework for a revised World Bank rural development strategy*. Washington, DC, The World Bank.

World Bank. 2001. *The World Bank and water*. Water Issue Brief. Washington, DC, The World Bank.

Yudelman, M. 1994. Demand and supply of foodstuffs up to 2050 with special reference to irrigation. *International Irrigation*

FUNDING INVESTMENT IN LAND AND WATER

Introduction

This paper advocates enhanced financing support for sustainable agricultural and rural development (SARD). It examines the trend in resource flows to agriculture and explores issues in sustainable agricultural development. It also presents an overview of innovative financing mechanisms and the principles of a framework for the coherent and effective use of investment resources.

Resource Flows to Agriculture: International financial flows

International financial flows are crucial to sustaining growth in developing countries. The financial crises in the second half of the 1990s adversely affected private financial flows and their recovery has continued to lag output and trade growth. Moreover, the cyclical slowdown of the global economy could well dampen these flows. However, this decline in private flows reflects some improvement in their quality as volatile short-term flows have fallen sharply. Foreign direct investment (FDI) is more stable. Countries experiencing rapid FDI growth have benefited from augmented domestic savings, financing for new investment opportunities, and exposure to international markets. The potential for productivity growth through private capital flows has probably increased because of the growing importance of knowledge as a production input. On average, private capital inflows raise domestic investment in a ratio of almost one to one. However, the effect is strongest for those countries that are least integrated with international financial markets. Thus, the association between foreign inflows and domestic investment is strong in Africa.

However, private flows favour high performing economies. The benefits are available mainly to countries that have a strong capacity to absorb them. This underscores the importance of a hospitable business climate in attracting and sustaining FDI flows. Short-term portfolio flows reinforce positive growth dynamics but decline in conditions of economic adversity. Moreover, their volatility can impose considerable costs. This calls for capacity building support to manage volatility and safeguard domestic financial stability.

Total net external flows to developing countries peaked in 1997 (Table 1). Net official flows have since declined to 63 percent of their level at the beginning of the decade. Net private flows (both capital and FDI) have also declined since 1997 but are still nearly 6.6 times higher than official flows. However, for many developing countries official flows provide important support to their economic growth momentum while their market-based reforms continue. To date, FDI flows have not been sufficiently responsive to these changes because of risk perceptions about the legal and regulatory frameworks and contract enforcement and dispute settlement mechanisms. The share of FDI in net private flows increased from 58 percent in 1997 to 69 percent in 2000, about US$5 000 million more than in 1997. FDI flows to low-income countries quadrupled between 1991 and 2000, but remained less than 2 percent of their GDP. The share of the low-income countries in all FDI flows to developing countries fell to 7 percent (13 percent in 1991). Sub-Saharan Africa has had particular difficulty in attractingFDI. This is due to insufficient market size, poor infrastructure, political uncertainty, corruption and restrictive policy regimes. The top ten developing country recipients of FDI (China, Brazil, Mexico, Argentina, Malaysia, Poland, Chile, the Republic of Korea, Thailand and Venezuela) accounted for 74 percent of total FDI flows to developing countries in 2000, amounting to 3.8 percent of their GDP.

TABLE 1

Net long-term resource flows to developing countries, 1991-2000

	1991	1995	1996	1997	1998	1999	2000
				US$ 000 million			
Total	123	261	311	343	335	265	296
of which:							
Official flows	61	55	32	43	55	45	39
Private flows	62	206	279	300	280	219	257
of private flows:							
Capital markets	26	99	148	127	104	34	79
FDI	36	107	132	173	177	185	178
Share of developing countries				Percent			
In global total private flows	12	12	13	14	10	8	8
In global FDI	22	32	35	37	26	19	16
FDI inflows as a share of total developing-country FDI							
Low-income countries	13	13	14	11	8	5	7
Least developed countries	5	2	2	2	2	3	3

Where net private capital flows and FDI decline, the need for official aid flows comes into sharper focus. Current levels of foreign aid, at some 0.24 percent of annual GDP, fall short of the 0.7 percent target set by developed countries. The actual aid falls short of that target by some US$100 000 million a year. Overseas aid to Africa fell from US$32 per person in 1990 to US$18 per person in 1998.

International official resource transfers provide about US$5 000 million a year, about 10 percent of official development assistance (ODA), to fund international public goods, e.g. health, agricultural research and environmental protection. An additional US$ 11 000 million finances complementary domestic infrastructure.

The proportion of sectorally allocable aid reaching agriculture, forestry and fisheries fell sharply from the mid-1970s to about 20.2 percent in 1987-89 and then to 12.5 percent in 1996-98. The real value of net aid disbursed to agriculture in the late 1990s was 35 percent of its level in the late 1980s. The share of agricultural lending in the loan portfolio of the World Bank fell below 10 percent in 2000, compared to an average of 14 percent for the decade ending 2000. Thirty years ago the figure was 40 percent. In constant 1995 prices, total commitments for agriculture are 8 percent below the level in 1990. Contributions from bilateral donors, mainly countries in the Development Assistance Committee (DAC), were about US$4 300 million in both 1997 and 1998. The increased levels of assistance in 1997 and 1998 over that of 1996 were due entirely to increased levels of multilateral assistance, particularly from the International Development Association (IDA), while bilateral assistance was actually lower than in 1996.

The share of agriculture in total government expenditure in developing countries ranges from 0.015 percent to 23 percent, with this share being lower than 10 percent in 90 percent of cases. Countries with high levels of undernourishment are also those with severe budgetary constraints. This points to the case for a larger flow of concessional development assistance to such countries to effectively face the challenge of food insecurity and undernutrition.

Investment Needs

The total annual gross investment needs of agriculture in the developing countries (primary agriculture, storage, processing and support infrastructure) would be about US$180 400 million for the period up to 2015. A continuation of current annual investment rates until 2015 would be insufficient to achieve the World Food Summit (WFS) target. The expected shortfall averages 12 percent for all developing regions and is 38 percent for sub-Saharan Africa.

Programmes such as the Soil Fertility Initiative, the Integrated Land and Water Management Action Programme for Africa, the International Programme of Land Quality Indicators, the Inter-American Water Resources Network, and the Critical Ecosystems Partnership need financial resources for implementation, up-scaling and replication. The sustainable development of land and water resources calls for increased resource flows from domestic and external sources, but also for a more effective use of such resources and improved frameworks of partnership and aid coordination among all stakeholders.

International Development Goals

The DAC guidelines on sustainable development strategies stress the need for deep structural changes in the economy, society and politics. Land and water issues are linked to the development goals of poverty reduction, food security and nutrition, and to the implementation of national strategies for sustainable development by 2005.

There is a trend towards the rural poor depending increasingly on non-farm sources of income generation. The share of non-farm employment in rural employment among the rural poor ranges from 30 to 50 percent. Despite this positive trend, the dependence of the poor on the natural resource base and on agriculture poses a challenge for the sustainable development of land and water resources. Addressing opportunities and constraints of smallholder agriculture requires both technical and institution-building support and financial resources for investment in rural infrastructure. Without such resource flows, the realization of the international development goals is not possible within the specified timeframe.

Improving Support for International Development

Governments can and must do more to encourage public awareness of assistance activities and support for international cooperation for development. This calls for:

- the establishment of clear goals for development policy,
- a reorientation of development education to portray issues objectively,
- an intensified effort to assure efficient and effective programme management, and

- the awareness that development cooperation deserves support because of the mutual interests that it serves and because of the moral imperative of helping others to help themselves.

Improving Resource Use

The main measures to increase the effectiveness of ODA are to:

- implement a holistic and cross-sectoral approach to sustainable development,
- develop a strategy for country leadership with mutual responsibility among partners for development outcomes and distinct accountabilities,
- emphasize partnership and collaboration among governmental and non-governmental actors at national level,
- ensure that aid coordination integrates external assistance with the development priorities of the recipient country. Donors and recipients should adhere to strategic objectives and investment programmes,
- place the responsibility for aid coordination primarily with the recipient country; two elements of an enabling environment are policy performance and institutional quality, and
- introduce results-based frameworks for assessing aid coordination.

There is a need to provide considerable capacity-building support in order to help governments nurture policy reform, strengthen aid coordination capacity, and reach partnership agreements with donors. These agreements need to delineate mutual responsibility for development outcomes and the distinct accountabilities of each partner. The Poverty Reduction Strategy Paper (PRSP) will serve as the main instrument for implementing these recommendations.

Issues in Land Resources Development

The deployment of resources through financing mechanisms and modalities involves three inter-related segments: (a) SARD; (b) land degradation; and (c) natural resource management (NRM). Water resources constitute a distinct cluster. The investment dimension of these segments encompasses such key issues as:

- economic and policy measures to increase sustainable productivity,
- the degradation of both marginal and high-productivity irrigated lands,
- sustained cultivation of sloping lands,
- deforestation and loss of biodiversity, and
- declining reserves and increasing competition for water resources.

The main planks of the integrated and participatory strategies to address these issues are:

- integrated systems approaches to sustainability issues,
- integrated research programmes to find least-cost, quick-return conservation methods,
- integrated approaches to pest, disease and weed management,
- improved information on declining productivity and natural resource degradation, and on the methods for their alleviation, and

- a search for solutions in the context of institutional, environmental and economic interfaces.

Sustainability

SARD implies jointly producing food and other goods for farm families and markets, and also contributing to frameworks to provide a range of public goods. However, SARD does involve difficult choices and trade-offs. It is also not easy to develop incentive frameworks that can ensure optimal solutions in terms of costs and benefits. An analysis of SARD issues requires a comprehensive framework that shows the interrelationship of all aspects of development.

Production gains from Intensification

Agriculture is the key sector for generating incomes and employment in both farm and non-farm economies in most developing countries. Therefore, agricultural intensification holds great promise as an instrument to simultaneously alleviate poverty, meet food needs, and avoid exploitation of the natural resource base.

To help ensure global food security, the developed countries need to aim for sustained gains in productivity in order to provide stable food stocks to meet emergencies or to fight hunger and malnutrition in pockets of chronic poverty and vulnerability.

Agricultural Intensification in Developing Countries

In the last 40 years, the doubling of cereal output has come from three sources: area expansion, intensification and yield increases. The area under irrigation more than doubled between 1950 and 1980. However, its rate of growth has since slowed substantially. In many areas, physical and technological constraints are likely to restrain large-scale conversion of potentially cultivable land. Increased cereal production has to come primarily from increased productivity or higher yields, but without compounding environmental problems such as erosion and salinization. In some countries annual losses in production potential attributable to soil depletion may reach 1.5 percent of GDP. Expanded production and employment in agriculture is usually feasible to the extent that:

- agriculture's total productivity factor grows enough to outweigh any falls in net farm prices,
- farm resources, especially land, are redistributed towards small and family farms,
- technology changes in a labour-using way, or incentives change so that farmers use a larger proportion of land labour-intensively.

Agricultural intensification need not degrade the environment, but inappropriate and mismanaged intensification can lead to environmental degradation. Rural poverty causes a more serious environmental problem in developing countries through the forced exploitation and consequent degradation of environmentally fragile lands. On balance, the potential for increasing yields through intensification outweighs the alternative of expanding acreage.

Large pockets of rural poverty are concentrated in dryland areas (fewer than 120 growing days per year). Drylands extend over at least 20 million km^2 with a population approaching 500 million. A central precondition for their development is the assignment of a high priority to drylands improvement.

Projects and programmes to combat land degradation need to be flexible and include:

- Strengthened information and monitoring systems, especially for drought preparedness,
- Integrated programmes and policies which balance conservation and production objectives,
- Improved dryland resource management through environmentally sustainable practices,
- Programmes to eradicate poverty and promote alternative livelihood systems,
- Support for indigenous technologies and local participation,
- Enhanced national capacity for rural development,
- Support for the control of population growth.

Intensification will have to meet the expected doubling in food requirements by 2050. Therefore, the sustainable use of land, whether in high potential or dry areas, becomes crucial. The FAO SOFA 2000 calls for a new green revolution, which involves resource-poor regions and farmers and so-called orphan species and varieties.

Issues in Sustainable Water Resources Development

Principles for effective water policy

The emerging principles for the efficient and sustainable use of water are to

- undertake national water resources development and management in a holistic and sustained manner to meet national development goals and protect the environment,
- decentralize the planning, development and management of specific water services to an appropriate level responding to basin boundaries,
- delegate the delivery of specific water services to autonomous and accountable public, private or cooperative agencies providing measured water services in a defined geographical area to their customers and/or members for an appropriate fee,
- allocate shared water resources efficiently for the mutual benefit of all riparian users,
- enable participatory and consultative activities at each level,
- ensure a commitment to sustained capacity building, monitoring, evaluation, research and learning at all levels, and
- ensure sustainable water use in society (with incentives, regulatory controls, and public education promoting economic efficiency, conservation of water resources, and protection of the environment) within a transparent policy framework.

An ideal institutional framework for rational water resource management would include:

- a decentralized, accountable structure that is coherent at each layer of administration,
- self-management of independent bodies and self-financing at user and higher levels of activity, according to users' ability to pay,
- market mechanisms as an integral part of water allocation,
- an enabling role for government, with key responsibilities for capital investment, supporting legislation, data collection and processing, and support for basic technical R&D,
- a comprehensive and consistent legal code which clearly defines the water rights and responsibilities of individuals, groups, agencies and government bodies, and

- a set of procedures for *de jure* and extra-legal arbitration of disputes and established enforceable penalties for misuse and degradation of water resources.

Irrigation, Drainage and Groundwater Development

Investments to promote efficient systems of surface irrigation and drainage and groundwater abstraction assume crucial importance within the framework of integrated water resources management policy. About 17 percent of all cropland are irrigated, accounting for some 40 percent of food and fiber production. Irrigated agriculture is highly water intensive, claiming nearly 70 percent of world water abstraction (over 90 percent in agricultural economies in the arid and semi-arid tropics). Wasteful irrigation practices not only entail the loss of precious water but also cause waterlogging and salinization. More than 10 percent of the world's irrigated land suffers from varying degrees of salinization, and the extent and severity of this phenomenon are growing. In addition, seawater intrusion can damage aquifers irreversibly. Despite large investments and subsidies, irrigation performance has not always fulfilled expectations in terms of yield increases and efficiency of water use. Agriculture is also a relatively low-value, low-efficiency and highly subsidized water user. This situation is not sustainable.

Food security is closely linked to success in water control. Moisture control at root level allows for the maximization and stabilization of production. Success will not come from expansion alone (more dams and canals, larger tracts of land levelled and watered). Increasingly, it must come from improved management and rehabilitation of inefficient systems, and the substitution of traditional systems by systems based on accurate technology. Achieving this will require funds and qualified, capable farmers and managers.

From the perspective of sustainable water resource management, Table 2 summarizes some examples of actions to be encouraged/discouraged in the irrigation and drainage subsectors.

TABLE 2

Issues in irrigation and drainage

Encourage	Discourage
Cost recovery	Non-transparent, non-targeted and non-temporal subsidies
Management of irrigation units by farmers and/or user associations	Emphasis only on main delivery and drainage systems without consideration for in-farm drainage
Added emphasis on in-farm operations	Groundwater depletion
Rehabilitation of existing systems	Conflicts with other uses
Economic incentives for water conservation, especially groundwater	
Maintenance of investments	
Financial sustainability	
Complementarity with other uses	
Farm drainage as part of the project	
Adequate disposal of irrigation return flows as an integral part of the project	
Explicit consideration of policies for tariffs and subsidies	

Other Priority Issues in Sustainable Agricultural Development

Synergies

To exploit the synergies between the Rio Conventions on desertification (UNCCD), biodiversity (CBD), and climate change (UNFCC), it is necessary to operate concurrently at four levels:

- awareness building and information dissemination,
- programming to build complementarities in respective pipelines of country-driven projects and programmes, or sub-regional/regional initiatives,
- implementation of programme elements requiring joint or mutually reinforcing complementary actions, and
- building of databases and information exchange.

Climate change, global warming and water resources

The impacts of climate change on water users and the water environment will depend on the nature of the institutions managing water and the physical infrastructure. Among the factors that influence the ability of a water system to respond to change are financial resources and technical expertise. The focus of water management is turning towards flexible, integrated systems, incorporating both supply and demand management. Such systems are inherently better able to cope with climate change, and are easier to adjust as more information appears.

The inclusion of soil carbon sequestration into future arrangements for carbon sequestration is an important development for the role of land-based activities within the framework of the Clean Development Mechanism (CDM). This issue calls for a more integrated approach to land productivity, soil fertility, forestation and biodiversity. The potential for soil carbon sequestration may be as high as 40 percent of the total amount of annual atmospheric increase in CO_2 concentration. Moreover, the appropriate choice of crops coupled with appropriate land management will lead to increased carbon retention. The Global Mechanism (GM) is associated with innovative ways of activating the flow of new funds for CCD implementation. However, many operational and measurement issues remain before activating the CDM as a source of fund raising.

FAO and the IFAD have agreed to implement a programme to strengthen regional and national capacities to define strategies focused on greenhouse gas emissions for the benefit of the sustainable management of natural resources of the region. Forestry and agroforestry can compensate for greenhouse gas emissions by creating new sinks for carbon dioxide, and by protecting existing forests that are carbon stores.

Valuation of environmental effects

The reasons for unsustainable practices and environmental damage lie in policy and market failures to value environmental resources and to incorporate environmental costs in prices. Part of the cause lies in unclear or non-existent property rights.

Valuing *in situ* natural resources solely as raw materials ignores their role in the earth's life support systems. This requires attaching non-monetary weights for forests, biodiversity, non-renewable resources, and global commons. Such a valuation system would establish linkages between the economic goals of profit maximization and environmental sustainability. Such

systems of green accounts seek to prevent the overuse of natural resources. However, translating this concept into practice raises many technical issues. The precise economic value of ecological assets is difficult to assess. This is due partly to the lack of information on the market value of ecological goods and services and partly to uncertainty about the dynamics of ecosystems, as well as problems of quantifying certain non-market values.

Many of the environmental effects are manifest either at distant locations (downstream effects) or in the future (the gradual depletion of soil nutrients). The effects may be *in situ* or off-site. However, quantifying such effects on ecological assets would require monitoring systems to collect and analyse data for economists to use in attaching values to ecological damage in relation to losses in productivity and sustainable development. One analytical tool is the social rate of discount. Apart from various technical issues involved in its application, there is also some apprehension that the use of such discounting may work against the interests of the natural environment. The higher the discount rate, the less long-term environmental damage will appear to matter, and the less attractive will investments to conserve the environment appear. However, the answer lies in incorporating a criterion of sustainability into certain aspects of decision making. Table 3 summarizes existing economic principles and their extensions at project, sectoral and macroeconomic levels.

TABLE 3

Techniques for valuing the environment

	Market type		
	Conventional market	**Implicit market**	**Constructed market**
Based on actual behaviour	Effects on production, health Defensive or preventive costs	Travel costs Wage differences Property values Proxy goods	Artificial market
Based on intended behaviour	Replacement cost Shadow project		Contingent valuation

Definitions: Defensive costs: Ex-post costs of mitigating damage. Replacement cost: Future cost of replacing an impaired environmental resource by an equivalent asset, assuming that original resource was at least as valuable as the replacement expense. Shadow project: cost of special project designed to offset environmental damage caused by another project. Proxy goods: Market value of a substitute for an environmental asset that itself is not marketed. Artificial market: Willingness to pay for an environmental asset determined on an experimental market. Contingent valuation: Willingness to pay for an environmental asset or willingness to accept compensation for its loss, determined by direct questions.

One method of project appraisal combines the concepts of economic feasibility, acceptability, and sustainability. In its application to a watershed development project, feasibility is measured by the change in sustainable income for the successive generations of project households as seen from today; acceptability by the average annual income which the current generation of project households derives from the project; and sustainability by the tax or subsidy equal to the difference between sustainable and average annual income for the current generation of project households. Internalizing external costs and negative welfare impacts in the project and forcing a sustainability constraint on the project do restrict the scope of feasible projects. However, potential gainers outside the project, either in space (externalities)

or in time (sustainability), can be taxed on the basis of part of the gains which rural development projects may create for them. This approach can help identify win-win investment options.

Such valuation/appraisal exercises require interdisciplinary team efforts within a framework for monitoring the costs of neglecting, and the benefits of, conserving such ecological assets. This needs funding support, as does capacity building of related expertise and institutional frameworks. Synergies between knowledge, environmental protection and investments include:

- Improved collection, transfer and use of agricultural and environmental information,
- Capacity building in approaches/methodologies to identify win-win outcomes,
- Improved environmental standards through incentive frameworks,
- New opportunities for profitable and sustainable environmental investments.

Market failures are the result of institutional failures the failure to establish the regulatory framework to: secure property rights, check open access to common resources, enforce contracts, impose and collect taxes, recover costs, and provide transparent rules governing incentives and disincentives, responsibilities and accountability. The key environmental principles are: proportionality; the polluter pays; prevention; and common but differentiated responsibility.

Technology and institutional modernization

A major weakness of agricultural research and technology generation and diffusion is that the national agricultural research systems (NARS) are underfunded and poorly equipped. Their research priorities do not fully incorporate the problems of dryland agriculture and resource-poor and low-potential areas. The linkages with extension services and farmers, and with international and regional agricultural research centres, leave much scope for improvement. It is necessary: (i) for farmers to adapt their traditional systems to a more competitive market environment; and (ii) to look for less costly, more responsive and more pluralistic transfer systems that can reach a wider clientele of small producers.

Another issue is the decline in public-sector agricultural support services, particularly in remote areas. There is a case for promoting efficient private-sector services, such as expanding NGO extension systems, provision of group-based financial services by intermediaries, and other forms of participatory credit delivery. There is a need for institutional decentralization and representative local structures to motivate and supervise grassroots rural development initiatives.

New techniques aimed at promoting sustainable intensive farming systems need to be developed and disseminated. Such techniques relate to soil and moisture conservation, soil fertility, crop protection, the management of new crop varieties, and water harvesting.

There is a strong case for strengthening programmes and funding to accelerate the implementation of CGIAR research programmes through collaboration with other agencies. The CGIAR recommends earmarking an increasing proportion of funding for sustainability-related research and providing it in the form of incentives or seed money to foster consortia and networks.

Other institutional issues

Institutions affect development outcomes in economic and social fields. For example, uncertainty of tenure is usually a deterrent to long-term sustainable land use. Ambiguities relating to usufruct rights of land, water and trees tend to contribute to environmental degradation. Other institutional aspects include the absence of clear community mechanisms for the upkeep of public assets and infrastructure, a lack of financial services, and the marginalization of women. The absence of micro-credit institutions discourages investment in soil and water conservation measures, particularly if payback periods are relatively long.

A priority area is the need to strengthen national and local environmental management capacities. Addressing global environmental problems requires: (a) integration of these concerns into national policy making; and (b) improved use of scarce resources through financial leverage and market-based approaches. Institutional frameworks need to be developed to promote and implement interventions to address cross-border concerns.

Financing Sustainable Development

International development cooperation

The rationale for development assistance has changed. Good governance is now an important component of the broad framework of policy dialogue. There is an emerging consensus that poverty reduction and growth must be at the heart of the agenda for sustainable development. Its basic principles are:

- to view development as a process of societal transformation that takes place over time,
- to adopt a comprehensive approach to development and a multidimensional view of poverty,
- to emphasize faster growth as being essential for sustained poverty reduction, and that greater participation of the poor enhances growth potential,
- to assure country ownership of the goals, strategy and direction of development and poverty reduction (shared ownership by representative segments of society) as being critical,
- to view the development community as a whole and that it must work closely together, and
- to have a clear focus on measurable development outcomes.

The main instruments to translate the above principles into action are:

- country-owned poverty reduction strategies that provide the basis for donor concessional assistance (particularly World Bank and IMF lending), and guide the use of resources freed by debt relief under the enhanced Highly Indebted Poor Countries (HIPC) initiative, and
- the World Bank's Comprehensive Development Framework (CDF) or its equivalent the UN Development Assistance Framework (UNDAF) at the country level is the basis for coordination around programmes and action plans based on the country's PRSP; the CDF represents an approach to policymaking based on a greater balance between the economic, human and structural elements of development, and on new partnerships that support countries in achieving this balance.

This framework would ensure coherent strategies which reflect ownership by a broad spectrum of domestic stakeholders. It would also improve donor coordination and serve as a platform to focus the analytical, advisory and financial resources of the international community on achieving monitorable results. However, implementation is a complex process involving many country-level trade-offs and tensions. Apart from capacity constraints in fully articulating strategies and action plans, the process involves conflict resolution between sectors, implementing agencies and public interest lobbies. The World Bank recommends that:

- more deliberate use of lending and non-lending tools to foster consensus through increased local involvement and more widespread dissemination of analytic work,
- more use of pilot projects to test new approaches, and
- greater use of advisory services and flexible lending instruments to nurture policy change.

The framework implies a greater selectivity among donors in allocating ODA resources. The case for increased financing for development rests not just on the principle of universality, but on policy orientation and performance. Developing countries need to demonstrate their commitment to, and progress in, undertaking market-based reforms. Moreover, their development strategies should be in tune with the objectives of good governance, poverty reduction, basic health, sanitation, and education. Another element of selectivity lies in the policy of individual bilateral donors in terms of the focus of their development assistance on a narrow set of priority areas and countries.

Developed countries channel a part of ODA as contributions to the core funds of multilateral institutions, or as trust funds. Through their support to a developing country, major institutions, e.g. the World Bank Group and the IMF, also trigger private capital flows by lowering private sector risk perceptions or more directly as part of a financing package. Furthermore, multilateral organizations of the UN system mediate with developed member countries to leverage financial resources to provide critical technical and advisory services to the developing countries. For example, FAO has promoted agricultural production and food security in developing countries and has helped raise resources in the fight against hunger and undernutrition through its Special Programme for Food Security (SPFS) in low-income food deficit countries (LIFDCs).

While ODA is the most dependable source of concessional assistance for the low-income developing countries, there is a need to explore other diversified funding channels to enhance financial flows for sustainable development. These include non-traditional sources, such as Arab Funds, Private Endowments, and private financial flows. Private flows comprise foreign direct investment, portfolio investments in marketable securities by foreign financial institutions, foreign bank loans, and export credits. However, such capital flows favour a limited number of better performing developing countries with absorptive capacity and infrastructure to attract private capital. All foreign investments augment the domestic rate of investment. However, private financial flows pursue profit and not social or development objectives. There are some corporate social investment avenues, but their contribution to resource flows for development is still limited.

Raising resources to finance development

In countries where food insecurity is prevalent, external assistance to agriculture accounts for up to 86 percent of gross domestic investment and 51 percent of government expenditures. The external assistance in such countries has to come primarily from ODA.

TABLE 4
A schematic typology of financing

	Concessional lending	Grants	Loans on ordinary terms	Private capital
Investment interventions	X		X	X
Policy & institutions	X	X	X	
Capacity building	X	X		
Support services	X	X		
Supervision, monitoring & evaluation	X	X		
Main sources of financing	IDA (World Bank's soft loan widow) IFAD Regional dev. banks (soft windows) Islamic Dev. Bank, Kuwait Fund, OPEC Fund Developing country budgets	Bilaterals Trust funds Technical assistance by multilaterals Social dev. funds HIPC UNDP FAO (technical services/SPFS) WFP (food aid) Other UN agencies GEF (env. problems) GM (for CCD) IFAD (TAGs) Regional banks (for feasibility studies, etc.) CGIAR/IARCs	World Bank (IBRD)/IFC Regional dev. banks IFAD Islamic dev. bank (leasing; equity participation KFW (Germany)	FDI Portfolio investments through capital markets Commercial bank borrowings Debt restructuring. Trade related deferred payment arrangements, supplier's credits Bonds & shares of developing country institutions in foreign capital markets

FAO estimates that the SPFS requires an annual financing of about US$1 400 million (US$17 million per country). The projected sources of funding are: the FAO SPFS Trust Fund (US$500 million), recipient countries (US$67 million), bilateral donors (US$137 million), and multilateral financing institutions (US$670 million). The actual mobilization over five years by FAO has been US$230 million, an indication of the scale of underfinancing that has constrained the implementation of the SPFS. To meet this challenge of persistent resource constraints, it is necessary to develop innovative ways to finance the sustainable development of land and water resources on a predictable and long-term basis.

Innovative financing mechanisms

The investments for the agriculture sector and food security form three broad categories: primary production, post-harvest system, and public support. Financing may come from domestic/external private and public channels. More generally, financing may be for: programme or project investments; policy and institutional reforms; capacity-building support; provision of support services; or supervision, monitoring and evaluation. Financing may be in the form of loans or grants provided by donor agencies, or through funds raised in the capital markets (Table 4).Innovations in financing mechanisms are unlikely to take the form of creating new funding channels. This became apparent during the negotiating process for the UNCCD, which incorporates the Global Mechanism (GM). The GM is a catalyst and facilitator for mobilizing resources for the implementation of the UNCCD in the developing member parties. It should work with all member countries to: (a) improve the efficiency of allocation and use of financial flows at both the supply and demand ends of the resource mobilization equation; (b) to add value through the reorientation of such flows towards the realization of the goals to combat land degradation; and (c) to do so through multi-channel partnerships and by acting as an honest broker between donors and recipients. The main lesson is that the international community is averse to creating new funds or financial mechanisms, and wishes to place greater reliance on the more effective use of existing channels. Thus, the search for innovation must focus on:

- effective coordination among various development partners,
- attention to diverse local conditions,
- adaptations and flexibility in reshaping existing instruments of lending or grant assistance,
- creation of a monitorable track record of effective implementation by developing countries,
- use of NGOs and civil society in funding arrangements at the grassroots level to prevent leakages or transmission loss in fund flows.

There are also global initiatives to leverage the potential of international financial flows, particularly on the issue of reforming international financial architecture. Although not borne out by trends in financial flows, the process of globalization has raised expectations that private capital flows and trade may gradually displace aid as the dominant financing source for developing countries as a consequence of:

- greater integration of the global economy,
- ongoing technological change,
- increased risk-management ability in developing countries, and
- an accentuated dualism between the modern and the subsistence sectors of the economy and in the agricultural sector.

The estimates of funds needed for this purpose must be brought within the global framework of financing sustainable development.

Instruments and Mechanisms

Flexible lending framework

The Country Poverty Reduction Strategy (CPRS) formulation exercises emphasize improving public resource allocation and raising the productivity and cost-efficiency of public investment. Once there is a consensus on the strategy among the main stakeholders, the World Bank and other donors are prepared to finance the resulting investments through a flexible framework. For example, the World Bank may take the lead in providing broad-based Poverty Reduction Support Credit (PRSC) linked to key objectives, reform areas and priority action areas. Governments will receive the credit on IDA terms in tranches geared to performance. The funding is integrated with the government budgetary cycle and augments the capacity to allocate resources on a cross-sectoral basis. FAO has a role in assisting governments in articulating their agriculture sector strategy and in the formulation of programmes within the CPRS framework. Interested bilateral donors could enter into partnership with FAO to support such programmes.

Improved aid effectiveness needs to complement flexible lending through: improved absorptive capacity in the developing countries: recourse by them to sound and pro-poor policies; and improved aid resource flows to such better performing countries. A logical extension of this process is the common pool approach to assistance. This implies that a single development strategy for each country would guide all donors (each receiving the same monitoring report) with the common pool of resources supplementing the recipient's budgetary resources.

Debt relief

Debt relief covered by the Heavily Indebted Poor Countries (HIPC) initiative can increase resource flows to developing countries. Such relief is tied to appropriate policy reforms. Under the enhanced initiative of 1999, interim debt relief begins immediately at the decision point for most countries. The enhanced initiative has quickened the pace of debt relief. It has the consequence of effectively increasing the resources available to developing countries for agreed priority programmes.

Overall, 41 countries with US$170 000 million in external debt are eligible for consideration. Debt owed to multilateral institutions accounted for about 40 percent of their total debt obligations in 1997. From the perspective of such countries, debt relief has a significant impact on their economic prospects. The debt of the average HIPC is more than four times its annual export earnings and well in excess of its GNP. The enhanced initiative seeks to establish a stronger link between debt relief and sustainable poverty reduction programmes in recipient countries. This framework must include support for FAO's WFS goals and the SPFS. Of the 23 LIFDCs with the highest prevalence of undernourishment, 17 are in to the HIPC group of eligible countries.

Debt relief helps countries access external financial resources by reducing their debt burden and servicing commitments. This should release budgetary resources to meet priority development expenditures. Moreover, debt relief would reduce the preoccupation with negotiating debt service modalities. Instead, it would allow relations with donors to focus on a long-term policy dialogue.

For countries not covered by the HIPC initiative, debt swap operations could link debt relief to targeted sectoral programmes. The IFAD has some experience in assisting developing countries in negotiating debt swaps linked to Paris Club debt relief operations. Similar debt swap arrangements have also been negotiated in the context of debt restructuring or buybacks financed by the IDA and other donors.

Private sector participation in public goods and services

International public goods make an important contribution in sustaining the development process in the developing countries. Specialized technical agencies of the UN system provide public goods in the form of technical assistance, advisory services and international standards. However, as conventional ODA ordinarily flows on a government-to-government basis, the financing of international public goods has tended to occur on an *ad hoc* basis. Structured funding mechanisms could provide systemic support for international public goods. This would require innovative mechanisms aimed at:

- integrating country-based financing with global and regional programmes,
- leveraging public resources with additional private money, and
- a framework to align the incentives of countries with the global public interest through standards, treaties and regulatory mechanisms.

Market distortions, imperfect access to information and uncertainty about cost-benefit relationships have discouraged private sector participation. This area requires capacity building in entrepreneurial skills and facilities for financial services and working capital support. The private sector does not find sufficient incentive to operate in remote rural areas with poor infrastructure. Decentralized financing mechanisms are needed to facilitate service provision, such as extension and micro-credit.

Some national public goods affect the creation of international public goods. For example, planting forests helps reduce gas emissions. However, there is a distinction between the financing of core activities to create public goods and support for complementary activities for their diffusion and use. Both types of activities may involve different types of financing mechanisms and cost recovery or revenue generation modalities. Moreover, there is a real need for innovation to facilitate direct financing of regional cooperation programmes.

The Clean Development Mechanism

Under the CDM, industrial countries could purchase rights to emit greenhouse gases from activities in developing countries. Emission rights trading is intended to ensure that emission reductions occur where they are cheapest to implement. The purpose of the CDM is, in part, to assist developing countries in achieving sustainable development. However, its functioning has raised a number of technical and institutional issues.

The Prototype Carbon Fund

The Prototype Carbon Fund is a private-public partnership (sponsored by the World Bank) to facilitate emission rights transactions between private investors and host countries. Through the monitoring, verification and certification of emission reduction, the fund could build trust between parties and so promote sound development of the market. The fund expects to attract additional public and private resources and promote the transfer of environmentally safe technologies.

Climate change

The first session of the Conference of the Parties (COP 1) on the UNFCC identified three stages in the adaptation process:

- Stage I. Impact studies to identify particularly vulnerable countries or regions. Assessments of policy options for adaptation, and appropriate capacity building,
- Stage II. Measures, including further capacity building, to prepare for adaptation,
- Stage III. Measures to facilitate adaptation, including insurance.

COP 1 decided to fund the full cost of Stage I measures where these are part of the formulation of national communications (extended to Stage II measures in 1998). The Global Environment Facility (GEF) has been financing climate change enabling activities. The UNFCC applies to activities to adapt to climate change. However, the financing mechanisms for these measures are not yet clear.

Joint implementation as a flexible financing framework

Joint implementation originally referred to a generic family of institutional mechanisms that would allow parties to engage in cooperative (bilateral and multilateral) implementation of their commitments. Such assistance could have three components:

- to support the implementation of sustainable agricultural development strategies, policies and activities which would also have a positive impact on adaptation to climate change,
- to finance activities which specifically implement adaptation concerns, and
- to enable the sale of emission reductions by developing countries.

The Global Environment Facility and the Global Mechanism

The role of the GEF is largely catalytic, providing funding in the form of guarantees, concessional loans and grants. The key features of GEF financing are:

- financing of incremental costs linked to interventions that address global environmental concerns which otherwise would remain unattended in the national projects. Thus, the GEF helps mobilize substantial cofinancing of resources relating to local/national investments,
- pursuing global and local linkages with an emphasis on global benefits, and
- promoting market-oriented policies in cooperation with both private and government partners, with an increasing focus on programmatic funding.

The focal areas of the GEF are: biological diversity; climate change; international waters; and ozone layer depletion. The GEF Council has decided in principle that land degradation should become a focal area. It has also made the IFAD one of its executing agencies. This provides an opportunity for closer collaboration between the Global Mechanism (GM), the IFAD and FAO to leverage GEF financing for the design and implementation of investment programmes linked to CCD. The GM is a facilitator for resource mobilization from multiple financing channels, seeking to promote partnerships for financing CCD implementation. In this context, the GM has sought to forge close collaboration with the GEF in:

- facilitating and generating a pipeline of projects and activities for potential GEF financing,
- forging partnerships based on CCD's cross-sectoral and participatory approach to land degradation as an integral part of development strategies, and
- facilitating the mobilization of financial resources to cofinance GEF assistance.

The development of a grant facility

Given the debt management problems of many developing countries, a grant facility can provide appropriate financing for many areas of investment, such as capacity building, institutional and policy development, and other public goods and social capital. Many of these countries need extensive capacity building support to implement their poverty reduction and agricultural development strategies. In this context, the establishment of trust funds in the multilateral institutions (funded by bilateral donors) has become an important source of grants (Table 5).

TABLE 5

Donor contributions to trust funds administered by selected international organizations

Organization	Most recent reporting year	Amount (US$ million)	Share of global or regional programmes (%)
UNDP	1999	329.0	20
WHO	1998-1999	93.0	70
UNICEF	1999	601.7	4
Asian Development Bank	1999	135.3	25
Inter-American Development Bank	1999	25.4	80
World Bank	2000	1 301.0	55

Conclusion

For many developing countries, investment in land and water resources is crucial to their efforts to achieve food security and sustainable development. Such countries need to attract significantly increased funding. This calls for a fully integrated framework and innovative approaches to facilitate financial flows throughout the developing world, with greater private-sector involvement and an enabling role for governments.

Developing countries, international institutions and donors need to channel investment resources to where they will be most effective in terms of achieving development goals. However, with the limited amount of public and private funding available, the emphasis has to be on a more rigorous prioritization of aid allocations and on the more effective use of aid resources. There is a strong case for including land and water resources as priority areas for ODA allocations within the framework of poverty reduction strategies.

INVESTMENT IN LAND AND WATER IN THE CONTEXT OF THE SPECIAL PROGRAMME ON FOOD SECURITY

On the basis of a desk review of Special Programme on Food Security (SPFS) projects, this paper presents findings, reviews constraints, and examines how water control, soil management and plant nutrition issues relate to other aspects of the SPFS and to the goal of ensuring food security for all.

Food Security and Sustainable Livelihoods for the Rural Poor

The FAO definition of food security is: "a state of affairs where all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". An estimated 800 million people worldwide suffer from malnutrition although food is not scarce at the world level. Food insecurity is a problem of lack of access resulting from either inadequate purchasing power or inadequate productive resources needed for subsistence. Other causes of food insecurity are drought, conflict, poverty, population growth, poor economies, and failures in governance and in aid. Rural areas have specific problems with fragile ecosystems, low productivity, neglect of pastoralism, narrow livelihood bases, weak infrastructure, few social services, and slow response to alerts. Resource-poor farmers have seen few benefits from economic liberalization, and financial markets view them as poor credit risks.

A livelihood encompasses income in cash and kind; social institutions such as kin, family and village, gender relations and property rights; and access to education, health services, roads, water supplies and other social and public services. It is sustainable when it can cope with stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.

The Aims and Components of the Special Programme on Food Security

The SPFS is a principal strategy of FAO. It seeks to help low-income food-deficit countries (LIFDCs) improve their national and household food security on an economically and environmentally sustainable basis. It aims to promote rapid increases in productivity by small farmers in food production and other rural activities, reduce production fluctuations and improve food access through increased household incomes. The SPFS provides an opportunity to test innovative approaches on a small scale with a view to their wider replication. The SPFS belongs to and is the responsibility of the participating countries with FAO acting as an international facilitator and catalyst. Its eventual success will depend on governments' willingness to establish a political, social and economic climate conducive to agricultural growth and the alleviation of rural poverty.

The guiding principles of the SPFS are: national ownership, a focus on high-potential foods and areas, participation, environmental awareness, and regard for the role of women. The SPFS approach emphasizes participation and building partnerships at all levels. It aims to involve all persons with a role to play: government officials of beneficiary and donor countries; scientists; extension workers; private traders and entrepreneurs; experts from intergovernmental agencies and NGOs; and farmers. It seeks to exclude no social group and to create no inequities and it attaches great importance to promoting the flow of information and knowledge to poor people. The SPFS generally endeavours to equip poor smallholders with productive assets in order to help them realize their potential.

The SPFS began in 1995 and is now operational in 60 countries (36 in Africa, 13 in Asia, 7 in Latin America and 2 in Oceania). It consists of two phases: pilot (Phase I) and expansion (Phase II). Phase I involves demonstrations on farmers' fields in selected areas within a country. These aim to: introduce farmers to innovative practices; enable participation in the evaluation of the technologies and management practices; identify and overcome obstacles to their adoption. Where reliable water supplies are unavailable, the SPFS envisages the introduction of low-cost irrigation and drainage systems, together with better storage systems and land use practices to conserve water. When it commences, Phase II will aim to create the environment for large-scale replication of development approaches that have proved successful.

Phase I has four main interrelated and complementary components: water control; crop intensification; diversification of production systems; and constraints analysis and resolution.

The focus on water control reflects the fact that timely water availability is crucial for plant development. With some investment and knowledge, many farmers could use water to safely increase the yield, quality and timeliness of crops. Water control entails complementary measures for intensification and the proper maintenance and operation of infrastructures. The diversification of production systems recognizes the complexity of farming strategies and the need to develop ways of generating income, and the benefits of a more diversified nutrition. The constraints analysis process feeds back into Phase I and forwards to Phase II.

Water Control

The SPFS focuses on the technologies of farm production including small water supplies under the control of farmers, such as furrow irrigation, pump systems and small water harvesting systems. Such decentralized production systems depend on a few centralized services to supply credit, seeds, animal disease diagnostics and pest control techniques.

Although in principle water is a public good, the 1992 Dublin Statement states that "water has an economic value in all its competing uses and should be recognized as an economic good". Privatization is increasingly denying the poor access to water, especially for irrigation. The SPFS supports water appropriation by the rural poor to make their livelihoods less vulnerable, and to anchor their water rights in the law.

Realizing the potential of water control for self-employment and wage-employment by the rural poor requires thorough investigation, in particular with regard to gender equity.

The impact of a water control project on the nutritional situation of the community is not easy to demonstrate in a quantitative and objective way. The ultimate measure of a project's success is the associated change in the nutritional level of the community. However, indicators of better nutrition require considerable time to become significant and meaningful.

Crop Intensification and Production System Diversification

Agricultural intensification requires increased flows of nutrients to crops, a higher nutrient uptake and higher stocks of plant nutrients in soils. However, unless implemented properly, intensification can cause nutrient depletion, threaten biodiversity, increase erosion and, ultimately, environmental degradation. Without nutrient inputs, agriculture in the tropics results in nutrient mining. Thus, the SPFS project report from Guinea underscores the need for soil fertility management. Plant nutrition management depends largely on prevailing economic and social conditions. Farmers' decisions depend on: their economic situation and socio-economic environment; their perception of economic signals; and their acceptance of

risks. Plant nutrition management can contribute to food security and to sustainable crop production.

Optimizing the management of plant nutrients while maximizing incomes for farmers within the local economic context entails local-level decisions on the management of and investment in local sources of nutrients (vegetation and livestock). The major aspects are: assessment of nutrient requirements; choice of sources and methods of supply; determination of the level of domestic fertilizer production required; price levels and subsidies for plant nutrients; legislative aspects; and technical support. Policy-making in these areas determines the extent to which farmers have access to plant nutrients and are able to increase their production while maintaining soil fertility. A farmer needs purchasing power to obtain external inputs, and advice on how to use them in a balanced way. In remote areas of developing countries, poor farmers lack purchasing power, mineral fertilizers are expensive because of transport costs and intermediaries, good advice is hard to obtain, and fertilizer subsidies have widely disappeared as a result of structural adjustment (FAO, 1998).

A concern in the SPFS is to overcome the yield gap (the usually considerable difference between per hectare yields in the food-challenged community and in experimental fields under controlled conditions). Among the reasons for this yield gap are: (i) government cuts in support for agricultural research (IFPRI, 1999); (ii) privatized research geared to farmers who can pay royalties rather than to subsistence farmers; (iii) limited research into crops grown in the tropics; (iv) constraints such as production costs and marketing.

Research-developed crop varieties need tending to in a particular context: the "technology package" surrounding the application of the selected seeds and ensuring the development of their potential. The main factors supporting the crop are water management at the root level, plant nutrition and pest protection. In Phase I, the SPFS tests and demonstrates the benefits of using improved seeds while adjusting the package to local conditions. If successful, the technology spreads to use by farmers who have had an opportunity to evaluate its application in their own household context.

Agricultural intensification and diversification have led the SPFS to support cash crops as a flexible way of improving nutrition, in particular for infants, and of facilitating children's access to education. A diversified productive base, such as in the "field, pond and stable" approach in Southeast Asia, enhances household food security through a more intense use of the available assets, availability of more varied food, and the added ability to generate cash. Such systems are easily internalised, in particular when they offer an opportunity for women to employ their time more effectively. For example, freeing them from carrying water from distant sources can have a positive nutritional impact as they can apply more time and energy to productive activities.

Many urban poor and underemployed resort to the street trade of food though often beset by hygiene and health hazards and lacking suitable land, safe water and adequate inputs. Phase I has evidenced the links between rural and urban poverty and the need for coherent food security policies. Consequently, SPFS activities have incorporated urban and periurban agriculture.

Project Findings and Constraints

This section presents project-specific data from initiatives in Africa and Asia (Boxes 1 and 2).

Senegal

A study carried out in Senegal (Sonko, 2001) identified the following factors as contributers to food insecurity in the context of a rural village:

- Lack of land ownership. Obstacles include: high population pressure, land parcelling, difficulties in reaching remote land, settlement of borrowed land (owing to migration), social status and gender,
- Disintegration of social culture in general and of the family in particular,
- Credit access difficulties. People's chronic debt related to former financing mechanisms has removed capital from the rural economy,
- Little development of off-farm employment opportunities,
- Conflict and insecurity. Some production activities are risky because of low prices, floods and other contextual hazards,
- Disability and old age,
- Macro-economic and structural adjustment-related policies may penalise rural activities.

Subsidized support tends to leak to the non-poor, where it is less effective in improving food security. For example, the Senegal study of sustainable livelihood approaches in the SPFS examined the situation at the Saré Bouka demonstration site. Ranking people by wealth, it found that 70 percent of those considered rich (19 percent of the population) received poultry, whereas only 22 percent of those considered poor (50 percent of the population) benefited from the programme. In the context of this village, the rich are people that fulfill their food needs over the year and have some surplus. Most of them have agricultural equipment and are able to recruit temporary workers. Some of them own businesses, save money, lend money or goods and have stocks of merchandise and provisions. Diligent monitoring and conservation can prevent the flow of project resources to the non-poor.

Tanzania

Small-scale rural producers may apply over 80 percent of their household product to meeting their basic food requirements and their livelihood strategies may be complex. For example, a joint FAO/DFID analytical study of the application of sustainable livelihood approaches to SPFS (Temu, 2001), carried out in areas of Tanzania vulnerable to food scarcity, identified strategies that include: (i) providing casual labour against payment, often at distant places; (ii) engaging in off-farm activities such as brick making, quarrying and brewing; (iii) consuming alternative foods, e.g. roots and tubers; (iv) seeking help from the extended family; (v) borrowing food or money; and (vi) reducing food intake. The first three options are common to most livelihood strategies, while the last three relate to a state of food distress. Households on the brink of food insecurity have no savings and limited or no access to credit, and any failure in their strategic enterprises may result in acute food insecurity, dissolution of the household, emigration of the stronger and starvation of its weaker members. Such households adopt conservative risk management strategies and are averse to engaging in any speculation as long as their food supply is not secure.

A nutritional impact survey carried out in Tanzania during Phase I enabled better planning of Phase II (Egal *et al.*, 2001). In Mali, the failure to conduct a preliminary study had a negative impact on certain social groups. The Tanzania study found no explicit documentation to indicate the undertaking of in-depth surveys and research to establish the food security status and vulnerability in the project area. With decisions based on secondary information and without a full understanding of economic and social forces, action will remain haphazard.

The FAO/DFID study found that current land tenure arrangements provide little incentive for smallholders to fully adopt the SPFS-recommended technological packages. Farmers highlighted problems of conflict between herders and crop producers. Other problems stemming from land tenure include apparent lack of concern to improve the quality of land by investing in it, and also failure to conserve it by measures such as fire prevention, erosion prevention, proper management of water catchments, tree planting, etc.

In Tanzania, the participatory approach was advanced through: (i) formation of homogeneous social economic groups (Participatory Farmers Groups, PFGs); (ii) a participatory process of identifying production constraints; (iii) participatory selection of appropriate production technologies; (iv) farmer training to enable full participation in technology dissemination; (v) creating understanding and acceptance of the programme through awareness and sensitization about SPFS; and (vi) orienting training of village extension workers and equipping them with participatory techniques and relevant technologies. Interviews with officials indicated that the approach recommended in the "Guide on Participatory Group Formation" was valid and succeeded in promoting farmer participation.

Constraints, Shortcomings and How to Deal with Them

Productivity gains depend increasingly on human resources. Professional training and integration of farming populations into the process of development must accompany improved health, nutrition and literacy levels. In this regard, Phase I tackled some activities originally envisaged for Phase II, such as farmers' field schools, and a number of points emerged. Technical solutions need to integrate with local issues to provide solutions for resource-poor communities. In very diverse social, economic and ecological environments, technology packages need to be diverse and adaptable. Extension staff need to be aware of the technology and the specific needs of their communities. However, extension staff are often poorly prepared in terms of new technology skills and knowledge and their transfer. This handicap, coupled with poor motivation due to low salaries and status, may make them reluctant to face farmers. Extension staff should be a first target for training.

Within SPFS, water control for irrigation focuses on simple low-cost technologies and involves other specific aspects such as institutional capacity building, promotion of support activities, and integration with other components. Success hinges on group formation and farmer participation in irrigation scheme maintenance, the promotion of relevant technologies and partnership arrangements. The need for multidisciplinary teams to support extension workers has emerged. Unsatisfactory farmer participation in the various stages of technology transfer often points to a persisting weakness in the approach. Reporting on irrigation activities should include such aspects as irrigated land increases and cropping intensity improvements.

There is a need to demonstrate that water is a major constraint, to fully determine the level of subsidies in irrigation, and to gather more data on technologies and returns to investments. For example, in Tanzania, Phase I showed farmers in irrigated demonstration areas how to double yields by using improved seeds at the proper planting dates, applying fertilizer,

spacing plants properly, and protecting soil and water. Although the exercise was successful, it did not provide a breakdown of the efforts and rewards at the household level derived from the use of irrigation. In Malawi, people interested in irrigation farming faced the problem of access to communal land. Most of the land belongs to particular individuals and unless genuine cooperation exists, using borrowed land for group farming usually results in conflict. There should be a critical assessment of land ownership before selecting sites for smallholder irrigation. Land tenure problems also exist in Nepal, were good irrigable land is underused while landless farmers are forced into temporary emigration.

In Pakistan (Box 1), zero tillage technology has saved irrigation water and reduced tillage operation costs. See Bangladesh (Box 2), the best practice in channel management decreased the pumping costs by 25 percent. In Bolivia, the technique has reduced erosion on land that intensification had rendered highly exposed. An important criterion was that the same land could be used for pasture before and after the cropping season.

Human Resources

Women

Rural women often have a threefold role within a household: child-rearing, household management and income earning. Women's share in the labour force is generally high in countries where land availability and income per agricultural worker are low. For example, in Zimbabwe's communal areas, women constitute 61 percent of the farmers and at least 70 percent of the labour force (FAO, 1996). Comparative studies of the productivity of irrigated plots in Burkina Faso (Zwarteween, 1997) and in Senegal indicate the higher productivity of female-managed plots. In Mali and Tanzania, entrusting women with marketing and managing the returns resulted in net benefits in child nutrition.

In Ethiopia, the SPFS includes 160 sites with over 30 000 participating farmers, more than 50 of them widows. It would thus appear that other women are supposed to participate through the male head of the household. The participation of women in the PFGs in Tanzania ranged from 49 to 19 percent. At a national SPFS workshop in Kenya, the 29 field staff were all men. This aspect requires further action, as achieving better nutrition without the full participation of women will be difficult.

Box 1

Special Programme for Food Security in Pakistan, 1998-2001

Objectives:

- supplement national efforts to increase food production through enhancing crop productivity,
- ensure food security and alleviate poverty at village level through improving productivity and income of small farmers,
- build a sustainable model to ensure continuity of the food security programme.

Phase I: operational in two pilot villages since August 1998 (and one other since August 1999).

Approach: participatory - farmers' leadership and participation in all field activities. Focus: small farmers (large farmers restricted to 12 acres for input provision from the project). Water Users' Associations established and federated in a Village Organization. Phase I completed end July 2000.

Phase II: completion of ongoing activities in existing pilot villages and start-up at two new pilot villages with the objective of training local manpower to extend the project model to other villages.

Programme components:

- water management (watercourse improvements, furrow bed irrigation technology, precision land levelling with laser technology, farm redesigning and planning, water scheduling and minimal tillage technology),
- crop management (improved and certified seeds, balanced fertilizer application, plant protection measures, modern farming technologies and machinery, and crop diversification),
- income diversification (small-scale rural poultry farming, bee-keeping, agro-forestry; growing off-season vegetables; fish farming at farm level; and production of certified seeds),
- human resource development (group extension approach; training in production technology for farmers and field staff of agriculture extension and on-farm water management departments; benchmarks established at village level),
- socio-economic constraints analysis (at village, district, provincial and national levels).

Food crops such as wheat, maize, rice, oilseeds and pulses are the main focus of the programme. Provincial governments have provided manpower and technical services assist farmers at their doorstep. For ensuring future sustainability, each village now has an input sales centre, farm services centre and revolving fund account under the supervision of the Village Organization.

Crop productivity: Under this project, wheat productivity increases (compared with the benchmark value) in the pilot villages ranged from 28 to 51.5 percent for the first crop and averaged 62 percent for the second crop with a maximum increase of 168 percent, while for rice the productivity increases were 26.7 percent (first crop) and 50.3 percent (second crop) with a maximum of 125.6 percent.

On-farm water management: **Furrow bed planting of wheat has given a 13 percent higher yield than with flat bed sowing and a water saving of 22 percent compared with the flood irrigation system. Zero tillage technology has penetrated the rice-wheat system and have farmers bought 50 drills at their own expense.**

Income diversification: The SPFS pilot project provided 500 birds and a poultry shed. The farmers then built seven more sheds for 12,000 layer chicks resulting in an 11-fold increase in poultry shed area and a 24-fold increase in the number of chicks within one year. From bee-keeping, each farmer has averaged a profit equivalent to that from 6 acres of wheat, 2½ acres of cotton and 5 acres of rice. Farmers have started fish farming at their own expense.

Revolving fund accounts ensure project sustainability, and at some site farmers now rent out their farm implements, so enabling a permanent source of income and access to all kinds of implements.

BOX 2

Special Programme for Food Security in Bangladesh

The On-farm Water Management Pilot Programme became operational in July 1999.

OBJECTIVES:

- demonstrate and pilot farm-level water management procedures and techniques consistent with farmers' needs and ensure the sustainability and participative management of surface water,
- develop and test procedures to strengthen the capacity of authorities and local NGOs to provide effective support to farmers to improve on-farm water management (OFWM) and to intensify crop production,
- monitor and assess programme effectiveness and prepare recommendations on how to expand the pilot demonstrations into national and regional development programmes.

Activities implemented:

- PARTICIPATORY RURAL APPRAISAL,
- DISTRICT WORKSHOPS AND FIRST NATIONAL WORKSHOP,
- Technical staff training, farmers' seasonal training, farmers' field school and technical field training,
- Pilot demonstration programme with main crops included (i) OFWM improvements and (ii) crop husbandry techniques and technologies adapted to the specific conditions,
- Community development with local NGOs,
- WOMEN'S GROUP TRAINING.

Achievements:

- On-farm water management - (i) delineation of manageable irrigation blocks, (ii) improvement of the distribution systems, (iii) irrigation scheduling and (iv) supplementary irrigation of rice,
- Best practice in channel management - command areas increased 20%; pumping costs decreased 25 percent,
- Crop demonstrations - new crops and varietal shift for agricultural diversification, improved rice nursery, line transplanting of rice, green manuring, balanced fertilization, integrated pest management and small pond fish culture now adopted at pilot sites and adjoining areas,
- Training for capacity building, skills development and empowerment - involving women,
- Community development and women's development training - water user groups and associations formed with groups for women.

Developing the sensitivity and capacity of SPFS staff so they can address inequity towards women and focus on supporting women's role in food supply and nutrition can have a large impact on the effectiveness of the SPFS, especially in reducing malnutrition among children. However, gender discrimination tends to remain entrenched. Participation at the information gathering phase should involve the stakeholders, that is, women in food-challenged households. The cultural patterns that result in gender inequity often also make it impracticable for male agents to collect and cross-check the relevant information. Among the subjects in any investigation are land tenure arrangements, water allocation to female-headed households and the non-agricultural uses of water that alleviate the workload and improve

health and nutrition for poor women and children. In order to target poverty alleviation and nutritional improvement effectively, the SPFS needs gender-integrated teams.

Attitudes and training

Field staff in Bolivia have been reluctant to change their methods as they assume that their technical knowledge is appropriate and that rural people require instruction rather than consultation. This problem is common to donors and to beneficiaries alike. The introduction of concepts such as sustainable livelihoods in various agencies is an attempt to overcome the narrow vision of some field staff. Without extensive re-training and full acceptance by staff at all levels, the impact on project implementation may be slight. Local assistance priorities and scientific analyses of local situations should form the basis for environmentally focused development assistance so that areas most in danger may benefit most.

Many project agents (national and international civil servants, consultants, experts, technicians and extension agents) are reluctant to venture out of their assigned field. Their assumption that others will combine all the elements to improve the nutritional situation is often mistaken and project benefits may accrue, not to the targeted group, but to the non-poor.

Another problem is the communication gap between poor farmers and researchers. Extension services are understaffed, often with ill-prepared, poorly paid and unmotivated staff. The Tanzania study points out that the delivery of extension services has been weak, while the PFG relies heavily on extension services for the dissemination of technological packages and conducting on-farm demonstrations. New approaches and commitment are needed to ensure that farmers benefit from technological innovation.

Elitist tendencies are common as non-local people find it is easier to deal with the more educated or cosmopolitan locals. However, the task is to ensure that every member of the community has internalised the pros and cons of the envisaged actions and the benefits and obligations of participation. Consensus then needs to lead to action, but not every community has the leaders and the team to do this.

A critical aspect in some projects is that local manpower is not familiar with the technicalities of on-farm water management. However, it is difficult to assess the extent to which training helps overcome constraints. Trainees attend courses because they feel the need for training in order to properly apply the knowledge to securing their livelihood. However, during the high agricultural season, farmers may prefer to tend to their fields. In rural areas with high seasonal or permanent underemployment and disguised employment, the prospect of receiving a financial benefit in the form of a training allowance may attract participants. This may lead to applying limited financial resources in an unsustainable and unsound approach.

Financial, Organizational and Technical Constraints

Credit, funding and the private sector

Large global and regional development banks are available to support government development efforts. However, in conventional banking, small producers are not creditworthy, or the business is too small to justify the transaction costs. Small farmers need more innovative forms of banking. In cohesive communities, small farmers groups can provide collateral, while loans in kind can help overcome practical difficulties.

Within an adequately implemented regulatory framework, the private sector should be increasingly responsible for investments and services such as input provision, credit and

marketing services, and the development of agro-industries. However, private investment in agriculture is seldom pro-poor. In many developing countries, traders provide marketing and credit services to farmers that lack access to a market within reasonable distance. However, traders tend to take a monopolistic position, are generally unable to supply technology and unwilling to finance infrastructure. This system leaves farmers no margin for capitalization. For many subsistence farmers, fertilizers are unaffordable. Pesticides are a health hazard as farmers lack training in their use. Under such circumstances, employment generation for unskilled local people is low quality and minimal. Lacking an adequate public policy framework, the potential of the private sector to improve incomes and food security remains underutilized.

The main problems small farmers have with input supply and output marketing relate to: enabling policy for private sector marketing; rural infrastructure investments; extension services; market information; and adequate post-harvesting handling and storage. Small farmers, rural traders and extension staff need improved business skills. Within a competitive environment, stable relations between farmers and the private services sector are advantageous. In the Kauti district of Kenya, for example, a wholesale exporter collects French beans produced by smallholders, but there is no formal contract, the exporter does not always take all the harvest and does not provide credits for inputs.

Organizational and technical aspects

Many countries have been slow to set up a national SPFS steering committee. For example, although Burkina Faso committed itself to implementing the SPFS in 1995/1996, in June 1999, while work in the field was advanced, there was still no steering committee. In Tanzania, owing to what may be an overly bureaucratic structure, senior officials and committees have minimal direct influence on farmers' activities. However, senior managers accept and support farmer ownership of the process. The success of Phase I was due to the active participation of stakeholders at every stage. Various stakeholders (farmer's groups, input suppliers, credit institutions, research and extension officers, regional and district policy-makers and authorities) participated in identifying key issues and, at a later stage, implementation approaches such as increased production, project financing, technology, expertise and human requirements, and information needs.

In Angola preliminary studies carried out by persons not familiar with the reality of the project region failed to provide the information required to formulate a work plan. It is necessary to establish preliminary contacts with the communities in order to identify and address problems that have immediate solutions, and so gain their trust. This makes it possible to obtain a clear picture of the existing socio-economic reality and a list of families, useful for defining the interventions and enabling participation. It is also essential to establish freely elected and recognized (by traditional and political authorities) community development committees which should be active in the planning and execution of all actions.

The full integration of infrastructure and rural development is essential. Projects aimed at water control infrastructure development alone have limited chances of benefiting the poor before they benefit the non-poor.

Although the privatization of public goods, such as knowledge, may aim to improve dynamic efficiency through greater innovation, a loss of static efficiency may result from thwarted competition and the underuse of protected knowledge (Stiglitz, 1999). The SPFS projects do not appear to have used copyrighted seeds, possibly because they are not relevant to the needs of the rural poor. Traditionally, farmers save selected seeds from one growing season and plant them in the next, and in this way are sure of using locally adapted varieties.

Rural people's skills may no longer be appropriate under changed conditions, but farmers are wary of changing traditional farming methods and need exposing to new techniques without their carrying too much risk. Applying technology to transform agriculture and raise incomes is at the heart of most development assistance in this field. The major problems are not technical but concern reaching agreements on facts, alternatives or solutions. Technology can contribute to economic growth by overcoming resource scarcities and by combining products and inputs to optimise output. However, complex, diverse and risk-prone production environments call for adaptive designs and strategies. Many technologies address single commodities and specific forms of production, such as rainfed or irrigated agriculture. In reality, farming households pursue a range of production activities, which may include spatial diversification to ensure food, fire, shelter and health. Designing support services to cater to such diversity is difficult.

Phase I highlighted other development constraints and problems including:

- open and porous borders with large and relatively developed countries,
- inappropriate donor policies and dependence on donors,
- misplaced national priorities,
- administrative instability,
- farmers abandoned the newly introduced subsidized cropping patterns once the FAO-recruited team withdrew,
- shortages of seeds and planting and propagation materials (centralized systems of input production, procurement and distribution fail to cater to local needs),
- a paucity of technical and economic information related to irrigation based on actual experience and observation, and
- fragmentation of holdings.

The SPFS has been subject to specific constraints and issues. The contingent of the FAO recruited staff may be operating in a different regime of rewards and incentives, or parallel to the existing network of agricultural research and extension services. Such factors and the associated issues of replicability and sustainability are the principal SPFS-created constraints that may seriously jeopardise its expansion.

Another SPFS-specific constraint relates to the doorstep delivery to farmers of inputs either free or at heavily subsidized rates. An efficient and effective input distribution system is essential to any development programme. The priority national policies attach to rural roads, technology systems, etc. is a testimony to the recognition of these prerequisites. However, the means and style adopted in actually implementing the SPFS may be at variance with its own and national goals. The SPFS approach of delivering key inputs itself or through seeking special favour is contradictory and can become a major SPFS-produced constraint on the programme's expansion as it is neither replicable nor sustainable. Instead, it should explore ways of improving existing institutions and systems.

Conclusions

There is general agreement that the provision of food security has to start from the household level. Changing the agricultural structure of developing countries while promoting sustainable livelihoods for rural people and reducing poverty requires a long-term commitment. However, as international instruments erode governments' capacities to implement national policy

objectives, national efforts need supporting in a context of food security as a global public good. Food security and rural development are essential precursors to prevent environmental degradation.

The SPFS has demonstrated that investment in land and water can promote agricultural intensification and diversification. The resulting sustainable productivity gains can improve household incomes and livelihoods, provided certain identified constraints are overcome. Overcoming such constraints usually requires funds, be they on long-term credit, on concessionary terms or grants. To generate funds, it will be necessary to prepare small, well-designed food security projects with concrete goals and reasonable overheads. Such projects will need to demonstrate what inputs are needed to obtain the results that the stakeholders desire. The results of such projects need to have an immediate and clear relation with the improvement of livelihoods and food security. Reporting changes in the nutritional situation may not be practicable in every case, but nutritional impact surveys and monitoring can provide proof that the SPFS is having an impact where it matters. Transparent implementation of the SPFS and an accurate monitoring and reporting system are preconditions for acquiring credibility. The capacity to generate, analyse and report the necessary data needs strengthening. A key role for FAO lies in collating and disseminating the critical information in a reliable way.

A lesson from the SPFS project in Guinea is that, before launching the project, institutional partners need to provide adequate and timely information at the field level in order to ensure that partners such as farmers' groups buy into it. The project identified a need to strengthen the capacity to monitor, evaluate and analyse the economic viability of proposed packages. Rural development specialists are a key element in establishing the capacity and professionalism of the SPFS teams.

Incorporating nutritional impact surveys in the SPFS planning process can help direct project benefits to improving the nutritional situation of the poorest households in the target community. There should be a special focus on understanding the role and functions of women in the household, as any action leading to increased effectiveness in family nutrition can free time for other productive tasks. Severe conceptual and methodological biases have undervalued women's role in agriculture. On the other hand, however, the experience with the SPFS shows the potential to improve upon tenancy rights and contract farming opportunities in some countries as significant developments.

In conclusion, land and water investments are essential components of an approach that seeks to ensure sustainable food security. However, small-scale project success and wider replication will depend on managing all pertinent aspects of investment in water (e.g. irrigation, drainage and water management), land (e.g. plant, nutrient and soil management), human resources and infrastructure in a dynamic national and international context.

Bibliography

Briscoe, J., 1998. *The financing of hydropower, irrigation and water supply infrastructure in developing countries*. Paper prepared for the United Nations Department of Economic Affairs, presented at the Expert Group Meeting on Strategic Approaches to Freshwater Management, Harare, 27-30 January 1998.

Egal, F., Kouadio, G., Siano, R. & Tiendrebéogo, F. 2001. *Impact des aménagements hydro-agricoles sur la sécurité alimentaire des ménages et de la nutrition: l'experience de la FAO.*

FAO, 1994. *New directions for agriculture, forestry and fisheries*. Rome.

FAO, 1996. *Food production: the critical role of water. Technical background*, paper for the World Food Summit. Rome.

FAO, 1998. *Guide to efficient plant nutrition management*. Rome.

FAO, 1998. *Rural women and food security: current situation and perspectives*. Rome.

FAO, 2000. *Food for cities; food supply and distribution policies to reduce urban food insecurity* (http://www.fao.org/AG/AGS/AGSM/SADA/Pages/DT/DT4300E.htm). Rome.

FAO, 2000. *New dimensions in water security: water, society and ecosystem services in the twenty-first century*. AGL/Misc/25/2000. Rome.

IFPRI, 1999. *The past 25 years: successes, failures, and lessons learned in feeding the world*. www.cgiar.org/ifpri/2020/background/25years.htm

Shakya, P.B. 1998. *Constraints analysis of the Special Programme in Nepal and investment model for its expansion phase*. Katmandu.

Sonko, L. 2001. *Joint analytical study of the application of sustainable livelihood approaches in the FAO SPFS: Senegal data collection*. Rome, FAO/DFID.

Stiglitz, J.E. 1999. Knowledge as a global public good. In: *Global public goods: international cooperation in the twenty-first century*. New York, UNBDP/Oxford University Press.

Sy, J.H. 1999. Global communications for a more equitable world. In: *Global public goods: international cooperation in the twenty-first century*. New York, UNBDP/Oxford University Press.

Temu, A. 2001. *Joint analytical study of the application of sustainable livelihood approaches in the FAO/SPFS: Tanzania mission report*. Rome, FAO/DFID.

Van Koppen, B. 1999. *More jobs per drop for the poor: poverty and gender dimensions in a vision for food and rural development.*

Zwarteween, M.Z. 1997. *A plot of one's own: gender relations and irrigated land allocation policies in Burkina Faso*. Research Report 10. IIMI, Colombo.

ENHANCED COMMITMENT AND INNOVATION IN FINANCING AGRICULTURE AND FOOD SECURITY

Introduction

Against a background of declining investment in the agriculture sector and the poor prospects for achieving the goals of the World Food Summit, this paper examines the challenge of enhancing investment in land and water. It focuses on finance, financing mechanisms and approaches to agricultural development. In this context of innovative financing, it reviews practical approaches for the mobilization of domestic resources, the prospects for improvements in the pattern and the size of official development assistance (ODA) and foreign direct investment (FDI), and the opportunities for developing countries to benefit from global markets.

The Case for Investment

During the past decade, agriculture has been the main engine driving poverty alleviation strategies. However, land alone could not have accommodated all the existing and potential economic agents in the rural areas. Off-farm employment has become available. Empirical evidence shows a strong correlation between the increase in the production of crops, livestock and forestry products on the one hand, and the growth of employment through enterprises linked with the main sector, on the other. Consequently, land and water are crucial to the rural economy. Moreover, these resources have to feed an increasing number of people and respond to poverty alleviation requirements.

Absolute poverty has been on the retreat in most high-potential areas in developing countries. The combination of more productive technologies, fertile land and water, infrastructure development and larger amounts of public investment has raised income significantly. However, this development has not always been equitable or sustainable. Though considerable, the challenge of poverty alleviation in high-potential areas is not insuperable, provided that agricultural intensification proceeds without environmental destruction.

For the 60% of poor populations who live in fragile ecosystems, and mainly remote and ecologically vulnerable rural areas, poverty alleviation constitutes a major challenge. These areas are home to politically-marginal, indigenous populations and displaced or emigrated groups from more fertile areas. There is no immediate or medium-term prospect of these categories of rural poor abandoning these areas and integrating successfully in other sectors of the economy.

Consequently, fragile ecosystems are rapidly turning into areas of poverty and environmental degradation. Reliance on currently prevailing patterns of growth will postpone the resolution of poverty in such areas indefinitely.

These areas warrant the highest priority for urgent action. They constitute a significant part of the world's land resources. Forty percent of the earth's land surface are drylands, of which approximately 70% are already degraded or subject to heavy degradation. In addition, hilly and mountainous regions cover about 21% of the Earth's landmass and they exert a far-reaching influence on other areas, primarily through watershed functions.

Approximately 900 million people live in dry zones. Although only about 10% of the world's population live in mountain areas, a much larger percentage (about 40%) occupy the watersheds below. Serious ecological deterioration, caused by overgrazing, deforestation and excessive cultivation, threatens the livelihood of these populations.

Mountains are important sources of water, energy, minerals, agricultural products and a major reserve for the world's biodiversity. Similarly, dry zones are rich in biodiversity, hosting many endangered species.

A high proportion of the absolute poor in ecologically fragile areas are indigenous peoples, estimated at some 300 million worldwide. They depend on renewable resources to maintain their well-being. This has led to the development of livelihood systems which are well adapted to the harsh conditions. Viable technology and institutional arrangements for resource conservation in these areas could build upon indigenous knowledge; and, similarly, effective disaster prevention policies can benefit from coping strategies developed by local populations.

Rural women play a key role in on- and off-farm activities in the developing countries. This is particularly true in the case of the ecologically fragile areas, where women are becoming increasingly responsible for the day-to-day survival of the family. Women tend to be more vulnerable than men to the effects of environmental degradation because they are often involved in harvesting common property resources, such as wood and water. As women usually make a greater contribution to household food security than men, a decline in women's access to resources may have a significant impact on household consumption. Environmental degradation implies further burdens and responsibilities, which are not compensated for by increased decision-making power.

Land degradation and the loss of vegetative cover also have consequences at the global level, primarily because of its influence on carbon exchange, but also in terms of loss of biodiversity.

The development and conservation of fragile ecosystems requires the sound use of resources. This necessitates a significant amount of appropriate investment. There is currently a dearth of funding for development in fragile ecosystems. Nevertheless, there are mechanisms and instruments to meet this challenge. However, some of these are not yet functional and some are too small and underfunded.

The Decline in Investment

The fall in ODA has had a severe affect on agriculture. The real value of net aid disbursed to agriculture in the late 1990s was only 35% of its level in the late 1980s. There has been a significant fall in the share of agricultural lending in the loan portfolio of the World Bank. In addition, investment in agriculture has fallen in many developing countries.

The downward trend in agricultural commodity prices (especially demand inelastic commodities) has compounded the effect of the drop in donor support to agriculture. World Bank data indicate that world prices for agricultural export commodities fell by 47% in real terms between 1965 and 1998 period. Low-income elasticity of demand for many such goods and depressed prices are likely to continue.

Still more difficult for developing countries to cope with is the high volatility of commodity prices, against which the existing capacities for risk management and access to hedging instruments are inadequate. Such price fluctuations negatively affect the overall economy and the prospects for the successful design and implementation of sound fiscal, monetary, trade and development policies.

However, aggregate investment in land and water may have not declined as drastically as it appears. During the past two decades, there has been a change in the international scenario and the pattern of investment in these two sectors with increased resource-user participation

and a revival in indigenous techniques and traditional knowledge. This has led to less costly and more effective land development schemes.

Moreover, a significant amount of local level and domestic investment took place in the 1980s and 1990s. The investments in land and water consisted of small farmers and the rural poor investing in small-scale or minor irrigation. Furthermore, considerable indigenous social capital has been invested in cropland intensification, especially in China, India and other parts of Asia. Much of this has been in rice paddy and irrigated wheat. The urban and rural populations in most of Asia and the Near East have sufficient food today because of the massive indigenous investments in land and water by local people and local governments, using domestic financial resources, materials and manpower. With specific regard to water resources, much indigenous social capital investment has gone into drinking-water supplies, including multipurpose facilities serving livestock and/or irrigation.

Towards Enhanced Investment

Harnessing domestic resources

The bulk of resources available for a country's development should come from its domestic sources at national and local levels. It is countries' policy frameworks which induce or impair economic growth, equity, social capital growth and the reduction of hunger and poverty. Governments can favour private-sector initiatives and resources. However, this does not imply total dependence on market forces in a liberal economy. Appropriate institutions and infrastructure need to link macro plans to the micro decisions of economic agents. For the development of the agriculture sector, a conducive macro-economic environment implies improved terms of trade in favour of the sector, through the adoption of appropriate fiscal and monetary policy instruments. Such instruments, including international exchange rates and interest rates, can complement measures to create greater savings, capital formation and investment towards and within the rural economy. However, such reforms require additional measures to ensure growth with equity.

Factors Influencing Investment in Land and Water

Improved access to productive assets

Land and water (and financial means) are critical to the empowerment of the rural poor. First, they constitute the major source of income, saving and resilience of the poor. Second, they are effective instruments for enhancing the leverage of the poor in local decision-making processes. Reduced landholding inequality is key to alleviating rural poverty and improving household food security. Appropriate land tenure, land use and property rights would also induce a greater incentive for investment in land. These would catalyse the practices of sustainable resource use and help combat land degradation.

Secured access to water is a determinant equity factor for many water-stressed developing countries. The rural poor have to obtain more access and control over water resources if more agricultural benefits are to accrue to them.

Improved access to credit

Traditional approaches towards credit provision, including supervised credit, have proved to be ineffective and not responsive to the real needs of small farmers and the poor. A more comprehensive policy-driven approach, which seeks to mobilize and recycle rural savings, has started to demonstrate its relative superiority to the externally driven line of credit.

The emerging market for land

As a result of economic liberalization in many countries, a market for land is emerging. Parallel to these developments, an increasing number of civil society initiatives are resulting in small-scale innovative approaches towards land and agrarian reform.

Pricing as a determinant for water investments

Water availability is the major constraint on crop and livestock production in developing countries. For other factors of production, pricing mechanisms are normally the means of allocating scarce resources to their most productive use. However, water taken out of rivers and streams in developing countries does not have a factor market price. In most cases, there has been no perceptible opportunity cost for water for other uses. However, increasingly in developing countries, due to rural population pressures, competition has emerged between: riparian users and freshwater fisheries, livestock watering and crop irrigation, as well as between garden crops and human drinking water. The increasing competition and trade-offs have led in some cases to the establishment of exclusive water rights for extraction. These water rights are proxies for water pricing because they reflect the inherent utility of command of a scarce resource, which under market conditions would translate into a tradable market value.

In the least developed countries (LDCs), local rural councils have traditionally recognized customary rights to usable water resources. However, in most cases these are not codified or transferable. In contrast, in industrialized countries, water rights have become monetized and marketable to the extent that they are readily transferable. In economic terms, the capitalized annual net benefits of water utilization constitute the market value of the water right. In most respects, water constitutes a limiting factor, which is also a fixed factor, both in terms of location and quantity, so the market values of its use are capitalized into the value of the fixed factor. The annual revenues are net of both variable/operating costs and of competing uses, so the water right valuation represents a residual value. However, where water rights are not transferable, it is not possible to determine a proper market value for the rights.

Water rights as proxies for water pricing

The proper pricing of scarce water resources can ensure a more optimal allocation to its most efficient uses. At present, water scarcity in rural areas is a major determinant of both rural poverty and crop/livestock levels. Experience in Asia shows that poverty has fallen where about one-third of cropland is irrigated. By contrast, in sub-Saharan Africa, where only about 5% of cropland is under some form of irrigation, poverty levels are persistent and pervasive.

The needs of future generations in rural areas require greater efficiency in the utilization of water in all aspects. Water pricing could be a powerful tool for improving the low efficiency levels of water use in most developing countries. However, water prices are not available or used in rural areas, nor is it politically possible to introduce them. Nevertheless, even partially

monetized water rights would provide a strong weapon for the more rational utilization of water resources and would constitute proxies for prices.

Some degree of monetization of water rights is possible by introducing partial transferability within communities. Individuals could transfer water user rights between one another while precluding sale to persons outside the immediate user community. Moreover, recognizing the difference between the control and the ownership can generate some gains. Control of water resources is more important to the rural community than ownership, which can become a separate semi-formal water right. The latter, where monetized, represents a store of value, a financial asset, and a basis for rural credit operations under rural finance.

Markets and Trade

Within the context of falling real agricultural commodity prices, the main opportunity for small-scale producers in developing countries lies in developing market niches offered by their particular biodiversity, micro-climates or unique geographical location vis-à-vis the major consumption markets.

The Role of External Resources

While ODA will remain as the major source of external finance and LDCs may receive a higher priority than at present, the FDI flow to LDCs and many other countries will continue to face the present barriers and competition from stronger developing countries. The pattern of aid allocation may remain as it is, with investment in natural resources, land and water following the pattern indicated below:

- Very limited amounts of market-led (largely private, often corporate) investment in productive commercial enterprises in developing countries which allow the repatriation of earnings/profits and the sale of investments in convertible currency.
- Investment to preserve or sustain proper natural resource management (NRM) by rural people in marginal or degrading situations. Such NRM investment would be mainly made for welfare reasons for rural people and secondly to protect scarce and vulnerable natural resources. There might be some additional ODA resources directed specifically at drylands because of the possible catalytic effect of new window of the Global Environment Facility (GEF) and a better performance by the Convention on Desertification (CCD)/Global Mechanism (GM).
- A revival of interest in carbon sequestration activities as a result of new breakthrough in negotiation on the Clean Development Mechanism (CDM).

International financing flows for investment in land and water may take at least four forms, comprising one or a combination of: (i) private/corporate; (ii) ODA through multilateral and bilateral loans and grants; (iii) philanthropic contributions from the private sector and individuals on the pattern of ODA; and (iv) alternative/innovative finance through emerging and new mechanisms or the adjustment of existing mechanisms. Any of the above sources may have links with domestic financial resources from public and private sources (including at local and community level). Domestic finance mobilization in developing countries will be also associated with non-monetary investment by rural people.

International Resolve

At international level, efforts to mobilize additional ODA also need to target the broader international constituency by highlighting the importance of preserving global assets such as land, water and other natural resources, and creating global public goods such as peace and security. It may be possible to link these concepts with the principle of several and joint global responsibility.

Furthermore, bearing in mind the disparity in the ratio of ODA to GNP between the G7 and non-G7 countries, ways of effectively influencing the latter group of countries warrant consideration. The annual G-8 Summit meeting could be a promising arena. So far, there has been no concerted action to interact with the G-7 over the critical role of the agriculture sector in poverty alleviation and environmental conservation.

There are still opportunities for enhanced levels of aid and a more accessible world financial market for the weaker developing countries, e.g.:

- Continuation of the Uruguay Round, moving towards implementation of the WTO Marrakech Decision and a breakthrough in the Millennium Round;
- More vigorous and decisive steps towards solving the debt problems of developing countries (e.g. the Highly Indebted Poor Countries Initiative);
- Resolution of issues related to the CDM, so activating the market for carbon trading and carbon sequestration.

Innovative or Alternative Finance for Development

General proposals

The two most important proposals concerning innovative or alternative ways of financing the development needs of developing countries are:

- The Tobin tax proposal entails taxation of foreign exchange transactions on a uniform ad-valorem basis (1.0%) for such transactions in all countries except in small countries whose currency is formally pegged to a major currency. The mechanism could discourage highly speculative currency transactions.
- Levies on use of global commons as a way of mobilizing large amount of resources automatically for international development cooperation. A small tax on air travel, international transportation and communication are example of sources considered for this purpose. However, there are three specific sources of levy which are worth pursuing for reasons which go beyond resource mobilization *per se*, namely: deep ocean and seabed resources; geo-synchronous orbiting, and the Antarctic landmass. A levy on their use would be a way of introducing the concept of pricing the major global commons. These are currently subject to overexploitation by members of the international community at the expense of weaker ones.

Sector-focused innovative finance

Many developing countries have a limited capacity to attract foreign private capital and FDI, particularly for the agriculture sector. Therefore, the effectiveness of innovative approaches would be contingent upon their potential to mobilize and/or catalyse domestic resources.

Bearing in mind the micro-economic attributes of small farmers, family farm labour and local resources could be an important source of innovation. Finally, as in any other field of investment, the innovation should be a tested reality. This implies the proven potential of the approach to be replicable on a large scale.

Innovative Financing Mechanisms

Direct financing mechanisms

Direct financing mechanisms involve the direct transfer of financial resources from source to beneficiary for specific activities. They normally comprise: credits, grants (both in cash and in kind through donors and government) and remittances from outside the rural area. The terms of funds could be commercial rate investments provided by the private sector (conventional capital markets), or below market rates. Two innovative approaches are:

- Instruments and mechanisms to foster rural financing systems including the provision of credit, saving facilities and banking transactions at grassroots level. These instruments would have the capacity to mobilize and recycle domestic savings. The terms of trade of the agriculture sector would be a determining factor in directing rural savings and attracting urban savings for investment in agriculture.
- Innovative partnership arrangements between landowners and tenants which would entail secure incentive for both sides to invest in land and water resources (enhanced capital from landowners and more intensive allocation of labour from tenants).

Forestry-sector and environmental conservation programmes have applied some innovative approaches for mobilizing funds and channelling them directly to the resources users. The most notable examples are:

- national environmental funds,
- debt swaps,
- biodiversity venture capital funds,
- community initiative development funds (a coalition to eradicate hunger and poverty involving the IFAD, FAO, the WFP, the World Bank, the EU and international and regional NGOs),
- portfolio equity instruments.

Indirect financing mechanisms

Indirect financing mechanisms address structural barriers that inhibit investment in the agriculture sector or which stimulate investment through economic measures. They include addressing policy failures such as incentives for unsustainable forestry management as well as water charge and cost recovery approaches to encourage the efficient utilization of water resources. In this context, there are also innovative market development initiatives to redress endemic market failures. These mechanisms form two subcategories: tradable commodities and non-tradable commodities. The former consist of farm products and the latter comprise services provided by resource users.

For tradable commodities (products)

- Market niche approach: This normally draws on the commercial potential of a country's biodiversity. It identifies and develops new market niches for high-value products from

small farmers. The underlying strategy entails the differentiation and segmentation of market. The microclimate of specific regions would also allow production of off-season fruits and vegetables, which could capture a higher price in the market.

- Market-based risk management instrument: This scheme (a World Bank initiative in collaboration with the EU, UNCTAD and the Chicago Board of Trade) aims to initiate a new wave of instruments to manage price risk in commodity-dependent countries through market-based approaches.

For services (non-tradable commodities)

- Services provided by resource users, and which conventional markets do not recognize as tradable. The principal aim of the mechanisms involved is to provide resource users with a means of recovering the incremental costs of providing these services through the market, so obviating the need for less effective subsidy or compensation arrangements. For example, sustainable forest management is inherently concerned with valuing the full range of functions played by forests. The related market development mechanisms ultimately seek to provide a direct market-based incentive for forest users to make the transition from unsustainable practices to sustainable ones.
- One of the major initiatives is the Regional Fund for Environmental Services. The initiative has considered the following avenues for direct and indirect resource mobilization to support farmers in the upland areas of Asia:
  - carbon sequestration,
  - maintenance of hydrological functions and water resource use charges,
  - biodiversity conservation.

Conclusion

Investment in land and water resources is crucial to achieving international development goals. However, international investment flows to developing countries have been inadequate and have indeed declined in real terms. Domestic investment has shown that it is possible to make an impact on the problems.

While the case for investment may be clear, conventional approaches to investment have failed. The pressing situation calls for innovative approaches to raising and channelling investment flows. After proving themselves on a small-scale, replicable mechanisms warrant large-scale application.

The issues involved in investment in land and water are of global importance. Hence, the situation warrants a global approach involving specific innovative instruments that bring benefits for all and for the rural poor in particular.

ESTIMATING NEEDS FOR AGRICULTURAL LAND AND WATER DEVELOPMENT IN AFRICA

Introduction

"A New Africa Initiative"(NAI) was adopted by the Organization for African Unit (OAU) in Lusaka, Zambia in July 2001 to promote economic recovery and development in Africa over the next fifteen years. Growth and development are to be achieved by according attention to five priority sectors including agriculture. While the intention is to promote balanced, sustainable development through complementary actions in these related sectors, agriculture will clearly be the lead productive sector underpinning overall growth. In order to raise agricultural growth to required levels increased investment is foreseen in land and water improvement among other ways of boosting production and productivity. Total investment required to achieve the objectives set out in the NAI is preliminarily estimated at US$ 64 billion annually. The Initiative set itself a first six month schedule (starting July, 2001) to assess more detailed needs for the five priority sectors starting at national level to then progress to regional and continental levels.

The purpose of this document is to support the New African Initiative regarding agriculture particularly in the area of land and water improvement and production intensification. After outlining key elements of the NAI the document emphasises the importance of agriculture and land and water development for Africa showing how these have been neglected. The apparent contradiction between general agreement on the imperative of increasing investment in land and water improvement for development, as envisaged in the NAI, and declining or stagnating investment in these areas, is examined. It is suggested that one way of resolving this paradox is for governments to demonstrate more clearly than in the past the impact of investment in land and water on desired development outcomes.

A method is outlined for use by governments to develop scenarios for country-specific investment in land and water improvement and production intensification. By placing agriculture in the context of the rural economy, the method also takes into consideration investment needs in processing, marketing and elements of rural infrastructure. In this way it provides a country-driven instrument to quantify the costs and benefits of investment in the sector, and one that helps understanding how such investment influences development and sustainable growth, thereby strengthening the case, at national level, for increased financial allocations to agriculture.

Use of the method is demonstrated by applying it to estimate additional production and corresponding investment needed for African countries to meet the World Food Summit goal of halving the number of hungry people by 2015. When additional production to meet the WFS target is expressed as a percentage of projected production in 2015, results suggest that 6 African countries would need to produce up to 10% more food, 27 countries between 10 and 25% and 12 countries in excess of 25% more food by 2015. An indication of the magnitude of additional investment required to achieve this increased production is provided; 16 countries would require up to 25% more investment in land and water development, 14 countries between 25 and 50% and 11 countries in excess of 50%, when such investment is expressed as a portion of additional total investment in the primary sector (crop and livestock production). Additional annual net investments of some US$ 7.6 billion would be required for Africa as a whole to attain the WFS target. The approximate and thus possibly misleading nature of these provisional results can not be overemphasized. They are based on outdated and

sometimes partial information. To be interpreted correctly they should be considered within the limitations of the method.

More precise and realistic agricultural investment requirements will be obtained through use of the method at country level based on up-to-date information. A distinct advantage of this would be ownership of the process and results by African countries thereby rendering outcomes more credible to potential development partners and aid donors.

A New African Initiative

Africa has outlined a course for its economic recovery and development in 'A New African Initiative (NAI), July 2001, that represents a new framework for interaction with the rest of the world. The long-term objective is "To eradicate poverty in Africa and to place African countries, both individually and collectively, on a path of sustainable growth and development and thus halt the marginalization of Africa in the globalization process; and to promote the role of women in all activities".

The NAI emphasizes the determination of Africans to shape their own future through deliberate development choices, empowerment and self-reliance. Development partners are called upon to complement these efforts by creating fair and just conditions conducive to accelerating Africa's effective participation in the global economy and body politic.

Goals to be achieved in pursuing the overall objective are an average gross domestic product (GDP) growth rate of above 7% per annum for the next 15 years, and to ensure that the continent achieves agreed international development goals (IDGs)[1] Attaining the World Food Summit goal of halving the number of hungry people by 2015 is implied.

Growth and development are to be achieved by according priority attention to five sectors:

- infrastructure;
- information and communications technology;
- human development (health, education, skills);
- agriculture; and
- diversifying production and exports.

Emphasis is placed on agriculture as the lead productive sector that provides the main source of livelihoods and income for Africa's rural population. Agricultural productivity and growth are to be boosted to meet country needs and for exports through a variety of measures including improved water use, better land tenure security, enhanced rural financial systems, more efficient marketing, reduced urban bias of public spending, improved preservation and storage, better research and extension, enhanced role of women and countering donor fatigue in agriculture. Agriculture's ability to contribute to development is to be enhanced through more diversified production and value adding agro-processing.

It is estimated that Africa needs 64 billion US$ annually or 12% of its GDP to achieve the above goals. While domestic savings will be increased and public revenue collection systems

[1] To reduce the proportion of people living in extreme poverty by half between 1990 and 2015; To enrol all children of school age in primary schools by 2015; To make progress towards gender equality and empowering women by eliminating gender disparities in the enrolment in primary and secondary education by 2015; To reduce infant and child mortality ratios by two-thirds between 1990 and 2015; To reduce maternal mortality ratios by three-quarters between 1990 and 2015; To provide access for all who need reproductive health services by 2015; To implement national strategies for sustainable development by 2005, so as to reverse the loss of environmental resources by 2015.

will be improved, the bulk of these resources will have to come from outside the continent; mainly debt reduction and Official Development Aid in the short to medium term and private capital flows in the longer term. Improved economic and corporate governance is seen as a prerequisite to attract foreign financial resources and to use these more effectively.

The NAI has a six month schedule (from July 2001) to flesh out its initial programme into more concrete proposals. This includes sectoral needs assessments progressing from national to regional and continental levels. Assistance is expected from developed countries and multilateral institutions to accelerate implementation of the programme.

The Case for Investment

Agricultural growth is more important for Africa than for any other continent. About 70% of people in Africa and roughly 80% of the continents poor live in rural areas. These people depend on agriculture and non-farm rural enterprises for their livelihoods, and increasingly are unable to meet their basic food needs as population pressure on land grows, and land and water resources become scarce or degrade and agricultural productivity stagnates. In Africa today agriculture is the most important rural enterprise, contributing an average of 30% of total gross domestic product in Sub-Saharan Africa (excluding South Africa), and over 40% in one third of countries. Agribusiness's, which themselves depend on agricultural growth, are responsible for an additional 20% of gross domestic product and about 25% of total rural incomes. Agriculture and the rural economy account for some 67% of employment and 40% of exports. Raising the productivity of agricultural and non-farm enterprises will profoundly affect the rate of economic growth for the majority of African countries over the next fifteen years. An increase in agricultural and rural growth will help address environmental degradation by facilitating the technological transformation needed to raise agricultural yields in a sustainable manner thereby reducing pressure on fragile ecosystems (World Bank, 2001).

Increases in agricultural productivity are central to growth, income distribution, and improved food security and poverty alleviation in rural economies. Increased farm production improves farmers incomes, generates on-farm employment and lowers food prices both of which reduce poverty as the poor typically spend 60-70 % of their income on food. Recent studies suggest that an even more significant effect on rural poverty comes from increased farm incomes that stimulate demand for the goods and services offered by the small scale enterprise sector. With abundant labour agricultural growth generates significant income and employment multipliers within the local non-farm economy. Where such large multipliers exist technological change in agriculture has the potential to generate significant new non-farm income earnings for the poor (Mellor, 2000;IFAD, 2001).

Few low-income countries have achieved rapid non-agricultural growth without rapid growth in agriculture.

Even though the focus of this document is mainly on investment in agriculture land and water, the importance of other sectors identified for priority action by the NAI is not overlooked. Their role in poverty alleviation is at the root of development strategies widely shared by the international community.

Land and Water: two corner stones

Land and water are the primary natural resources that enable agriculture, food production and rural development in most countries. They are also equally important factors of production whose association with appropriate technologies and related factors such as labour,

investment and institutions enhances their productivity. This fortunate association has enabled global agricultural production to outpace growing demand despite declining availability of per caput land and water resources. For this trend to continue, increased output will have to come mainly from intensified production as general land expansion can make only a limited contribution. The availability of land and water is thus central to development, food security, and poverty reduction.

FAO estimates that between 1995/7 and 2030 about 75% of the projected growth in crop production in sub-Saharan Africa will come from intensification in the form of yield increases (62%) and higher cropping intensities (13%), with the remaining 25% coming from arable land expansion. The share due to intensification will exceed 90% in land-scarce countries of North Africa. Intensified production occurs mostly on land already under cultivation (FAO, 2000a).

In 1995/7 water withdrawal for irrigation accounted for about 7% of total water resources in developing countries. The forecast is for withdrawal to grow by 12% by 2030. Thus there is sufficient water for irrigation and other needs in these countries. Nevertheless, the combination of uneven distribution and expanding population is putting increasing pressure on available water resources in a number of countries, mainly in Africa and the Near East. Increasing water scarcity will result largely from rapidly growing demands for agricultural, industrial and household purposes. At the same time, the potential for expanding supplies in many countries and localities is diminishing. Deteriorating water quality and environmental conditions, degradation of irrigated land, insufficient river flow, upstream land degradation and seasonal flooding will aggravate water shortage problems. Unless there is prompt action, a number of countries in Africa risk severe water shortages that could depress agricultural production and limit industrial and household use (IFAD, 2001). Given the need to boost agricultural productivity and growth in these countries, the importance of investing in water saving technologies and practices is clear.

The threat to agricultural production is particularly severe because this sector is the major user of water in most African countries, often accounting for 90 percent or more of total water use. As the biggest user of water, often at highly subsidised rates, attention is focussed on irrigation to improve water use efficiency levels that are generally low.

Irrigation

In 1995/7, the total irrigated area in developing countries amounted to about 197 million ha (three-quarters of the world's irrigated area). Seventy-four percent of this irrigated land is in Asia, 14% in the Near East/North Africa, 9% in Latin America and 3% in sub-Saharan Africa. Between 1961/63 and 1995/7 the irrigated area in developing countries increased at an annual rate of 1.9% to 197 million ha. Asia registered the largest increase: 70 million ha (mainly in India, Pakistan and China); while in sub-Saharan Africa the increase was 2 million ha. The prediction is for the area of irrigated land to increase by 0.6% per year to 242 million ha in 2030. Declining and insufficient investment in agriculture, the broader water sector and irrigation reflect this decrease in irrigation expansion.

Irrigation is fundamental to agricultural intensification. Irrigated agriculture practised on 20% of all arable land accounts for 40% of all crop production and almost 60% of cereal production in developing countries. In coming decades an estimated 80% of the growth in crop production will come from intensification largely enabled by irrigation. Seventy percent of the increase in cereal production expected by 2030 will be attributable to irrigation. As rainfed agriculture lacks the potential to replace irrigated agriculture in any significant way,

there is no major alternative to irrigation in the challenge to meet future growing food and other agricultural needs in developing countries.

Irrigation increases cropping intensity and contributes to expansion in cropped areas. It increases yields, stabilizes output, enables crop diversification, reduces risk and increases farm incomes and employment. Through its influence on agricultural incomes, irrigation has a multiplier effect on non-farm incomes. It contributes to food security and poverty alleviation. By improving agricultural productivity, irrigation contributes significantly to overall growth and development. Irrigation reduces the risk of crop losses from uncertain rainfall and enables production in areas or at times without rainfall. However diverse, irrigation systems provide water to enable farmers increase output per hectare. There are strong synergies between irrigation and other principal sources of agricultural growth such as fertilizer, improved plant varieties, better husbandry, up graded infrastructure and better integration into markets. These encourage farmers to invest in land improvements and in other inputs.

By boosting agricultural productivity, irrigation contributes significantly to rural incomes, rural employment, food security, poverty alleviation and overall growth and development. It also helps keep food affordable to the poor. Without more irrigation, many countries will be unable to achieve food security and reduce poverty. Irrigation has good distributional effects as it mainly targets smallholder farmers, and most of its beneficial impact is in rural areas where three-quarters of the world's poor live (IFAD, 2001).

There are now technical, economic, social and environmental solutions to most of the problems caused by irrigation. Thus, if projects adhere to sound investment design and implementation guidelines, irrigation can be an environmental asset. As irrigation is a major water user, improvements in the current low level of water use efficiency will release large volumes for expansion, and use by other sectors. Technological, operational and managerial techniques are improving efficiency levels. The application of the principles of irrigator participation, financial autonomy, and privatization will enhance the viability of future investments in new or existing schemes.

Contrary to a widely held view, returns on investments in irrigation are generally comparable to alternative investments. Moreover, most analyses fail to take the positive indirect social and environmental effects of irrigation fully into account. Future investments in irrigation will be mainly for rehabilitation and upgrading. Such incremental investment will benefit from the large amount of sunk costs in existing schemes thereby enabling higher rates of return. A clear indication that irrigation yields adequate returns is the considerable amount of private investment it attracts world wide (see private investment).

Land Improvement in Less-Favoured Rainfed Areas

Agricultural development strategies emphasizing irrigated agriculture have increased food production and stimulated economic growth. At the same time large areas of less-favoured rainfed lands suffer from neglect and lag behind in their economic development. These lands are characterised by low agricultural potential, often because of poor soils, steep slopes, short growing seasons and lower and uncertain rainfall, but also because neglect has left them with limited infrastructure, weak institutions and poor access to markets. As population densities grow with no matching increases in production, food insecurity and poverty worsen and widespread degradation of soil and water resources tends to occur.

Such remote areas are home to some 60% of the poor often made up of politically marginal, indigenous people and displaced groups or immigrants. There is no immediate or medium-term prospect for them to leave these areas by being absorbed in other sectors of the economy.

These ecologically vulnerable zones warrant priority attention as they constitute a significant part of the world's land resources. Forty percent of the earth's land surface is dryland of which some 70% is degraded or subject to heavy degradation. In addition, hilly and mountainous zones that cover about 21% of the earth's landmass have important watershed functions. Land degradation and reduced vegetative cover contribute to loss of bio-diversity. Despite these imperatives there is a dearth of funding for land improvement and development in less-favoured rainfed areas.

On development and environmental grounds alone, there should be greater focus on less-favoured areas in setting priorities for policy and public investments. In some cases land expansion can contribute to increased agricultural production. However, in many less-favoured areas, social and environmental crises are already common sometimes soliciting more investment in crisis relief than in development from governments and donors. There is evidence that strategic investments in the economic development of less-favoured areas can be more cost effective than relief even in a relatively short period of time (Owens and Hoddinott, 1998). Increased public investment in technology and infrastructure in less-favoured areas may yield higher marginal returns than comparable additional investments in irrigated agriculture (Fan and Hazzell, 1997).

Techniques such as conservation tillage and integrated watershed development have demonstrated that investment in these areas can yield acceptable returns while achieving the twin goals of productivity growth and poverty alleviation. Marginal returns to such investment in less-favoured areas can exceed those in irrigation. This does not mean that there should be less public investment in irrigated and high-potential rainfed areas in developing countries. It signifies that there should be a better investment balance between irrigated and less-favoured areas because reclamation and/or further development of the latter can benefit the large numbers of poor people living there. The amount of economically justifiable public investment in any locality should depend on the net social returns from productivity growth, poverty reduction and the containment of environmental degradation.

The investment needs of less-favoured rural areas often involve improving health and education, infrastructure and agricultural production in different combinations and in an integrated manner. Farming systems in less-favoured areas typically include mixed investment balance between irrigated and less-favoured areas because reclamation and/or further development of the latter can benefit the large numbers of poor people living there. The amount of economically justifiable public investment in any locality should depend on the net social returns from productivity growth, poverty reduction and the containment of environmental degradation.

The investment needs of less-favoured rural areas often involve improving health and education, infrastructure and agricultural production in different combinations and in an integrated manner. Farming systems in less-favoured areas typically include mixed farming and other practices that contribute to soil, nutrient and water conservation. Thus, while commodity improvement is relevant for less-favoured areas there is growing consensus that major productivity gains will have to come from improved natural resource management practices and technologies tailored to the ecological, social and economic circumstances of rural communities.

Land improvement techniques and integrated watershed development have shown promising results. They should be a key component of development strategies in less-favoured rainfed areas in certain countries. Such investments can yield acceptable economic rates of return with direct benefits for participants. Where the evaluation takes their social and environmental impacts fully into account their returns may exceed those of other agricultural investments.

Nevertheless, because the shortage of water limits the production potential of most less-favoured areas, their contribution to overall food grain production and food security in most countries will remain relatively modest. High-potential areas with irrigation will continue to be the breadbaskets for most developing countries.

Declining Investment and its Consequences

It is widely understood that the concept of investment to augment the productive capacity of agriculture entails physical assets, science and technology dissemination, human capital enhancement and social capital accumulation. Capital is a major determinant of agricultural growth. It's absence or scarcity constrains growth. Creating a pro-investment climate to raise productivity levels and realise the needed structural changes becomes a principal policy challenge. The entire policy and institutional environment needs to be conducive to investment by private agents, in particular farmers.

Private Investment

More than half of investment in agriculture and related activities in developing countries is made at farm level. Most is in the form of household labour for land clearing, levelling and terracing, irrigation and drainage, orchard establishment and building up livestock numbers. Private investment provides all the financing for about 20% of the total area currently irrigated (about 264 million ha in 1995/7). The share of private investment in the remaining 80% is approximately half of the total investment. Furthermore, there is an estimated additional 70 million ha of land under informal private irrigation that falls outside government control.

Private investment (internal and external) in developing countries expanded approximately five-fold between 1990 and 1997. Although data on internal private investment is scarce, any such increase is likely to have been considerably lower in most African countries because of their very low income and savings levels. Moreover, poor countries have difficulty attracting foreign direct investment (FDI) because of their underdeveloped financial markets and because potential investors face high long-term risk. FDI tends to follow growth rather than lead it. During the above period Africa received only about 1 percent of total world foreign direct investment and 4 percent of FDI to developing countries. Public investment in agriculture thus remains vital for most African countries.

Government Expenditure

Useable data on public spending and investment in African agriculture are scarce. Evidence suggests that since the 1990s the level of public resources allocated to agriculture has been consistently low relative to the sector's size and contribution to the economy. In most African countries the sector receives less than 10% of public spending (recurrent and investment) but accounts for 30-80% of gross domestic output. Countries with high levels of hunger are also those in which public expenditure on agriculture does not reflect the importance of the sector.

In general, public spending on agriculture has been inferior to direct and indirect transfers of income from the sector to government and the rest of the economy. Inadequate public resources have constrained the development of rural public goods (e.g. infrastructure, institutions, support services, human capital) and the ability of private sector to develop. In turn, such policies have stifled economic development by forfeiting the strong multiplier effects of high agricultural growth on the rest of the economy.

Where public investments in Africa have been high they have often been misallocated, or recurrent budgets to maintain investments have been inadequate.

External Financial Resources

Because of its low income and savings levels Africa still relies heavily on external financial resources to support growth needed to promote development and overcome poverty. Most African countries have failed to attract meaningful amounts of private capital, in particular foreign direct investment, for reasons already provided. Official development finance will have to be significantly increased if the continent is to achieve the kind of growth that will eventually attract foreign investment and make aid less necessary (UNCTAD, 2000). At present there are major signs of under-investment and under-performance in African agriculture.

When measured in constant 1995 prices, official development assistance from bilateral and multilateral donors is 8% below 1990 levels. Throughout the 1990s the flow of funds to primary agriculture declined while there was increasing attention on other areas, in particular environmental protection, rural development and infrastructure (FAO, 2000b). The proportion of sectorally allocable aid reaching agriculture, forestry and fisheries fell to 20% in 1987-89 and then to 12.5% in 1996-98. The real nature of net aid disbursed to agriculture in the late 1990s was 35% of its level in the late 1980s (IFAD, 2001). The share of agricultural lending on the loan portfolio of the World Bank fell below 10% in 2000 compared to an average of 14% for the preceding decade. This was its lowest ever in both percentage terms and absolute amounts (World Bank, 2000a). At the same time, spending on economic sector work to provide the analytical basis for rural development assistance in Africa decreased by 82% in the 1990s with no sign of slowing. This drastic decline is likely to translate into a further drop in lending and project quality during the next few years.

Estimates of current annual investment in the water sector range from approximately US$ 60 000 million to US$ 80 000 million (DFID, 2000; Elz, 2000.). Of this amount approximately 90% comes from domestic resources and the rest from international donor aid and multilateral funders, of which the World Bank is the principal source (DFID, 2000; World Bank 2001). The World Commission on Water considers investment levels to be less than half of that needed (about US$180 million per year) to meet minimum water, sanitation and nutrition requirements, mostly in developing countries, by 2025. On a global level there is a substantial shortfall, both for capital investment and for the operation and maintenance (O&M) of existing infrastructure. The tendency is to allocate most money to new capital works with insufficient funding for operation, maintenance and system rehabilitation. Recent studies indicate that the amounts allocated for irrigation scheme O&M are typically less than 50% of those required (DFID, 2000). From 1950 to 1993, 7 percent of World Bank lending went to irrigation, more than any other sub-sector (Jones, 1995), but fell to about 4% for the period 1990-1997 (DFID, 2000).

Consequences

Inadequate attention to agriculture, and the rural economy has had severe consequences for Africa. Comparisons of aggregate performance across continents over the past forty years show Africa to be the only continent where agricultural production per worker has deteriorated. In 1997, 34 of 49 (70%) African countries were producing less food per person than a decade earlier. Agricultural productivity per worker for the continent has stagnated

since 1990 at about US$ 375 (constant 1995 US$). This is 12% lower than in 1980. The gap between what is produced and what is needed is widening.

Low productivity results from weak investment in productivity-enhancing factors such as irrigation, the use of fertilizer and other purchased inputs and mechanisation. Only 4-7% of cropped land in Africa, or less than 20% of the theoretical irrigation potential, is irrigated. This compares with 13% in Latin America and the Caribbean, a region with similar population densities and resource endowments. Insufficient investment in soil improvement has led to excessive nutrient extraction through crop production (Scherr, 1999). Soil degradation over the last 50 years has caused a 25% drop in Africa's cropland productivity that constrains growth.

Africa's capital stock per hectare of agricultural land in 1988-92 was about one sixth of that in Asia and less than one-quarter of that on Latin America (UNCTAD, 1998). Under capitalisation is associated with the lack of competitiveness of African products in world markets. Since 1970 Africa has suffered losses in its world market share for agricultural exports to the extent of 55 percentage points for groundnuts, 27 for cocoa and 14 for coffee (World bank, 2000a).

Weakly developed agriculture is associated with food insecurity and poverty. Today more than 180 million people in Africa do not have enough to eat for a healthy life, one third of the total population. FAO's latest projected trends in under-nourishment for Africa and for the Near East/ North Africa are given in table 1.

Table 1: Projected trends in under-nourishment.

	1990-92	1996-98	2015	2030	1990-92	1996-98	2015	2030
	Percent of population				Millions of people			
Sub-Saharan Africa	34	34	22	15	162	186	184	165
NearEast/North Africa	8	10	8	6	25	36	38	35

Source: Agriculture towards 2015/30, Technical Interim Report, FAO, 2000.
The State of Food Insecurity in the World 2000, FAO, 2000.

These projections show that no progress has been made since 1992 (the base period for the World Food Summit target) in either region towards reducing the number of undernourished people. Due to population growth the total number of hungry people will remain approximately constant until 2015 before decreasing towards 2030. This is far from what is needed to meet the World Food Summit target of halving the number of hungry people by 2015. The data mask differences between countries within the regions. For example, in sub-Saharan Africa, significant progress has been made toward food security by six countries, whereas others are worse off than at any time during the last three decades. Exceptionally high rates of growth will have to be attained by the latter for them to achieve the WFS target.

Paradox

Part of the challenge facing Africa to transform its agriculture in the interest of achieving the goals of the NAI is to overcome two related paradox's. The one is shrinking aid to agriculture even though there is substantial agreement on the importance of this sector, and despite the fact that features that have reduced aid effectiveness are changing. The other is decreasing investment in agriculture, particularly land and water at a time when more irrigation and more

efficient use of land and water are needed to intensify production if the increasing demand for food is to be met.

In pursuing the goals set for agriculture in the NAI, African countries face a glaring contradiction. There is convincing evidence that development, food security and poverty alleviation will not be achieved without rapid growth in agriculture, and it is widely recognised that increased investment in productivity-inducing resources such as land and water is needed for this. And yet financial resources allocated by governments and development partners to agriculture, land and water improvement remain disproportionately low in relation to the latter's importance, and are declining. Attention has been drawn repeatedly to this paradox with no apparent effect.

Declining investment in agriculture land and water has been explained in a number of ways. At a general level, reasons offered for waning aid and inadequate investment to agriculture particularly in Africa include the following; decreasing political support for aid, composition of aid flows shifting from project assistance and structural adjustment to humanitarian assistance and peace building, greater competition for aid from East European transition economies, lack of concern about food security because global supply exceeds demand, Africa's lower strategic importance since the end of the cold war, donor fatigue explained by the perception that aid to Africa has done little to raise growth or reduce poverty, relatively little success in Africa in areas such as agriculture and rural development, aid not focussed on the poor, relative ineffectiveness of aid due to donor and recipient related factors. More specifically, low investment in land and water improvement, specially irrigation, has been ascribed to high development costs contributing to low returns on investment, negative social and environmental impacts particularly of large schemes, inefficient water use, and lack of financial and organisational sustainability due to inadequate operation and management.

General reasons for declining aid should be addressed in appropriate forums dealing with the debate on aid restructuring. Even though objective examination reveals that criticism has been too generalised and sometimes misplaced (see irrigation section) greater efforts may still have to be made to correct misconceptions about the costs and benefits of investing in land and water improvement. However, another, possibly more effective, way of beginning to resolve the paradox of inadequate and declining investment in land and water when this is patently counter productive for development in Africa, is to demonstrate more clearly than in the past the impact of investment in land and water on desired development outcomes.

Estimating Investment Needs

Past approaches

The challenge of revealing the relationship between investment and agricultural outcomes is complicated as many factors influence the effectiveness of such investment. Few systematic records exist of past investments, and few projections have examined the investment implications that must underlie any assumption on agricultural growth (FAO, 1996).

FAO has estimated that total annual gross investment in agriculture in developing countries including primary agriculture as well as storage, processing and support infrastructure to reach the WFS target of halving the number of hungry by 2015would be about US$ 180 billion. The same study showed that a continuation of past annual investment rates until 2015 would fall short of requirements to meet the WFS target by 12% for all developing countries and by 38% for Sub-Saharan Africa (FAO, 2001). While such global, long term estimates may be useful to attract political and popular attention to the issue they have less value for planners, donors and investors who require more quantitative information on investment in

agriculture and its likely shorter term impact at national level. Global methods, based on macro economic ratios, are very approximate particularly when applied to developing countries because of scarce and often unreliable data. Furthermore, these methods do not provide insight into the nature of linkages between investment and development. They do not highlight investments made by farmers to augment their capital stock, for example, in land, water and related production inputs and activities, that contribute significantly to increase production.

Soon after the WFS, FAO assisted developing countries estimate investment needs in agriculture to meet the WFS target. However, there are too many inconsistencies in the way this was done for each country to use the information as a basis to arrive at a global figure for Africa.

Because of the lack of more specific information, budgetary submissions for agricultural financing are too frequently based on generalisations about the contribution of agriculture to development and assumed effects agricultural expenditure may have on achieving development goals such as economic growth rates. Such generalisations and assumptions may be valid. However, they remain unconvincing to representatives from Ministries of Finance and of Planning and Central Banks usually responsible for allocating scarce budgetary resources between economic sectors. Arguments supporting investment in agriculture need to be based on rigorous analysis to enable better understanding of the relationships influencing the likely economic impact of investment in productivity-enhancing factors such as land and water. Better insight into these linkages would enable more rational inter-sectoral allocation of funds as well as within the agricultural sector.

This was not done in the past because of the absence of a suitable method. A method to do this is proposed in the following section.

Method to Quantify Investment Needs in Agriculture, Land and Water

Rationale. The method is designed for use by governments to develop scenarios for country-specific investment in land and water improvement and production intensification. By placing agriculture in the context of the rural economy, the method also takes into consideration investment needs in processing, marketing and elements of rural infrastructure. In this way it provides a country-driven instrument to quantify the costs and benefits of investment in the sector, and one that helps understand how such investment relates to specific development objectives, thereby strengthening the case, at national level, for increased financial allocations to agriculture.

The method is conceived to estimate investment requirements for incremental production that would be required to meet anticipated increased food needs at country level. It can not address the issue of how or whether such needs can be translated into effective demand. The method is empirical and approximate but straightforward, transparent and adaptable to country circumstances. The accuracy and reliability of results obtained should thus not be misinterpreted. It has the advantage over more global approaches of enabling governments to track relationships between investment in a range of selected items contributing to development, and chosen development goals such as growth and food gaps. Attention is thus focussed on trying to demonstrate how investment in agriculture influences development rather than assuming this to be the case. The method can be tailored to individual country circumstances and choices by selecting a preferred development goal, by including investment items most likely to influence the goal and by applying country-specific unit costs for each investment item. It does not prescribe investment items or the source of funding for investment.

The method's greatest value is likely to be that it provides agricultural authorities with an instrument to quantify the likely costs and benefits of investing in the sector. Such quantification - particularly as it becomes more refined with use- should serve to strengthen agriculture's case for greater prominence in policy debates and investment allocation with those who control finances in countries, with donors and with potential investors. It is a step towards relatively detailed analysis of the impact of agricultural investment on given growth targets which is a pre-condition for realistic policy. It enables policy goals to be analysed in terms of investment requirements even though in relatively crude fashion. Greater insight into the linkages between investment in agriculture and desired development outcomes at country level should help reverse the downward trend in agricultural investment which seems to have been little influenced by general (though true) statements about the centrality of this sector for growth, development and food security.

Increased demand. It is assumed that the New Africa Initiative is inspired, at least partly, by the need to improve efforts to achieve the goals of the WFS, particularly to reduce the number of hungry by half by 2015. Since the purpose of the exercise is to develop scenarios for country specific investment in land and water development, and production intensification, additional food needs have to be quantified before possible investments to meet these increased needs can be established under various assumptions. The purpose of the exercise is thus to estimate investment required to generate incremental production needed to meet the WFS goal by 2015 as illustrated in the "on track" projection for developing countries in the diagram below.

The anticipated additional demand for food is expressed by FAO in a revised per capita kcal food intake for each country that would achieve the goal of halving the number of undernourished people assuming that the WFS target applies to each country and that the per capita calorie consumption pattern remains the same as the base year (1995/1997)[2]. This enhanced daily per capita calorie food intake (consumption) and projected population size provides the anticipated increased demand for food at national level. Population and income growth assumptions determine whether such demand for food becomes effective demand in both the "business as usual" as well as in the "on-track" scenarios.

Increased domestic production. The need for increased domestic production is arrived at by subtracting FAOs latest estimates of likely food supply in 2015[3] from the anticipated increased demand for food. The portion of the increased demand to come from increased domestic production is established by maintaining the projected AT 2015/30 Self-Sufficiency Ratios (SSR) constant. Doing this assumes that net imports of foodstuffs will increase at the same rate as domestic production. Increased production requirements vary according to country-specific planning assumptions. Ongoing policy and investment interventions, that could impact substantially on domestic production (for instance, emphasis on rice production in Ghana), are not considered.

Yield increases and harvested land expansion. Increased harvested area (rainfed and irrigated) and higher yields provide the required increase in production by country. The AT 2015 crop growth factors (yield increases and harvested land expansion) for each of the 34 crops under the "business as usual scenario" were used. It is assumed that increased fertilizer

[2] It should be noted that the AT2015/30 scenario is based on the UN 1998 Assessment for population projections and on FAOSTAT data as known in June 1999. The scenario is currently being revised and will be presented in the final AT2015/30 report due early 2002.

[3] Estimates of food supply in 2015 are presented in *Agriculture Towards 2015/30*, Technical Interim report, April 2000. However, data used by FAO are subject to continuous revision and only country specific information provided by OAU countries can lead to greater accuracy in these estimates. The estimates are in particular sensitive to population growth, and as such, also the estimate used for daily per capita calorie food intake.

inputs will also contribute to improved yields. Because fertilizer use in Africa is low, farmers will achieve higher aggregate yields at national level only when fertilizer use becomes more profitable. This implies that increased demand for food becomes effective, that increased food supply originates primarily from domestic production and that improved fertilizer response, for which investment in soil fertility is a prerequisite, materialises.

Investment. In order to relate increased production to investment, capital items contributing to agricultural production, developed by FAO, are proposed. These cover resource and input requirements for primary agriculture, marketing and processing facilities and include other elements of rural development such as infrastructure. No direct provision has been made for investment in technology development and transfer because of the difficulty of establishing a basis to estimate this for Africa as a whole. Individual countries may thus chose to add research and extension as a capital item contributing to agricultural development.

Provisional Outcome

In this document use of the method is demonstrated by applying it to estimate additional production and corresponding investment needed for African countries to meet the World Food Summit goal of halving the number of hungry people by 2015.

When additional production to meet the WFS target is expressed as a percentage of projected production in 2015, results suggest that 6 African countries would need to produce up to 10 % more food, 27 countries between 10 and 25 % and 12 countries in excess of 25 percent more food by 2015. Increased production to achieve the established goal, under the assumptions made, would thus seem to be substantial for most countries. An indication is provided of the additional area under rainfed and irrigated land required per country to achieve this increased production. Results show that unless farmers increase yields considerably, substantial land expansion will be required in Tanzania, The Democratic Republic of Congo, Ethiopia and Nigeria. Major efforts will be required under the assumptions made to expand irrigated agriculture, in particular in countries in North Africa (Egypt, Morocco and Algeria).

An indication of the magnitude of additional investment required to achieve this increased production is provided; 16 countries would require up to 25% more investment in land and water development, 14 countries between 25 and 50% and 11 countries in excess of 50%, when such investment is expressed as a portion of additional total investment in the primary sector (crop and livestock production). Fully realizing the limited value of taking Africa as an object of analysis because of large differences between countries, the method is used to estimate the incremental production and corresponding investment needed for each country to meet the WFS goal of halving the number of hungry people by 2015. Using published data, likely to be outdated, and recognizing other above listed limitations, the outcome shows that reaching the WFS goal in 2015 would involve an additional annual net investment of some US$ 7.6 billion. The estimate includes investment by public and private sector including farmers. The relative contribution of these sources and the origin of funds is at each country's discretion.

The approximate and thus possibly misleading nature of these provisional results can not be overemphasized. They are based on indicative investment cost expressed in calibrated 1992 US$ while some investment items have not been costed at all due to lack of data.

Conclusion

Agricultural development is more important for Africa than for any other continent. About 70% of people in Africa and roughly 80% of the continents poor live in rural areas. These people depend on agriculture and non-farm rural enterprises for their livelihoods, and increasingly are unable to meet their basic food needs as population pressure on land grows, and land and water resources become scarce or degrade and agricultural productivity stagnates. It is estimated that in the coming decades some three-quarters of the projected growth in crop production in sub-Saharan Africa will come from intensification with the remaining quarter from arable land expansion. The share due to intensification will exceed 90% in land-scarce countries of North Africa.

Irrigation is fundamental to agricultural intensification. Through its impact on agricultural productivity, irrigation has beneficial effects on rural incomes, rural employment, food security, poverty alleviation and overall growth and development. Moreover, it has had a significant effect in keeping food affordable to the poor. Without more irrigation many countries will not attain the agricultural and overall economic growth rates required to achieve food security and reduce poverty. Irrigation also has positive distributional effects because it mainly targets smallholders living in poor rural areas.

There is also a need for more investment in land and rainfed agriculture in less-favoured areas where most of the rural poor reside. Investment in such areas can yield acceptable returns while boosting productivity and alleviating poverty. Their marginal returns can exceed those in irrigation in these areas. There needs to be a better balance between the two to help develop the untapped potential of less-favoured areas and to satisfy the needs of those living there.

Land and water are key to achieving development goals in many countries. However, investment in developing land and water will have to increase if they are to make their full contribution. Although information is scarce there are indications that in Africa investment in agriculture, land and water has declined at best stagnated. Private investment, made mainly at farm level, is weak due to low income and savings levels of most African farmers. Government expenditure is low relative to agriculture's size and contribution to the economy, and foreign aid to agriculture has decreased significantly.

As a result of inadequate attention to agriculture and the rural economy, Africa is the only continent where agricultural production per worker has deteriorated over the past decade. Low productivity results from weak investment in productivity-enhancing factors such as irrigation, the use of fertilizer and other purchased inputs and mechanization. Only 4-7% of cropped land in Africa, or less than 20% of the theoretical irrigation potential, is irrigated. This compares with 13% in Latin America and the Caribbean, a region with similar population densities and resource endowments. A consequence of this under-investment is that approximately one third of the Regions population are under-nourished and most African countries are far from achieving the WFS goal of halving the number of hungry by 2015.

Part of the challenge facing Africa to transform its agriculture in the interest of achieving the goals of the NAI is to overcome two related paradoxes. The one is shrinking aid to agriculture even though there is substantial agreement on the importance of this sector, and despite the fact that features that have reduced aid effectiveness are changing. The other is decreasing investment in agriculture, particularly land and water at a time when more irrigation and more efficient use of land and water are needed to intensify production if the increasing demand for food is to be met.

A possible reason for under-investment in agriculture and land and water improvement is that in the past not enough was done to demonstrate how such investment influences production and other development goals. This appears not to have been done because of the absence of a

suitable method. To fill this gap an empirical and approximate but transparent and adaptable method is proposed. It is designed to enable relatively detailed analysis of the impact of agricultural investment on given growth targets, which is a pre-condition for realistic policy. By way of example the method is applied to estimate additional production and corresponding investment needed for African countries to meet the World Food Summit goal of halving the number of hungry people by 2015. Some very provisional outcomes are given. They confirm that major investment still needs to be made in land and water development in Africa if agriculture is to contribute effectively to improving food security and reducing poverty.

FAO suggests that countries initiate a process to establish their agricultural investment needs in a transparent manner that is acceptable to their monetary authorities. This would facilitate appropriation of adequate financial resources to finance investments to meet established national goals, which could in turn be used to arrive at regional and continental needs. Such information would thus contribute to the NAI goal of establishing needs for the agricultural sector, which is one of the five priority sectors identified. Should the method proposed by FAO seem useful in this regard, assistance could be provided to governments to apply it at national level.

Bibliography

DFID. 2000. *Addressing the Water Crisis - Healthier and More Productive Lives for Poor People*. Consultation Document. London, DFID.

Elz, D. 2000. *Is the world running out of water?* Quarterly Journal of International Agriculture, 39, No.2. Frankfurt/M, Germany, DLG-Verlag.

Fan, S. & Hazzell, P. 1997. *Should India Invest More in Less-favoured Areas?* EPTD Discussion Paper No.25. Washington, DC, International Food Policy Research Institute.

FAO. 1996. *Investment in Agriculture: Evolution and Prospects*. World Food Summit, Technical background document 10. Rome.

FAO. 2000a. *Agriculture: Towards 2015/30*. Technical Interim Report. Rome.

FAO. 2000b. *The State of Food and Agriculture*. Rome.

FAO. 2001. *Resource Mobilisation in Support of Food Security in Developing Countries*. Draft, ES Department. Rome.

IFAD. 2001. *Rural Poverty Report 2001: The Challenge of Ending Rural Poverty*. International Fund for Agricultural Development. Rome.

Jones, W.I. 1995. *The World Bank and Irrigation*. Washington, DC, The World Bank,.

Mellor, J.W. 2000. *Agricultural Growth, Rural Employment and Poverty Reduction: Non-tradables, Public Expenditure and Balanced Growth*. Paper prepared for the World Bank Rural Week 2000, *Poverty or Prosperity: Rural people in a Globalized Economy*.

Owens, T. & Hoddinott, J. 1998. *Investing in Development or Investing in relief: Quantifying the Poverty Trade-offs Using Zimbabwe Household Panel Data*. Washington, DC, International Food Policy Research Institute.

Scherr, S.J. 1999. *Soil Degradation: A Threat to Developing-Country Food Security by 2020?* Food Agriculture and the Environment Discussion Paper 27. International Food Policy Research Institute, Washington D.C.

UNCTAD. 1998. *Trade and Development Report*. Geneva.

UNCTAD. 2000. *Capital Flows and Growth in Africa*. UNCTAD/GDS/MDPB/7, Geneva.

World Bank. 2000a. *Can Africa Claim the 21st Century?* Washington, D.C.

World Bank. 2000b. *Reaching the Rural Poor: Framework for a Revised World Bank Rural Development Strategy*. Washington, D.C.

World Bank. 2001.*Africa Rural Development Strategy; Vision to Action Update*, (Draft, February,2001). Washington, D.C.