

# Investments in land and water

SOLAW Background Thematic Report – TR17

P. Koohafkan, M. Salman and C. Casarotto





# Table of contents

1. Introduction: the challenges	5
2. Investment trends in land and water	6
2.1. ODA, FDI and public expenditures	6
2.2. Major sources of funding	11
3. The commitments	13
4. Future investment needs	14
5. A framework approach for investment in land and water	19
5.1. The investment framework	19
5.2. Accelerating investment flows	20
6. Conclusions	23

# List of figures

1. ODA commitments to the land and water sector (CRS Database of OECD)
2. ODA Commitments for the nine subsectors presented based on their sector of affiliation
3. Major donors for land and water
4. Distribution of aid for land and water by region, average 1995-2008

# List of tables

1. Estimated inward FDI stock, by sector and industry, 1990 and 2004 (million US dollars)
2. Public expenditure in agriculture 1980-2002
3. Investments in infrastructure development in irrigation and drainage sector, 1961-2002 by AfDB, ADB, IDB and the World Bank
4. Cumulative investment over 2005/2007 to 2050 in billion 2009 US dollars
5. Cumulative investments in crop production over 2005/2007 to 2050 by region

# List of boxes

1. Land deals in developing countries
2. Past FAO estimates of investment requirements
3. Demand driven investment estimates – the Sirte Conference and the CAADP Tools
4. Returns to water management projects

# Abbreviations and acronyms

<b>ADB</b>	Asian Development Bank
<b>AfDB</b>	African Development Bank
<b>AgR</b>	Agriculture and rural development
<b>CAADP</b>	Comprehensive Africa Agriculture Development Programme (CAADP)
<b>DFID</b>	UK Department of International Assistance
<b>EAP</b>	East Africa and the Pacific
<b>Env</b>	General environmental protection
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>FDI</b>	Foreign Direct Investment
<b>GEF</b>	Global Environment Facility
<b>GWP</b>	Global Water Partnership
<b>IBRD</b>	International Bank for Reconstruction and Development
<b>IDA</b>	International Development Association
<b>IDB</b>	International Development Bank
<b>IFAD</b>	International Fund for Agriculture
<b>IFPRI</b>	International Food Policy Research Institute
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IRR</b>	Internal rate of return
<b>LAC</b>	Latin America and the Caribbean
<b>MDG</b>	Millennium Development Goals
<b>MENA</b>	Middle East and North Africa
<b>NEPAD</b>	New Partnership for Africa's Development
<b>CAADP</b>	The Comprehensive Africa Agriculture Development Programme
<b>NRL</b>	Land and Water Division (FAO)
<b>ODA</b>	Official Development Assistance
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>SSA</b>	Sub-Saharan Africa
<b>WFS</b>	World Food Summit
<b>WSS</b>	Water supply and sanitation
<b>WWC</b>	World Water Council

# 1. Introduction: the challenges<sup>1</sup>

The Declaration of the World Food Summit on Food Security (Rome, 16-18 November 2009) states, “We recognize that increasing agricultural productivity is the main means to meet the increasing demand for food given the constraints on expanding land and water used for food production”. In face, by 2050 there will be an estimated 2.3 billion more people to feed, one-third more than reported in the World Population Prospects of the United Nations (UN, 2008). To feed a population of more than nine billion, global food production must increase 70 percent by 2050 or, alternatively, policies and actions should be put in place to change consumption patterns, and promote balanced diets, less food wastage, increased local food production and improved food distribution.

Investment in land and water is one of the main means of achieving sustained agricultural productivity and of embedding a clear multiplier effect in the non-farm sector, which may continue beyond a project’s rate of return. Increased farm production goes beyond improving farmers’ incomes, it generates on-farm employment, enhances food security, lowers food prices, thus reducing poverty as the poor typically spend 60–70 percent of their income on food (FAO, 2002). Other significant positive effects on the non-farm economy are that an increased farm income stimulates consumption of goods produced by the small-scale enterprise sector; agricultural growth carries a multiplicative effect on income and employment in the local non-farm economy and through technological change in agriculture the poor can benefit from the generation of significant non-farm earnings (Mellor, 2000; IFAD, 2001).

From 1980 to 2006, the agricultural sector responded to global demands for food and fibre by increasing productivity and opening new land to agriculture, which resulted in higher per capita production and lower commodity prices. In recent years, newly emerging challenges linked to the negative impacts of climate change have placed an upward pressure on prices. In many countries, water scarcity will increase, along with unpredictable rainfall and increasing areas of land will be diverted from agricultural production to urbanization and energy production. Recently, at global level, annual growth rates for yields of major grains decreased from 3 percent/year in 1980 to 1 percent (World Bank, 2008).

In the past agricultural growth was achieved by cultivating large areas of land and consuming disproportionate water and other inputs. Today, in more densely populated parts of the world, there is no more room for expansion of the cultivated area and water is increasingly scarce. In Central Asia, Europe and parts of Latin America land is still relatively abundant, and there is scope for expansion in some sub-Saharan African countries. In Asia, however, land scarcity has become acute, with urbanization further reducing the land area available for agriculture. With declining land and water availability, efforts should be concentrated on improving land and water productivity and focusing on land-use priorities. With increased land scarcity, investment in agricultural productivity growth, particularly at the smallholders’ level, will be fundamental to tackling these challenges.

Besides increasingly scarce resources, global agriculture will need to cope with the challenge of climate change. The Intergovernmental Panel on Climate Change (IPCC) has documented the likely impact of climate change on agriculture in great detail. In general, impacts are expected to be positive in the temperate

<sup>1</sup> P. Koohafkan, Director, Land and Water Division (NRL), FAO; M. Salman, Technical Officer, Land and Water Division (NRL), FAO; C. Casarotto, Consultant, Land and Water Division (NRL), FAO.

regions and negative in the tropical. However, it is still uncertain how projected changes will play out at the local level, and potential impacts may be altered by the adoption of risk-management measures and adaptation strategies that strengthen preparedness and resilience. If temperatures rise by more than 2 °C, global food production potential is expected to contract severely and yields of major crops may fall globally (IPCC, 2007). In Africa, Asia and Latin America, for instance, yields could decline by 20–40 percent. In developing countries, 11 percent of arable land could be affected by climate change, including a reduction of cereal production in up to 65 countries, about 16 percent of agricultural GDP (FAO Committee on Food Security, Report of Thirty-first Session, 2005).

## 2. Investment trends in land and water

### 2.1 ODA, FDI and public expenditures

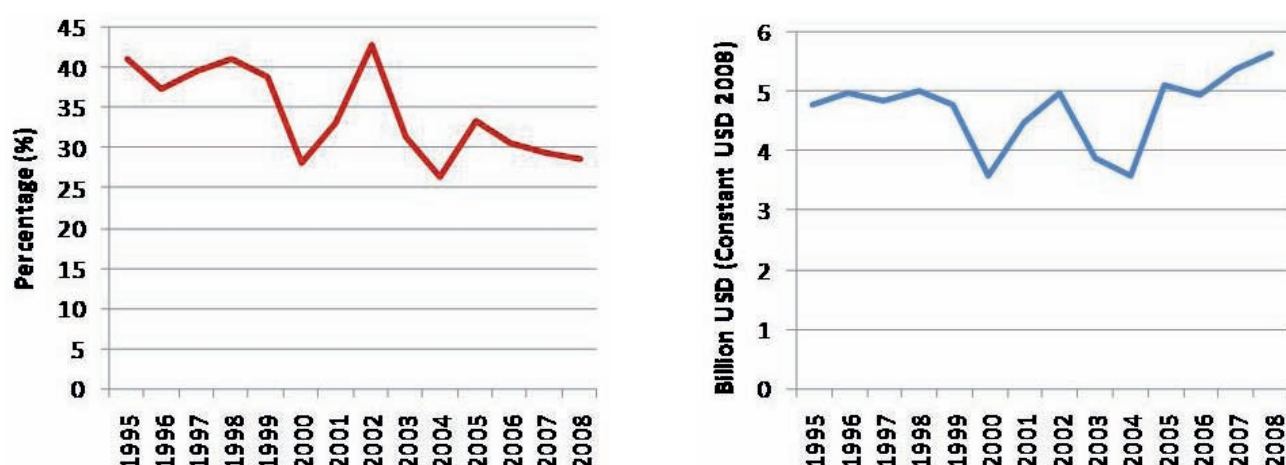
International investment and funding for land and water increased rapidly as a result of major famines and food shortages in the 1950s and 1960s. Investments increased particularly in the Asia region, where governments directed the largest share of expenditure toward agriculture and irrigation development, as a major component of the green revolution. In the 1980s and 1990s, as a result of a long-term decline in international food prices, investments in land and water slowly tapered off or were redirected toward urban sectors and institution-building (Rosegrant *et al.* 2001; 2002).

The 2000 Millennium Summit, the 2002 Monterrey Consensus on Financing for Development, the 2005 World Summit and the 2005 Paris Declaration on aid effectiveness helped revive international investment and funding for agriculture, land and water. As a result of the new international commitments, the food price crisis and acute water and land shortages, investments in land and water increased. However, the level of investment remains far below identified needs and the level of dependence of people and economies on these resources.

While funding levels over the last ten years have increased for some regions and sectors, overall Official Development Assistance (ODA) support as a share of GDP has remained below the target level of 0.7 percent in many developed countries (UNDESA, 2010). Overall, total donor assistance to all sectors in developing countries has increased over the past decade from US\$57 billion in 1995 to US\$158 billion in 2008 (in constant terms)<sup>2</sup>. Support to land and water fell in the 1990s, and stagnated until recovery in 2005 (Figure 1). Although, in absolute terms, the 2008 amount of ODA directed toward land and water grew past the 1995 level, support for land and water had decreased when measured as a share of the total ODA for agriculture and rural development (AgR), water supply and sanitation (WSS) and general environmental protection (Env).

<sup>2</sup> The values are in constant 2008 US dollars.

FIGURE 1: ODA COMMITMENTS TO THE LAND AND WATER SECTOR (CRS DATABASE OF OECD)



Note: this shows commitments for the nine subsectors identifying land and water, as a share of total ODA for water supply and sanitation, agriculture or forestry and fishery, general environmental protection and rural development. AgR was used to simplify the language and indicates the agriculture forestry, fishery, rural development sectors.

ODA for the nine subsectors<sup>3</sup> in the land and water group for this analysis shows in general, stable or decreasing trends, except for aid to agricultural water resources and environmental policy and management, both show a positive trend (Figure 2). In the last few years, increasing aid to these two subsectors is behind the apparent increasing trend for the land and water group. The largest activities in support of the Environmental Policy subsector were undertaken by France and the European Union, which were the top donors in 2008.

Japan, the International Development Association (IDA) and the United States were the main donors in 2008 for agricultural water resource projects, subsector, with US\$430, 242 and 212 million respectively. A large share of aid went to irrigation projects in Iraq and Afghanistan. Japan committed US\$300 million to the construction and rehabilitation of irrigation systems in Indonesia and US\$100 million in Pakistan for improvements to irrigation systems in Punjab. The United States committed more than US\$100 million for irrigation projects in Armenia<sup>4</sup>.

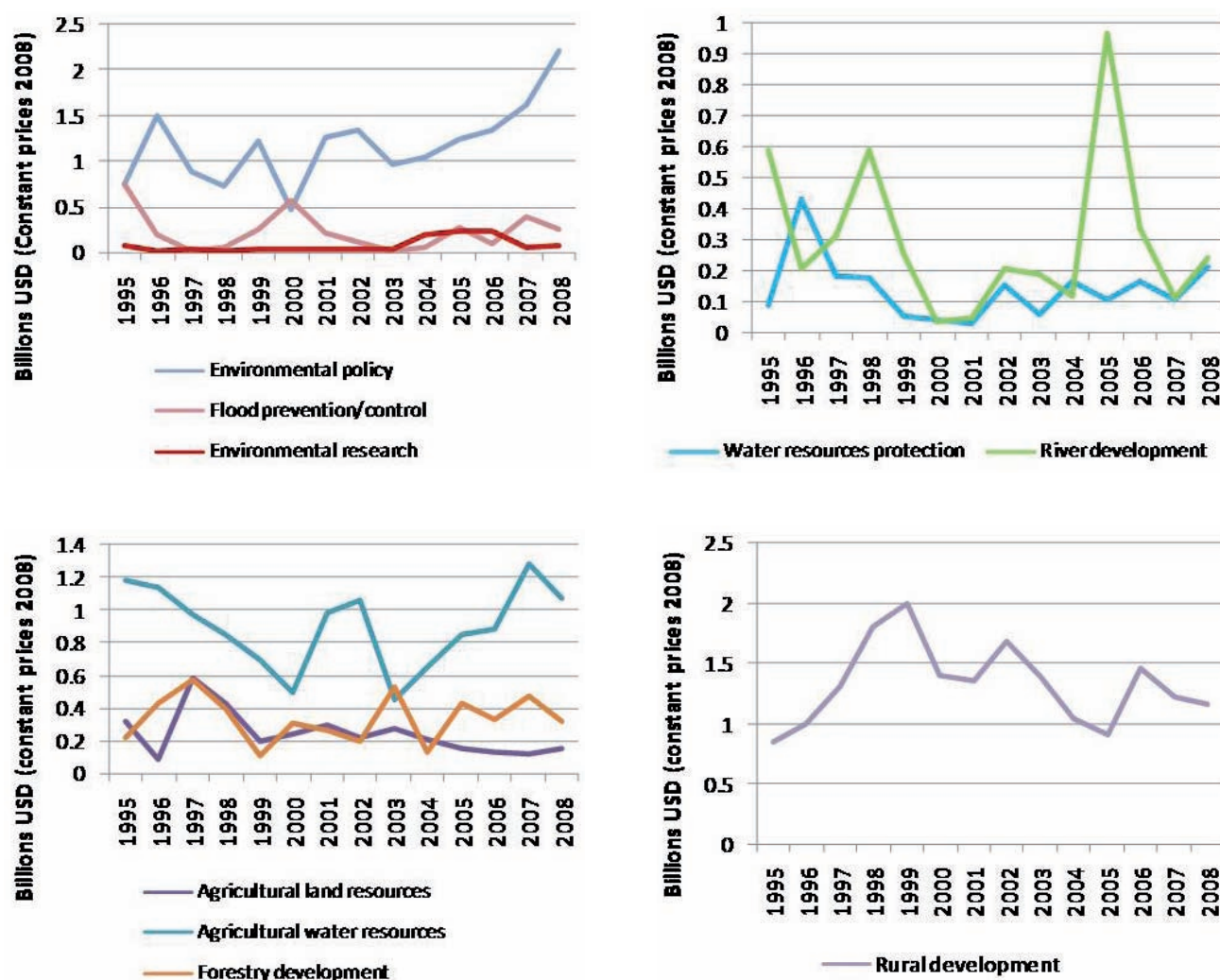
Since the late 1990s, ODA for the agriculture land resources subsector has fallen, despite international calls for more support to land and soil conservation management projects. In 1997, the ODA was almost US\$600 million, with IDA and Japan contributing jointly US\$500 million for drainage works in Pakistan, and the European Union providing US\$12 million for conservation of water and land resources in Honduras. By 2008, the number of activities increased fivefold, but ODA fell to US\$140 million, with the highest loan being US\$17 million from Germany to Ethiopia for sustainable land management activities, and US\$13 million from Italy to Kenya for development of the Sigor Wei-Wei agricultural scheme.

<sup>3</sup> To analyse specific support for land and water ODA data from the CRS Aid Activity Database of OECD were used (available at: <http://stats.oecd.org/Index.aspx?DatasetCode=CRSNEW>). The data refers to all commitments in constant 2008 million US dollars, and covers nine subsectors in the following sectors: water supply and sanitation, agriculture forestry and fishery, general environmental protection and other multi-sectors. The nine subsectors are: water resources protection; river development; agricultural land resources; agricultural water resources; forestry development; environmental policy and administrative management; flood prevention/control; environmental research and rural development.

<sup>4</sup> Details from the CRS Database of the OECD (accessed June 2010).



FIGURE 2: ODA COMMITMENTS FOR THE NINE SUBSECTORS PRESENTED BASED ON THEIR SECTOR OF AFFILIATION (CRS DATABASE OF OECD: ACCESSED JUNE 2010)



Note: The affiliation sectors going clockwise starting from the top left figure are: Water supply and sanitation, Agriculture/Forestry and Fishery, General Environmental Protection, and Other Multi-sector.

Foreign Direct Investments (FDI) recover a relevant role in financing the primary sector in developing countries, though the great majority of FDI target developed economies. As illustrated in Table 1, about US\$24 billion in 1990 and US\$152 billion in 2004 were invested in the primary sector in developing economies. Nonetheless, agriculture accounts for little total primary sector investments, which are, instead, allocated to mining and petroleum. Nonetheless, a clear upward trend in agriculture in FDI can be noted, with investments increasing more than threefold between 1990 and 2004 (UNCTAD, 2006).

Note that in the current global environment, private capital and trade flows do not seem to favour developing countries and developed, industrial countries are more attractive as major partners and players in industry and trade. Industrial countries account for most of the recent surge in global FDI flows, which reached US\$1.1 trillion in 2000. Moreover, the flow of FDI directed to developing countries remains heavily concentrated in East Asia, the Pacific, Latin America and the Caribbean. While FDI declined in the early 2000s, the long-term trend suggests future increases, including in sub-Saharan Africa (Winpenny 2010).



**TABLE 1: ESTIMATED INWARD FDI STOCK, BY SECTOR AND INDUSTRY, 1990 AND 2004 (MILLION US\$)**

Sector	1990			2004			
	Developed countries	Developing economies	World	Developed countries	Developing economies	Southeast Europe and CIS	World
Primary	139 563	23 715	163 278	268 171	151 632	20 725	440 529
Agriculture	3 193	4 063	7 256	7 739	14 339	483	22 561
Mining, quarrying and petroleum	136 371	17 601	153 972	256 642	137 294	20 242	414 177
Unspecified primary	-	2 051	2 051	3 791	-	-	3 791
Manufacturing	586 379	144 372	730 750	2 406 127	613 559	20 448	3 040 135
Services	716 544	151 589	868 133	4 624 699	1 224 356	34 286	5 883 341

Source: UNCTAD, 2006

Looking at the land and water sectors, while ODA is significant, most investments in land and water are funded privately by end users. Net private flows (both capital and FDI) which, in 1991, was at a level comparable to official development assistance (US\$62 billion), increased in 1997 to US\$300 billion (seven times higher than official flows). In 2000, the net private flows declined by US\$43 billion to US\$257 billion. This decline in private flows was more than that for official flows (US\$39 billion) and was nearly 6.6 times higher than official flows in 2000.

Recent increases in FDI in agriculture in developing countries create opportunities and challenges. These include employment opportunities, potential transfer of land and water technologies to smallholder farmers, development of rural infrastructure and greater food security in the host countries and in the global market in general. Potential negative impacts of local and foreign land acquisitions include loss of land rights for land holders without formal title deeds. Investors from high-income countries, where environmental standards and enforcement is higher, may use cheaper inputs or land management practices that could contribute to land degradation, environmental pollution and over-exploitation of water and other resources in developing countries.

Rules of engagement need to be established, as is the case for other international trade and foreign direct investment, to ensure foreign investments are beneficial to the host countries and to land users who may lose their land permanently or temporarily. These rules could include: transparent negotiations and trade deals; protection of investors; compensation of land users; respect for existing land rights; focus on investments that benefit local communities; and assessment of potential positive or negative environmental impacts (Von Braun and Meinzen-Dick, 2009; Coutila *et al.*, 2009).

Because of the transnational nature of certain land acquisitions, no single institutional mechanism will ensure favourable outcomes for all parties involved. Rather, cooperation through international law, government policies, and the involvement of civil society, the media, and local communities are needed to ensure that the land transactions follow the rules of engagement described above.

Although most capital for development in the agricultural sector comes from private sector investment, including farmers, external financial resources are extremely important for promoting economic, social development and food security, public expenditure in agriculture and, in particular, in land and water, it is essential to boost agricultural production and growth. Inadequate government spending and low gross

capital formation seriously compromise agricultural productivity in countries where there is widespread poverty and undernourishment. Low government expenditures per agricultural worker are reflected in low value-added per agricultural worker (a measure of labour productivity). Between 1990 and 1999, value-added per worker in the countries with the lowest rate of malnutrition was about 20 times higher than countries having high rates of malnutrition (FAO, IFAD, WFP, 2002).

#### BOX 1: LAND DEALS IN DEVELOPING COUNTRIES

“Rise in land deals could create a form of ‘neo-colonialism’, with poor states producing food for the rich at the expense of their own hungry people.”

(Jacques Diouf, head of the UN Food and Agriculture Organization)

As an outcome of the world food crisis, investments in fertile land in developing countries have significantly increased. Most land deals are in excess of 10 000 ha and the lease period is between 50 and 99 years. The main actors in the transaction are national governments, agricultural investment funds and the private sector, including investment banks, agribusinesses, commodity traders and mining companies (Smaller and Man, 2009). Figure 3 shows the number of large land acquisitions by different target and investor countries.

There are found types of land acquisition (Bickel and Breuer, 2009):

- countries with large populations and sustained growth (China, India, Japan, South Korea) undertake investments to satisfy the increasing internal demand for agricultural products;
- countries with negative food balances and limited land and water resources but rich in capital (Gulf states, Libya);
- industrialized countries that target land investments for biofuel production; and
- domestic land speculation in developing countries (e.g for tourism).

The land acquisition strategy is often described as a win-win situation. The investor country acquires land and is guaranteed access to food produced on it, while reaping high returns to the investment. At the same time, the recipient country has an infusion of capital into its agricultural sector, leading to economic development. For this to truly be a win-win arrangement, however, it is imperative that the investor country protect the recipient country’s citizens from nationalization or expropriation, labour abuses and loss of their own food security (World Bank, FAO; IFAD, 2009).

Moreover, high returns inherently involve high risk, which is a major drawback when the goal is food security. Opting to invest in third-party countries, instead of using the market, requires the investor to take on all the weather risks of the host country, rather than choosing where to secure food. Idiosyncratic political risk in the host country may be a major concern. The market allows for more flexibility than third-party investment. Capital locked in land purchases and long-term leases cannot easily be freed to buy food from other suppliers when there is bad weather or political disruptions in the host country.

Number of land acquisition operations (IFPRI, 2009)

a) Target countries      b) Investor countries

A recent DFID/World Bank study shows that real agriculture expenditures increased between 1990 and 2002, though they declined when considering expenditures as a share of GDP (Table 2). The increase in real expenditure is evident in Asia, where expenditures almost tripled to US\$163 billion in 2002. African countries recorded a more modest increase, while in Latin America and the Caribbean expenditures dramatically decreased between 1980 and 1990, recovering, to levels below 1980 expenditures in 2002. On average, Asia and Latin America showed higher expenditures as percentage of agricultural GDP than African countries where expenditures decreased from 1980 to 2002 reaching a modest 6.7 percent.

**TABLE 2: PUBLIC EXPENDITURE IN AGRICULTURE 1980–2002 (AKROYD AND SMITH, 2007)**

Region	Constant 2000 US\$ (billion)				Percentage of agricultural GDP				Agricultural share of total government expenditure		
	1980	1990	2000	2002	1980	1990	2000	2002	1980	1990	2002
Africa (17)	7.3	7.9	9.9	12.6	7.4	5.4	5.7	6.7	6.4	5.2	4.5
Asia (11)	74	106.5	162.8	191.8	9.4	8.5	9.5	10.6	14.8	12.2	8.6
Latin America and Caribbean (16)	30.5	11.5	18.2	21.2	19.5	6.8	11.1	11.6	8.0	2.0	2.5
<b>Total developing countries</b>	<b>111.8</b>	<b>125.9</b>	<b>190.9</b>	<b>225.6</b>	<b>10.8</b>	<b>8</b>	<b>9.3</b>	<b>10.3</b>	<b>11.3</b>	<b>7.9</b>	<b>6.7</b>

Note that the share of public expenditures allocated to agriculture declined from 11 percent in 1980 to 7 percent in 2002. In Africa, the agricultural share of total government expenditures decreased from 6.4 to 4.5 percent, far below the Maputo target. Latin America experienced the most rapid decline, with a fall from 8 to less than 3 percent of total government expenditures over the period.

## 2.2. Major sources of funding

After many years of declining investment, key land and water investors such as the World Bank and the African Development Bank made commitments and increased investment to re-engage in agriculture and water in sub-Saharan Africa (Table 3). The food price crisis and climate change drove other multilateral and bilateral donors, such as the Asian Development Bank, United Kingdom Department for International Development (DFID) and German Assistance to increase support to agriculture and food security which, in turn, affected land and water resources. World Bank support to irrigation in Africa, for example, more than doubled from 2000–2002 to 2006–2008, increasing from US\$2.3 billion to US\$4.1 billion (World Bank, 2009). Moreover, as overall International Development Association (IDA)/ International Bank for Reconstruction and Development (IBRD) financing for development is expected to increase, these scaled-up projections translate into an estimated change in the share of IDA/IBRD Agriculture and Related Sector Financing from 12 percent in 2006–2008 to between 13 and 17 percent in 2010–2012.

**TABLE 3: INVESTMENTS IN INFRASTRUCTURE DEVELOPMENT IN THE IRRIGATION AND DRAINAGE SECTOR, 1961-2002 BY AFDB, ADB, IDB AND THE WORLD BANK**

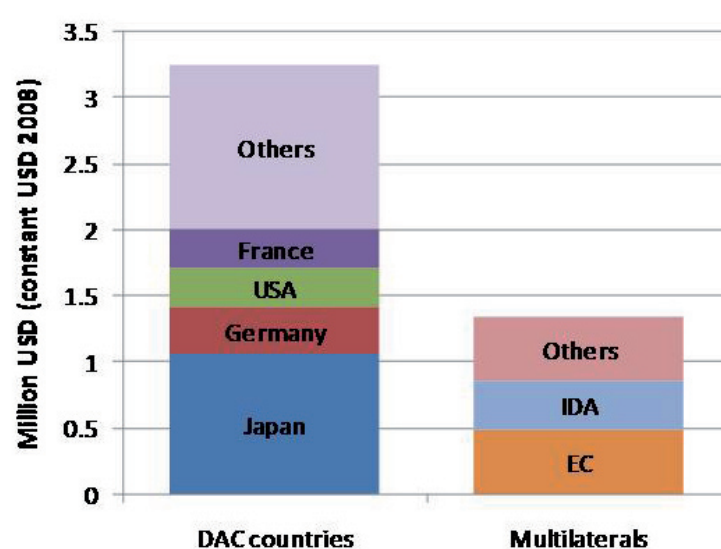
Region	Investment (Billion 1995 US dollars)								
	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90	1991-95	1996-00	2001-04
SSA	0.2010	0.0161	0.4524	0.5358	0.7054	0.4384	0.7901	0.2129	0.4138
MENA	0.0840	0.4612	0.5020	0.7411	0.6328	0.7283	1.2302	0.6418	1.0199
LAC	0.6250	1.2110	2.0120	2.5610	1.5480	1.4190	1.3570	0.4510	0.3505
EAP	0.1770	0.8280	1.3480	5.0010	2.9730	1.7390	1.6060	0.8700	0.7291
SA	1.0230	0.3840	0.3120	1.7140	2.5530	1.8350	1.4450	1.3630	0.4024
India	0.3240	0.1660	0.8040	2.2290	3.4320	1.6290	0.7470	0.6620	0.4440
China	0.0000	0.0000	0.0000	0.0000	0.2600	0.4410	1.5920	1.2150	0.2473
<b>Total</b>	<b>2.4340</b>	<b>3.0663</b>	<b>5.4304</b>	<b>12.7819</b>	<b>12.1042</b>	<b>8.2297</b>	<b>8.7673</b>	<b>5.4157</b>	<b>3.6063</b>

Note: SSA – Sub-Saharan Africa; MENA – Middle East and North Africa; LAC – Latin America and Caribbean; EAP – East Asia and Pacific (excluding China); SA – South Asia (Excluding India)

Source: Rosegrant et al. (2005) based on African Development Bank, Asian Development Bank, Inter American Development Bank, World Bank; compiled by authors and Upali Amarasinghe.

Japan, Germany and the United States are the major bilateral donors to land and water. Support fluctuates across the years given changes in national political context, budgets, priorities and external factors (Figure 3). For instance, the two decreases in ODA for agricultural water resources, which also drove the fall in total ODA for the land and water sector, were mainly because Japan withdrew aid between 1998 and 2000 and for 2003 and 2004. The Asian financial and economic crisis of 1997–1998, and the 2002 stock market downturn most likely caused these decreases. This pattern underscores the risks involved in international assistance and the need for recipient countries to have contingent plans in the short- and medium-term to address unexpected cuts in donor assistance and to reduce donor dependence over the long-term.

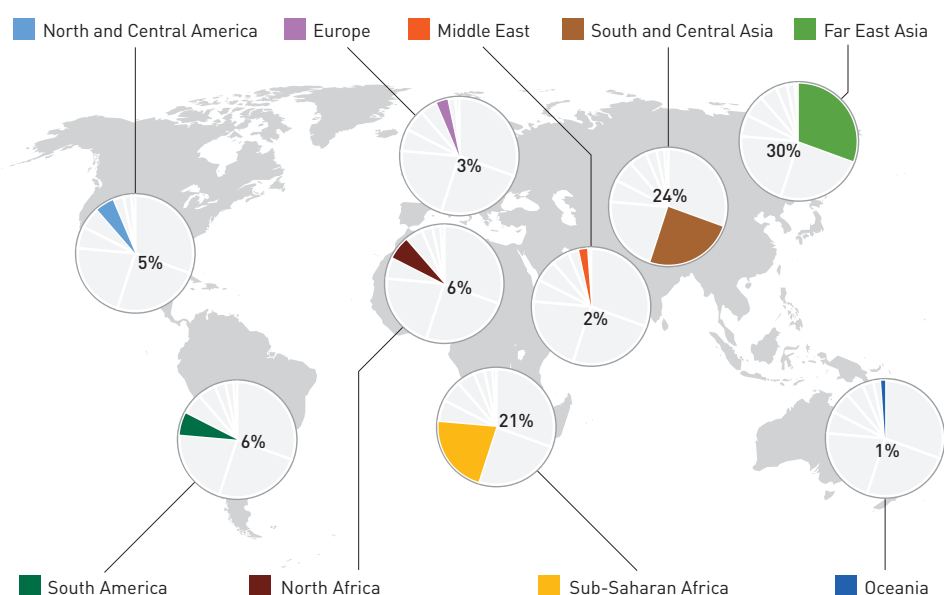
**FIGURE 3: MAJOR DONORS FOR LAND AND WATER (CRS DATABASE OF OECD: ACCESSED JUNE 2010)**



Note: The figure reflects average aid between 2000 and 2008

On average, between 1995 and 2008, total ODA support for land and water from all donors was for East Asia (30 percent) followed by South and Central Asia (24 percent) and sub-Saharan Africa (21 percent) (Figure 4). For example, between 2004 and 2005, aid to the land and water river development subsector, increased eightfold owing to a commitment from Japan of US\$900 million, of which US\$770 went to Malaysia for the Pahang-Selangor Raw Water Transfer Project, and more than US\$90 to the Lower Solo River Improvement Project in Indonesia.

FIGURE 4: DISTRIBUTION OF AID FOR LAND AND WATER BY REGION, AVERAGE 1995-2008 (ODA DATA, CRS DATABASE OF OECD: ACCESSED JUNE 2010)



Most programmes specifically focusing on improved land and water for developing countries tend to depend on one or very few donors, and have been struggling to maintain or expand their funding base. As such, they have focused on leveraging funds from other donors, such as the Global Environment Facility (GEF) or the World Bank. However, overall investments remain far below estimated investment needs.

### 3. The commitments

In the framework of the commitments made at the FAO High-level Conference on World Food Security (Rome, June 2008), the G-8 Summit in July 2008 in Japan, and G-8 Summit 2009 in L'Aquila Italy, US\$30 billion should be invested each year in agriculture to combat hunger and feed a growing population. This is equivalent to 8 percent of the subsidies Organisation for Economic Co-operation and Development (OECD) countries pay to their farmers. Pledges of US\$20 billion to be mobilized over three years were made at the G-8 Summit in L'Aquila in July 2009. This is to transform programmes from sending emergency food relief to building capacity in developing countries to reliably producing their own food.

On a regional scale, in Maputo, in 2003, the Heads of State and Governments of the African Union committed to allocating at least 10 percent of their national budgetary resources for agriculture and rural development. Unfortunately, progress remains slow. Estimates indicate that about a dozen countries have reached or exceeded half of the Maputo budget target, but only a handful have achieved it.

Although there are encouraging signs, such as the European Union's approval of the 'Food Facility for Developing Countries' amounting to 1 billion Euros, the replenishment of the International Fund for Agriculture's (IFAD) resources and greater credit to the agricultural sector from the World Bank, the financial resources for intervention still fall short of funds required. Governments, authorities and development practitioners are thus facing the paradox of having agreed to development goals requiring increased agricultural production with diminishing per capita resources, but without the concomitant investment to do this.

The world is now in a serious financial and economic crisis after the world food crisis that shocked the international agricultural economy. This has highlighted the fragility of food security. In a context of global instability, greater uncertainty in the financial system, unpredictable price fluctuations, investments in agriculture appear to be the cornerstone for any sustainable solution to overcome the challenge to ensure adequate food for more than one billion hungry people in the world and to feed 9.2 billion people in 2050 (FAO, 2006; FAO, 2009).

It should be indicated that positive signs have been noted. First, a policy favouring increased production by smallholders in food-deficit developing countries has been embraced at the international and national level. For example, the Joint Statement on Global Food Security made at the L'Aquila G-8 meeting stressed the need to adopt a comprehensive strategy focusing on small farmers. The second encouraging sign is that many countries have made considerable steps towards eradicating hunger. Ghana, Malawi, Mozambique, Thailand, Turkey, Uganda and Viet Nam have significantly reduced the number of undernourished people in their countries over the last five years. The foundations for increased agricultural productivity and production to foster food security have been laid: programmes, projects and plans exist and are awaiting the political will and financial resources to become operational.

## 4. Future investment needs

In any event, the future of land and water management requires consideration of the economic demand for agricultural products. The demand for food is primarily a function of population and income. Relatively accurate estimates of future food demand are to be found in FAO's studies for 2030 and 2050 (FAO, 2006). FAO estimates that at the world level, the growth of demand for all crop and livestock products is projected to be lower than in the past, 1.5 percent per annum in the period 1999/2001-2030 and 0.9 percent for 2030-2050 compared to rates from 2.1 and 2.3 percent per annum in the preceding four decades.

It is mainly the slowdown in the growth of demand in developing countries, which attained a fairly high level of per capita food consumption (above 2 960 Kcal/person/day in 1999/2001), and in particular in China, which accounts for much of the global deceleration. In China, food demand will increase by a still non-negligible 11 percent in 30 years to achieve consumption levels close to those of developed countries (3 300 kcal). This is low growth when compared with the 50 percent growth in the preceding 30 years, though it should



be noted that the price-based volume of consumption will increase faster, at rates close to 36 percent, as the consumption structure will continue to shift towards higher value products (Schmidhuber *et al.*, 2009).

In contrast, it is projected that the growth in per capita demand in developing countries with food consumption levels of below 2 700 kcal/person/day in 1999/2001 will not slow. This group of countries includes India with a population of one billion out of the group's 2.3 billion. Food demands in sub-Saharan Africa alone will more than triple between 2000 and 2050 in response to increased population and improved diets. These rising trends in demand should be set against the inherent spatial and temporal variability and increasing volatility of global food markets, as demonstrated in the last two years (Food Outlook, FAO). If this variability amplifies under climate change, meeting the predictable but rising demands for food will become ever more of a challenge.

To remain consistent with FAO's long-term estimates of food demand (World agriculture: towards 2030/2050), projections for investment requirements for primary agriculture and its downstream industries in developing countries show that the total over the 44-year period 2005/2007 to 2050 could be US\$9.2 trillion (2009 dollars), 57 percent of this would be for primary agriculture, and the remainder for support services (Table 4). In primary agriculture, about one-quarter of all capital needs stems from projected mechanization needs, almost 18.5 percent from further expansion and improvement of irrigation, and about 3 percent for land development, soil conservation and flood control. The investments to be allocated for agriculture development is low compared with the US\$365 billion spent in 2007 to support agriculture in rich countries and the trillions of dollars found on short order in 2008–2009 to prop up the financial sector.

TABLE 4: MAJOR DONORS FOR LAND AND WATER (CRS DATABASE OF OECD: ACCESSED JUNE 2010)

	Net	Depreciation	Gross
<b>Total for 93 developing countries</b>	<b>3 636</b>	<b>5 538</b>	<b>9 174</b>
<b>Total investment in primary production</b>	<b>2 378</b>	<b>2 809</b>	<b>5 187</b>
of which crop production	864	2 641	3 505
Land development, soil conservation and flood control	139	22	161
Expansion and improvement of irrigation	158	803	960
Establishment of permanent crops	84	411	495
Mechanization	356	956	1 312
Other power sources and equipment	33	449	482
Working capital	94	0	94
of which livestock production	1 514	168	1 683
<b>Total investment in downstream support services</b>	<b>1 257</b>	<b>168</b>	<b>3 986</b>

Source: elaborated from Josef Schmidhuber, Jelle Bruinsma and Gerold Boedeker, 2009



A breakdown by region suggests that Asia would account for the largest portion of global investment needs in crop production overall, about 58 percent, equally distributed between East and South Asia; the Near East and North Africa region would account for about 18 percent, Latin America would absorb about 15 percent and sub-Saharan Africa the remaining 9 percent of capital needs (Table 5). Asia's high share reflects the region's large agricultural base, its high overall output and its relatively capital-intensive forms of agricultural production (irrigation, mechanization, terracing). Growth rates for Asia would, however, be more modest. The opposite is true for sub-Saharan Africa, where the overall level of investment requirements is expected to be relatively low because of the region's generally labour-intensive and capital-saving forms of production. Growth rates, instead, are projected to be higher, reflecting a very gradual shift to a more capital-intensive form of agriculture and moderately rising per capita production levels driven by a doubling of its population and consumer base.

**TABLE 5: CUMULATIVE INVESTMENTS IN CROP PRODUCTION OVER 2005/07 TO 2050 BY REGION**

	Net	Depreciation	Gross	Share in total
	Billion in 2009 US dollars			Percentage
Developing countries – 93	3 636	5 538	3 505	100
Sub-Saharan Africa	478	462	319	9.1
Latin America and Caribbean	842	962	528	15.1
Near East and North Africa	451	742	619	17.7
South Asia	843	1 444	1 024	29.2
East Asia	1 022	1 928	1 015	29.0

Source: elaborated from Josef Schmidhuber, Jelle Bruinsma and Gerold Boedeker, 2009

Nonetheless, different models have been adopted to estimate investment needs, both at the global and regional scale. An excursus of the estimates of investment requirements in agriculture conducted by FAO from 1981 until 2003 is reported in Box 2.

**BOX 2: PAST FAO ESTIMATES OF INVESTMENT REQUIREMENTS**

The 1981 publication *Agriculture: Toward 2000* (FAO, 1981) estimated that the average annual gross investment over the 20 year period 1980-2000 for 90 developing countries (excluding China) to be US\$69 billion in 1975 dollars, US\$47 billion for investment in primary agriculture (of which about one-third was for investment in replacements) and US\$22 billion for investment in supporting capital stock. Separate estimates are given for (net) investment in forestry and fisheries. These investment estimates refer to total investment required, i.e. the sum of private and public investment.

The 1988 FAO study *World agriculture: toward 2000* is an update of the 1981 study and follows the same methodology. For 93 developing countries (excluding China) the estimate of annual (average over the 17-year period 1982/1984-2000) gross investment amounts to US\$88 billion in 1980 dollars. Investments in primary agriculture are estimated at US\$50 billion (nearly 60 percent for investment in replacement), and investment in supporting capital stock at US\$38 billion. No estimates were given for investment in forestry and fisheries.

## BOX 2: PAST FAO ESTIMATES OF INVESTMENT REQUIREMENTS (CONTINUE)

The investment estimates of the Technical Background document No 10 for the 1995 World Food Summit, *Investment in agriculture: evolution and prospects* were based on the FAO study (Alexandratos, N; 1995), *World agriculture: toward 2010*. The estimates given in this publication refer to the group of 93 developing countries and are those needed to achieve the production projections of the latter publication (i.e. the WFS target is not considered and 637 million people were left undernourished in 2010).

The estimate for annual (average over 1993-2013) gross investment in 1993 dollars is US\$129 billion, of which US\$86 billion in primary agriculture (US\$61 billion for replacement) and US\$43 billion in support (or post-production) investment. To this is added US\$37 billion worth of investments in public support services (mainly technology generation and transfer) and rural infrastructure, two categories that were not covered in earlier studies. The total then amounts to US\$166 billion of which about three-quarters (US\$125 billion) is private and one-quarter (US\$41 billion) is public investment.

The next FAO exercise giving investment estimates (of a slightly different nature) was: FAO (1999), *Investment in agriculture for food security: Situation and resource requirements to reach the World Food Summit objectives*. The estimates are an update of the 1995 estimates – still for developing countries only – but this time refer to what is needed to reach the WFS target of halving the number of undernourished people in 2015. They are: an annual (average over 2000-2015) gross investment in 1995 dollars of US\$140 billion, of which US\$93 billion (US\$66 billion for replacement) in primary agriculture and US\$47 billion in support (or postproduction) investment. To this is added an US\$40 billion of investment in public support services and rural infrastructure. The total amounts to US\$180 billion.

Another FAO publication giving investment estimates is FAO's (2003), *Anti-hunger programme*. The estimates given refer to what is needed to reach the WFS target in 2015. They cover only investment incremental to expected future public investment. Annual (average over 2003-2015) investment in 2002 dollars of US\$23.8 billion of which US\$2.3 billion for productivity improvements, US\$7.4 billion for natural resource development, US\$7.8 billion for rural infrastructure, US\$1.1 billion for knowledge generation and US\$5.2 billion for ensuring access to food.

Source: Josef Schmidhuber, Jelle Bruinsma and Gerold Boedeker, 2009. *Capital requirements for agriculture in developing countries to 2050*. Expert Meeting on How to Feed the World in 2050. Paper presented at the FAO Expert Meeting on "How to Feed the World in 2050", 24-26 June 2009, Rome.

Looking at investments in agricultural water management, the World Water Council (WWC)/Global Water Partnership (GWP) Vision and Framework for Action in 2000, estimated that the annual investment requirements for agricultural water would need to rise from the current levels, variously estimated to be in the range US\$25-30 billion, to US\$40 billion by 2025. In a recent systematic analysis of the options for meeting the Millennium Development Goals (MDG) for hunger, the annual investment and running cost of all water resource related management was estimated to be US\$ 47 billion in the period 2005-2015, rising to US\$67 billion in 2015-2030, and falling to US\$58 billion in 2030-2050. According to a study conducted by International Food Policy Research Institute (IFPRI) in 2008 on irrigation investment needs, it is estimated that the global incremental public agricultural investment required to meet MDG1 by 2015 would be US\$14 billion for all developing countries, with more than 50 percent of the total (US\$7.76 billion) allocated to irrigation development.

Recent work has been conducted with a specific regional focus on Africa: the New Partnership for Africa's Development-The Comprehensive Africa Agriculture Development Programme (NEPAD-CAADP) (NEPAD, 2003) estimated total investments required to be US\$37 billion between 2002 and 2015 in land management and water control in Africa. A similar figure, but for sub-Saharan Africa, was obtained by IFPRI (IFPRI, 2008). A recent FAO/IFAD study (FAO, 2008) estimates that the total cost of water infrastructure that could be developed to support rural poverty reduction in sub-Saharan Africa to be as high as US\$85 billion.

The preparatory work to the Sirte Conference, held in December 2008, showed that the cumulative amount of investment for ongoing and pipeline projects in water for agriculture and energy in Africa, excluding major hydraulic storage works, was US\$64.6 billion. The highest proportion of the cost is noticeably allocated to large-scale projects, including large-scale irrigation schemes development and hydropower projects. Similarly, 56 percent of the total investment envelope is expected to be exhausted in the medium term, showing a clear need to enhance the planning for investments in the long term to ensure sustained and permanent growth in the agriculture and energy sector to meet food and energy security goals.

### BOX 3: DEMAND DRIVEN INVESTMENT ESTIMATES - THE SIRTE CONFERENCE AND THE CAADP TOOLS

The Ministerial Conference on "Water for Agriculture and Energy in Africa: The Challenges of Climate Change", held in Sirte, Libyan Arab Jamahiriya, from 15 to 17 December 2008, was attended by more than 400 participants, including 37 Ministers, from 48 African countries, 54 representatives of Intergovernmental Organizations, 34 representatives of Civil Society Organizations, and ten representatives from six Organizations of the United Nations system.

The Conference discussed the prospects for food and energy demand by 2015 and the projections for 2030 and 2050 based on the key drivers of population and income growth and under the threat of climate change, concluding that policy decisions and budget allocations should prioritize assistance to farmers to adapt to climate change and budgets should be made available for investment in agriculture water and infrastructure development for integrated hydropower generation and irrigated agriculture. The Conference discussed the investment envelopes needed to address future food and energy demands. The preparatory work of the Conference allowed for drawing up a detailed portfolio of about 1 000 projects and programmes of investment in water control for agriculture and energy in Africa. The cumulative investment over the next 20 years was estimated at about US\$64.6 billion.

The investment estimates have been derived by adopting a participatory and demand-driven approach. Concrete investment projects have been collected and compiled into a country database based on close consultation with national governments, and a thorough revision of their investment plans, and in collaboration with donors involved in water resources management. Detailed information was provided for each project on total cost, yearly expenditures, funding sources, area under irrigation, hydropower generation capacity, cropping patterns, etc.

The compiled information was input in a financial diagnosis tool developed by FAO for the Sirte Conference and enhanced within the Comprehensive Africa Agriculture Development Programme (CAADP) Pillar I Framework - Sustainable Land and Water Management. The tool is an instrument that:

- assesses the current trends in public and private expenditures;
- supports realistic estimates and assessment of available means of finance from governments,

donors and the private sector within short, medium and long-term time frames;

- supports the prioritization of national projects and programmes that will eventually lead to the development of comprehensive national investment programmes.

The CAADP provides a common framework for stimulating and guiding national, regional and continental initiatives on enhanced agriculture productivity fostering greater resource mobilization at the national and regional level. Combined with this financial tool, FAO and other development partners are working to develop other tools to deepen the understanding of common priorities to ensure that any investment programme developed responds to specific problem(s). In particular, two tools will facilitate the identification of key investment priorities and policy issues for the private and public sectors:

- 1) a technical diagnosis tool that supports stocktaking and assessment of sustainable water and land management technical interventions and water strategies; and
- 2) an institutional and policy tool that identifies policy priorities, goals and targets and the distribution of clear roles among agencies.

## 5. A framework approach for investment in land and water

### 5.1 The investment framework

The current and projected gaps between demand and domestic food supply will not be closed if current trends and investment responses continue. The hope is that investments can be geared towards sustainable development of water and land resources, and that comparative advantages will be recognized and shared benefits identified.

Prerequisites are policy alignment, public and private institutional capacity, and an enabling environment that can attract and implement greater proportions of investment in agriculture production. Of fundamental importance is the state of existing institutions that allocate water and land, govern their use and operate and maintain infrastructure – the software. Investment projection requirements should include an evaluation of public and private capacities to absorb an increase in financial support and improve performance in delivering regulatory and operational services. The functioning of public regulation, local government services, users' associations, catchment boards and public turnkey operations for bulk infrastructure are equally important. The value of new assets cannot be realized without them. If investment targets can be identified and prioritized, then this aspiration should be set against the fact that agriculture and related infrastructure is undercapitalized in relation to its economic importance.

To be effective, given any set of policy directions, the development of a project or programme pipeline will need to be prioritized and graded. Not everything can be done at once and screening methods, both supply driven and demand driven, initiatives according to financial, economic, social and environmental criteria will need to be applied. Further, since initiatives will generally be chasing scarce financial resources, some means of phasing investment to match available finances needs to be anticipated. None of this has to amount

to a 'master-plan' approach, but can be done iteratively and in consultation; although with realistic natural and human resource limits. The purpose of prioritization and phasing is to build in some measure of equity, concerning public expenditure and regional balance, and to avoid dilution of investment where only periods of concentrated investment – such as building dams during dry seasons – will bring results. At the national level the generation of nationally owned recurrent and capital expenditure plans needs to be adept at defining priorities and matching these to the various finance sources. It is suggested that an investment framework approach can help resolve confusion and duplication in water and land related investments.

Simply stated, an investment framework combines sectoral typologies (such as irrigation schemes or soil conservation), development objectives and time horizons in a way that facilitates strategic planning and the establishment of cost envelopes, and that can be applied at any hierarchical level within a sector and at any level of detail. As such, investment frameworks can be thought of as providing the space within which investment decision-making is both responsive to local needs and priorities and subject to cross-sectoral regulation, including natural resource management and environmental impact.

An investment framework translates specific policy measures for programmes, projects and budgets, considers institutional, regulatory and legal as well as infrastructural measures, all of which can be clustered as civil administrative or hydrological entities. For the investment framework to be effective, it must generally define what needs to be done to achieve the objective in question. Guided or (where appropriate) constrained by the framework, decision-makers, beneficiaries and the development partners can then identify, select, prepare, finance and implement specific interventions that respond to those needs in a policy-compliant fashion. Such an investment framework therefore has a regulatory aspect, and helps focus investments on the achievement of stated goals.

Irrespective of the sources of finance and the coherence of specific sector support, in the spirit of the Paris Declaration, it is important for individual countries to be clear about investment needs in land and water for agriculture to address food security, poverty alleviation and to promote growth. An investment framework is necessary to make a sound quantification of overall finance needs in relation to specific policy targets. Over time such frameworks can be used to monitor the rate and balance of investment to determine whether a better structured sector or subsector is evolving and whether policy targets need to be modified or changed. This does not preclude the formulation of detailed projects but it does recommend that individual projects are recognized and evaluated within the investment framework along with programmatic demand-led investments that may have shorter investment cycles. Such frameworks can set the basis for reciprocity between governments and donors to ensure that the investment envelopes are both mutually credible and eligible.

## 5.2 Accelerating investment flows

Beginning to solve agricultural investment problems will need greater financial commitments from governments and donors, along with a progressive policy and institutional reform agenda, as part of an enabling investment environment. In agriculture, three principal areas of policy and investment intervention can be identified:

- At micro level, individual farmers and households need to be assured stable engagement with land and water resources. Systems of land tenure and water-use rights need to be flexible to promote the realization of comparative advantage in food staples and cash crops. They need to be matched by



access to rural credit and finance that suits specific agricultural systems and are not only linked to annual repayment or harvest production, but allow longer-term finance of farm inputs. Such initiatives should be complemented by the dissemination of technology and good practice in water control and agricultural productivity.

- At irrigation scheme level, a focus on rehabilitation, that includes modernization and management transfer, offers tangible scope for extracting the full value out of sunk costs and reducing pressure on public funds. Such programmes are essential before longer-term investments in new-build can be evaluated.
- At macro level, government policy and investments need to be aligned to allow local markets for agricultural produce to become more effective in meeting local demands. This will require investment in the key public goods such as roads and storage and will involve a more progressive role for large-scale private investment. Key considerations are to create these conditions, while also guaranteeing allocation of sovereign resources through negotiation of shared water resources, for instance.

At the international level, any attempt to accelerate investment for food and energy security must remain coherent with the principles of the Paris Declaration on Aid Effectiveness and the Accra Agenda for Action, and therefore build on available funding mechanisms. There are examples of vertical funds to address specific issues at the regional level. IFAD, for instance, is discussing its Eighth replenishment seeking a substantial increase in resources for support to smallholder agricultural development. An African Fertilizer Financing Mechanism, hosted by the African Development Bank, designed to lower unit costs of fertilizer throughout Africa, was recently established but is not yet adequately funded. As a follow-up to the G-8 held in L'Aquila in July 2009 and the G-20 summit in Pittsburgh in September 2009 the World Bank Group created the Global Agricultural and Food Security Programme, a multilateral financing mechanism that will allow the immediate targeting and delivery of additional funding to public and private entities to support national and regional strategic plans for agriculture and food security in poor countries. The question as to whether such vertical funds should be promoted, or existing financing mechanisms should be scaled-up to accommodate the additional financing is worth considering.

#### BOX 4: RETURNS TO WATER MANAGEMENT PROJECTS

Too often investments in water development are evaluated based on the direct rate of return of single-purpose schemes, without considering the multiplier effect on other sectors and the additional benefits possible from multipurpose projects (WWAP, 2009). It is increasingly evident that investments in water have spill-overs at an economy-wide scale; local water management initiatives in China have resulted in great improvements in local GDP (SIWI, 2005). Moreover, clearly the lack of investments in water resources can result in enormous costs, particularly in developing countries. For example, in Kenya the combined impact of the floods in 1997/1998 and the following droughts between 1998 and 2008 was estimated at US\$4.8 billion (Gichere *et al.*, 2006) and the inability to deal with hydrological variability in Ethiopia caused a 38 percent decline in GDP (Biemans *et al.*, 2008).

When considering the rate of return as a proxy for the profitability of investments in water management, a great variation in results and estimates appears and it is difficult to draw a clear-cut conclusion.

**BOX 4: RETURNS TO WATER MANAGEMENT PROJECTS (CONTINUE)**

The most comprehensive evaluation of irrigation project performance is provided by the World Bank study of 208 World Bank funded irrigation projects, which were 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 (Jones, 1995). The study shows that at appraisal the economic rate of return on irrigation investments was expected to average 22 percent. The average evaluation rate of return was 15 percent. Of the six most important factors that enter economic-returns calculations, the factors that most significantly affect the outcome of irrigation projects are the size of the irrigated area, output price, crop yield, and unit cost. Variations in implementation (whether overall time or delay) had no effect on economic returns.

The table below, elaborated from Fan *et al.* (2003), reports the returns – as a dollar increase in agricultural output per dollar of incremental spending – to investments in various agricultural related activities for a selected number of countries. Agriculture research and extension typically generates the highest returns, followed by investments in roads. Investment in irrigation infrastructure proves to be slightly profitable in many circumstances, although returns can vary considerably by location and over time.

Item	China	India	Thailand	Uganda	Viet Nam
Research	9.6	13.5	12.6	12.4	12.2
Irrigation	1.9	1.4	0.7	-	0.4
Roads	2.1	5.3	0.9	7.2	3
Electricity	0.5	0.3	4.9	-	-
Education	3.7	1.4	2.1	2.7	2.1

Focusing on Asia, several studies attempted to estimate the internal rate of return of irrigation water investments. Evenson *et al.* (1999), having analysed data from nearly all districts of thirteen states in India from 1956 to 1987, found that the marginal internal rate of return (IRR) to investments in irrigation was only about 5 percent, while they reported a 58 percent IRR for public expenditures on agricultural research. For India, Fan *et al.* (1999), confirmed that irrigation development distantly trailed road building, agricultural research and development, and education in its impact on poverty reduction, although irrigation showed a somewhat more favourable impact on productivity. A similar conclusion was found for a study focusing exclusively on China (Fan *et al.*, 2002). In the Indian context, a study carried out by Bhattarai *et al.* (2007) attempted to estimate the irrigation multiplier (i.e. accounting for direct and indirect project benefits) and derived values ranging from 3 to 4.5, suggesting that more than two-thirds of the benefits from irrigation developments accrue to the non-farm economy.



## 6. Conclusions

Agriculture is a key to poverty reduction and strong agricultural growth has been a consistent feature of countries that have successfully managed to reduce poverty. GDP growth generated in agriculture is, on average, four times more effective in benefiting the poorest half of the population than growth generated outside agriculture (World Bank, 2007). Increased agricultural productivity improves farmers' incomes, generates on-farm employment, lowers food prices, and has significant employment multipliers within the local non-farm economy, all of which reduce poverty as the poor typically spend 60–70 percent of their income on food. 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. The drop off in investment in agricultural land and water was mainly driven by the perception of the decline in rate of return, compared to alternative investments in other sectors. The recent surge in food prices and degradation of food security situation show the limits of such short-sighted strategies. Indeed, the fact that the return on capital invested in agriculture rarely matches that in industry and urban services does not capture the multiplier and social benefits from rural investment, beyond the direct impacts on food security.

Governments, authorities and development practitioners are thus facing the paradox of having agreed to development goals requiring increased production with diminishing per capita resources, but without the concomitant investment to do this. FAO projects that, based on long-term estimates for food demand, investment requirements for primary agriculture and its downstream industries in developing countries could amount to US\$9.2 trillion for the period 2007–2050, with 18.5 percent of the total allocated to expansion and improvement of irrigation and about 3 percent for land development, soil conservation and flood control.

Not only financial resources are needed, policy alignment, public and private institutional capacity, and an enabling environment that can attract and implement much larger proportions of funding in land and water are prerequisites to the effectiveness of investments. It is particularly important for individual countries to be clear about investment needs in land and water to address food security, poverty alleviation and to promote growth. An investment framework is required to make a sound quantification and prioritization of overall finance needs in relation to specific policy targets. This does not preclude the formulation of detailed projects but it does recommend that individual projects are recognized and evaluated within the investment framework along with more programmatic demand-led investments that may have shorter investment cycles. Such frameworks can also set the basis for reciprocity between governments and donors ensuring that the investment envelopes are both mutually credible and eligible.

It is vital, particularly in times of crisis, that support to land and water not be reduced. Only a healthy agricultural sector, combined with a growing non-farm economy and effective safety nets and social protection programmes will permit facing the global recession as well as eradicating food insecurity and poverty.

## 7. References

- AfDB. 2009.** Achieving outcomes in African development through water. (Available at: <http://www.afdb.org/en/topics-sectors/sectors/water-supply-sanitation/bank-group-vision/>).
- Akroyd, S. & Smith, L. 2007.** Review of public spending to agriculture – Main Study & Country Case-Studies. London and Washington, DC, A joint DFID / World Bank study.
- Bickel, M. & Breuer, T. 2009.** Foreign direct investments in land in developing countries. Rural 21, April 2009.
- Bhattarai, M. Barker, R. & Narayanamoorthy, A. 2007.** Who benefits from irrigation development in India? Implication of irrigation multipliers for irrigation financing. *Irrigation and Drainage*, 56: 207-225 (2007).
- Biemans, H., Bresser, T., van Schalk, H. & Kabat, P. 2006.** Water and climate risks: a plea for climate proofing of water development strategies and measures. Fourth World Water Forum, Cooperative Program on Water and Climate, Wageningen, The Netherlands.
- Comprehensive Assessment of Water Management in Agriculture. 2007.** London: and Colombo, Earthscan and International Water Management Institute.
- Cotula, L., Vermeulen, S., Leonard, R. & Keeley, J. 2009.** *Land grab or development opportunity?* Agricultural investment and international land deals in Africa FAO, IIED and IFAD.
- Evenson, R.E. Pray, C. & Rosegrant, M.W. 1999.** Agricultural research and productivity growth in India. Research Report 109. Washington, DC, International Food Policy Research Institute (IFPRI).
- Fan, S. & Rao, N. 2003.** Public spending in developing countries: trends, determination and Impact. EPTD Discussion Paper No. 99. Washington, DC, IFPRI.
- Fan, S., Zhang, L. & Zhang, X. 2002.** Growth, inequality and poverty in rural China: the role of public investments. IFPRI Research Report 125. Washington, D.C.
- Fan, S., Hazell, P. & Thorat, S. 1999.** *Linkages between government spending, growth and poverty in rural India.* Research Report 110. Washington DC, IFPRI.
- FAO. 2002.** Investments in land and water. Proceedings of the regional consultation, Bangkok, Thailand, 3-5 October 2001. RAP Publication 2002/09.
- FAO. 2006.** World agriculture towards 2030/2050. Interim Report. Rome. 71pp.
- FAO. 2007.** *Adaptation to climate change in agriculture, forestry and fisheries: Perspective, framework and priorities.* FAO, Rome.

- FAO. 2008.** Address of the Director-General, Islamic Development Bank. Washington, DC, 12 October 2008. (Available at: <http://www.fao.org/english/dg/2008/12october08.html>).
- FAO. 2008.** *Climate change and food security: a framework document*. FAO, Rome.
- FAO. 2008.** Committee on World Food Security. Thirty-fourth Session. Assessment of the world food security and nutrition situation Rome, 14-17 October 2008.
- FAO. 2008.** *Crop prospects and food situation*. No. 4. (Available at: <http://www.fao.org/docrep/011/ai473e/ai473e00.htm>).
- FAO. 2008.** Statement of the Director-General. Thirty-fifth Special Session. Rome, 18-22 November 2008.
- FAO. 2009.** Allocution de M. Jacques Diouf, Directeur Général de l'Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO). World Water Forum 5. L'eau pour l'alimentation et l'élimination de la pauvreté. Table ronde Ministérielle. Istanbul, 21 Mars 2009. VERSION PROVISOIRE 25/2/2009.
- FAO. 2009.** Address by Jacques Diouf, Director-General of the Food and Agriculture Organization of the United Nations (FAO). High-level Meeting on 'Food Security for All', Madrid, 26-27 January 2009.
- FAO. 2009.** Address by the Director General at the World Food Day Ceremony, Rome, 16 October 2009.
- FAO. 2009.** Food prices indices data. Rome.
- FAO. 2009.** Food Outlook November 2008: Falling prices in perspective. (Available at: <http://www.fao.org/docrep/011/ai474e/ai474e13.htm>).Rome.
- FAO. 2009.** FAO Director-General's Message on the World Food Day/TeleFood 2009 theme: Achieving food security in times of crisis. Rome.
- FAO, 2009.** *More people than ever are victims of hunger*. (Available at: [http://www.fao.org/fileadmin/user\\_upload/newsroom/docs/Press%20release%20june-en.pdf](http://www.fao.org/fileadmin/user_upload/newsroom/docs/Press%20release%20june-en.pdf)).
- FAO, IFAD, WFP, 2002.** *Reducing poverty and hunger: the critical role of financing for food, agriculture and rural development*. Paper Prepared for the International Conference on Financing for Development Monterrey, Mexico, 18-22 March 2002. Rome, February 2002.
- Gichere, S., Davis, R. & Hirji, R., 2006.** *Climate variability and water resources degradation in Kenya: Improving water resources development and management*. World Bank Working Paper Series 69. Washington, DC, the World Bank.
- GWP & WWC. 2009.** Financing Water for All. (Available at: <http://www.financingwaterforall.org/index.php?id=1751>).
- IFAD. 2001.** *Rural poverty report 2001: the challenge of ending rural poverty*. International Fund for Agricultural Development. Rome.

- IFPRI, 2009.** 'Land Grabbing' by foreign investors in developing countries: risks and opportunities. (Comprehensive table available at: <http://www.ifpri.org/sites/default/files/bp013Table01.pdf>).
- IPCC, 2007.** Climate Change 2007 – the physical science basis. Contribution of Working Group I to the Fourth Assessment Report of IPCC. Cambridge, United Kingdom.
- Jacques Diouf, Director-General of the UN Food and Agriculture Organization (FAO), OECD Observer, 2003.** Agriculture, food security and water: Towards a blue revolution. (Available at: [http://www.oecdobserver.org/news/fullstory.php/aid/942/Agriculture,\\_food\\_security\\_and\\_water:\\_Towards\\_a\\_blue\\_revolution.html](http://www.oecdobserver.org/news/fullstory.php/aid/942/Agriculture,_food_security_and_water:_Towards_a_blue_revolution.html)).
- Jones, W.I. 1995.** The World Bank and irrigation. A World Bank operations evaluation study. Washington, DC, the World Bank.
- Koohafkan, P. 2004** (unpublished). Investing in land and water resources: Enhanced commitment and innovation in the financing of agriculture and food security. Internal Document. FAO, Rome.
- 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.
- Millennium Project, 2007.** Global challenges facing humanity. (Available at: [http://www.millennium-project.org/millennium/Global\\_Challenges/chall-03.html](http://www.millennium-project.org/millennium/Global_Challenges/chall-03.html)).
- Rosegrant, M., Cai, X. & Cline, S. 2002.** *Global water outlook to 2025. Averting an impending crisis*. Washington and Colombo, IFPRI and IWMI Food Policy Report.
- Rosegrant M.W., Paisner, M.S., Meijer, S. & Witcover, J. 2001.** *Global food rojections to 2020: Emerging trends and alternative futures*. Washington DC, IFPRI.
- Rosegrant, M.W., Valmonte-Santos, R.A. & Basani, M. 2005.** The role of irrigation and drainage in global agricultural development, 1994-2004. (Mimeo)
- Shenggen Fan & Rosegrant, M.W. 2008.** Investing in agriculture to overcome the world food crisis and reduce poverty and hunger. IFPRI Policy Brief 3, June 2008. Washington, DC, IFPRI.
- SIWI (Stockholm International Water Institute), 2005.** Making water a Part of Economic Development: the Economic Benefits of Improved Water Management and Services. Stockholm.
- Smaller, C. & Mann, H. 2009.** International Institute for Sustainable Development (IISD) –Foreign Investment for Sustainable Development Program. A thirst for distant lands: Foreign investment in agricultural land and water. IISD.
- UNDESA. 2008.** *Trends in sustainable development 2008-2009: Agriculture, rural development, land, desertification and drought*. New York, United Nations. (Available at: <http://www.un.org/esa/sustdev/publications/trends2008/fullreport.pdf>).

**UNDESA. 2010.** *The United Nations Development Agenda: Development for all – goals, commitments and strategies agreed at the United Nations World Conferences and Summits since 1990.* New York, Department of Economic and Social Affairs of the United Nations.

**United Nations. 2008.** *World population prospects. The 2008 Revision.* New York.

**UNESCO, 2004.** (Web site: [http://wwap.unesco.org/ev.php?URL\\_ID=6480&URL\\_DO=DO\\_TOPIC&URL\\_SECTION=201&PHPSESSID=bc12e5d7e7f78af5](http://wwap.unesco.org/ev.php?URL_ID=6480&URL_DO=DO_TOPIC&URL_SECTION=201&PHPSESSID=bc12e5d7e7f78af5)).

**von Braun, J. & Meinzen-Dick, R. 2009.** 'Land Grabbing' by foreign investors in developing countries: Risks and opportunities. IFPRI Policy Brief 13. Washington, DC, IFPRI.

**Cline, W.R. 2007.** *Global warming and agriculture – Impact estimates by Country.* 250 pp. ISBN 978-0-88132-403-7.

**Winpenny, J. 2010.** Global trends in financing water. *In Globalization, Trade, and Global Change: Implications for Water and Food Security*, C. Ringler, A. Biswas, and S.A. Cline (eds). Springer, New York.

**World Bank, 2008.** *World Development Report 2008.*

**World Bank, 2007.** Emerging public-private partnerships in irrigation development and Management. Water Sector Board Discussion Paper No. 10. (Available at: [http://siteresources.worldbank.org/INTWSS/Resources/WS10\\_txt.pdf](http://siteresources.worldbank.org/INTWSS/Resources/WS10_txt.pdf)).

**World Bank. 2009.** Implementing agriculture for development: World Bank Group Agriculture Action Plan – 2010-2012. Washington, DC.

**World Bank. FAO, IFAD. 2009.** Improving food security in Arab countries. Washington, DC.

**World Water Assessment Programme. 2009.** *The United Nations World Water Development Report 3: Water in a changing world.* Paris and London, UNESCO and Earthscan.

**World Water Forum. 2006.** Financing Water for Agriculture. Progress Report No 1 –Contribution to the task force on financing water chaired by Angel Gurría and submitted to the Fourth World Water Forum, Mexico, March 2006.