UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT
UNCTAD

Water for Food

Innovative water management technologies for food security and poverty alleviation

UNCTAD Current Studies on Science, Technology and Innovation. N°4

UNITED NATIONS
New York and Geneva, 2011

NOTE

The United Nations Conference on Trade and Development (UNCTAD) serves as the lead entity within the United Nations Secretariat for matters related to science and technology as part of its work on the integrated treatment of trade and development, investment and finance. The current work programme of UNCTAD is based on the mandates set at UNCTAD XII, held in 2008, in Accra, Ghana, as well as on the decisions by the United Nations Commission on Science and Technology for Development (CSTD), which is served by the UNCTAD secretariat. UNCTAD's work programme is built on its three pillars of research analysis, consensus-building and technical cooperation, and is carried out through intergovernmental deliberations, research and analysis, technical assistance activities, seminars, workshops and conferences.

This series of publications seeks to contribute to exploring current issues in science, technology and innovation, with particular emphasis on their impact on developing countries.

The term "country" as used in this study also refers, as appropriate, to territories or areas; the designations employed and the presentation of the material do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delineation of its frontiers or boundaries. In addition, the designations of country groups are intended solely for statistical or analytical convenience and do not necessarily express a judgement about the stage of development reached by a particular country or area in the development process. Mention of any firm, organization or policies does not imply endorsement by the United Nations.

The material contained in this publication may be freely quoted with appropriate acknowledgement.

UNCTAD/DTL/STICT/2011/2

ACKNOWLEDGEMENTS

This study was prepared by Melvyn Kay (consultant to UNCTAD) under the direction of Dong Wu. Juana Paola Bustamante and Jenny Lieu contributed to research. Anne Miroux and Mongi Hamdi provided overall guidance.

Comments were received from the following UNCTAD staff members: Ulrich Hoffmann, Oliver Johnson and Jason Munyan.

UNCTAD also wishes to acknowledge comments and suggestions provided by David Molden and Barbara Van Koppen (International Water Management Institute), Rudolph Cleveringa (International Fund for Agricultural Development), Timothy Karpouzoglou (Science and Technology Policy Research, University of Sussex), Shirley Malcom and Sophia Huyer (Gender Advisory Board, UN Commission on Science and Technology for Development), Vijaya Kumar (Industrial Technology Institute, Sri Lanka), as well as from members of the UN Commission on Science and Technology for Development.

Laurence Duchemin formatted the manuscript. Nadege Hadjemian designed the cover. Michael Gibson edited the report.

ABBREVIATIONS

AgWA	Agricultural Water for Africa
AMCOW	African Ministers' Council on Water
AWM	Agricultural Water Management
BRIC	Brazil, Russia, India and China
CAADP	Comprehensive Africa Agriculture Development Programme
CP-MUS	Challenge Program-Multiple-Use Water Systems
FAO	Food and Agriculture Organization
GHG	Greenhouse gas
IDE	International Development Enterprises
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
IWMI	International Water Management Institute
LDC	Least Developed Country
MDG	Millennium Development Goals
NEPAD	New Partnership for Africa's Development
OECD	Organisation for Economic Co-operation and Development
PPP	Public Private Partnership
SSA	sub-Saharan Africa

CONTENTS

WATER FOR FOOD – INNOVATIVE WATER MANAGEMENT TECHNOLOGIES FOR FOOD SECURITY AND POVERTY ALLEVIATION

Modern irrigation is one of the success stories of the 20th century. As the world's population doubled, irrigated farming expanded from 40 million hectares to almost 300 million hectares today – a seven-fold increase. This revolution in water technology improved crop yields and enabled farmers to grow additional crops each year. China, India, Indonesia, and Pakistan together account for almost half the world's irrigated area and they rely on irrigation for more than half their domestic food production.

But the world's population continues to grow and so do concerns about food security and particularly the availability of water to grow crops. Global agricultural food production already accounts for 70 percent of all water withdrawn from rivers and aquifers. Climate change will only make matters worse.

Can agricultural water management (AWM) technologies provide innovative solutions that meet this challenge of feeding a growing population by producing more food but with fewer resources? This paper reviews the water-food-poverty nexus and examines the role that AWM technologies may play in achieving world food and water security.

1. Agriculture and water

Agriculture is central to food security and economic growth in developing countries and provides the main source of livelihood for three out of four of the world's poor (Wheeler and Kay, 2011). But food production requires substantial amounts of water. Globally, agriculture accounts for 70 percent of all water withdrawn from rivers and aquifers. Several regions are already facing acute physical water scarcity – North Africa, South Asia, and the drier regions of sub-Saharan Africa (SSA). Water scarcity is one of the most pressing issues facing humanity today. More than 1.4 billion people live in water stressed river basins and by 2025, this number is expected to reach 3.5 billion. Moreover, over 20 percent of the world's rivers run dry before reaching the sea (World Resources Institute, 2003).

This situation is set to deteriorate. Global food demand is expected to increase by as much as 70 percent by 2050 (FAO, 2006a) as the world's population rises from over 6.8 billon to 9 billion and diets change as a result of socio-economic improvements, particularly in OECD and BRIC (Brazil, Russia, India and China) countries. About 1.4 billion people live in extreme poverty (defined by the World Bank as living on less than US$1.25 a day). Most are living in LDCs (Least Developed Country) in Asia and Africa and to a lesser extent in Latin America and the Caribbean (Figure 1). Even though there is a shift towards urbanisation, poverty is still largely a rural problem (approximately 1 billion people) and this is likely to remain so for the foreseeable future (IFAD, 2011). Not only is poverty highly regionalized and rural, it is also disproportionately female (Rauch, 2009), especially as men are drawn to the cities to seek alternative incomes. In developing countries, women provide around 43 percent of the labour force. In SSA, 62 percent of the region's economically active women are engaged in the agricultural sector (FAO, 2011).

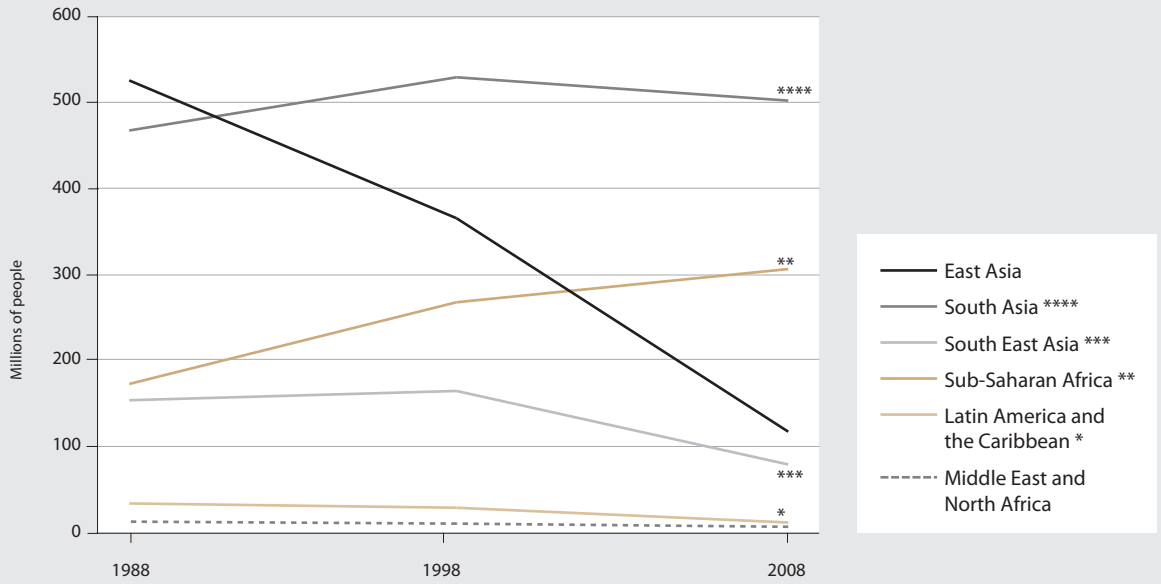
Food demand in LDCs is expected to double as the population in the developing world reaches 7.5 billion by 2050 – including 2.2 billion in south Asia and 5 billion in SSA. Most LDC Governments look to their rural communities to produce more agricultural products but those same communities are impoverished, have low productivity, and use resources inefficiently.

The burden of the poor is made worse by the changing nature of rural life – the new 'rurality' (Rauch, 2009). Globalisation is transforming the marketplace, new patterns of poverty are emerging as livelihoods adjust, and reforms in governance and rural service systems are changing the nature of institutions. All these issues create uncertainty and risk and are likely to have a disproportionate impact on the rural poor and their ability to access and make good use of limited water resources.

2. A 'perfect storm'?

Water resources are already under stress in many parts of the world yet the demand for water will substantially increase in order to meet the additional requirements for food and energy crops. Competition for water will inevitably intensify among the different water using sectors – municipalities, industry, agriculture and the environment. There are increasing pressures to divert land away from food production towards

Figure 1. Rural people living in extreme poverty (IFAD, 2011).
(Millions of rural people living on less than US$1.25/day)



Source: IFAD, 2011

energy crops. There are concerns that available water resources will decrease in some critical regions as a result of climatic changes and the available land area for agriculture will continue to decline because of land degradation and urbanisation.

The range of issues has created a 'perfect storm' with 'dark clouds' converging towards 2030 and beyond to produce problems far greater than the sum of the parts. As most of the population increase will be among those already disadvantaged in the developing world, there may be increased competition for food, water, and energy; rises in food prices; and increases in the number of people going hungry (Beddington, 2009).

and increased risk of more extreme and frequent floods and droughts. The Intergovernmental Panel on Climate Change (IPCC) projected an increase in annual mean rainfall in high latitudes and Southeast Asia and decreased rainfall in Central Asia, the southern Mediterranean, and SSA. Such changes will impact people's livelihoods and ecosystems, particularly in semi-arid and arid areas.

Decreasing rainfall, particularly in areas that are already water-short, will impact both surface and groundwater supplies. Melting glaciers will initially increase but then strongly decrease dry-season water supplies. This will affect the design of new water infrastructures. Design is normally based on historical weather patterns but this will no longer be helpful in