







UKCDS
UK Collaborative on Development Sciences

# Science and Innovation for Development

by Gordon Conway and Jeff Waage

# Science and Innovation for Development

by Gordon Conway and Jeff Waage
with Sara Delaney

Published by:

UK CDS
UK Collaborative on Development Sciences

Production funded by:

DFID Department for International Development

This publication is also available at www.ukcds.org.uk.

For any other use of this material please write to:

UK Collaborative on Development Sciences (UKCDS)
Gibbs Building
215 Euston Road
London
NW1 2BE
Email: info@ukcds.org.uk



British Library Cataloguing in Publication Data. A catalogue record for this book is available from the British Library.

ISBN 978 1 84129 0829

Further copies of this book can be ordered direct from BCPC Publications Ltd, 7 Omni Business Centre, Omega Park, Alton, Hampshire GU34 2QD, UK

Tel: +44 (0) 1420 593 200 Fax: +44 (0) 1420 593 209 Email: publications@bcpc.org

For fast order processing and secure payment order online at www.bcpcbookshop.co.uk


The production of this book is funded by the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of DFID.

Design and typesetting by: m360° Ltd, Nottingham, UK

Edited and project managed by: Moira Hart, Dewpoint Marketing, Long Clawson, UK

Printed by: Latimer Trend and Company Ltd, Plymouth, UK

# Contents



## Part One – Mobilising Science for Development

## Part Two - Science and the Millennium Development Goals

## Part Three - The Challenge of Climate Change

# Box titles

**Chapter 5**



**Chapter 6**

**Chapter 7**



**Chapter 8**



**Chapter 9**



**Chapter 10**

# List of tables

# Foreword

**Professor Calestous Juma FRS**

Belfer Center for Science and International Affairs
Harvard Kennedy School, Harvard University

*Science and Innovation for Development* is a path-breaking book that reconnects development practice with the fundamental, technical processes of development outlined more than 50 years ago. It is a refreshing reminder that development is a knowledge-intensive activity that cannot be imposed from the outside. It is consistent with leading theories that define development as an expression of the endogenous capabilities of people.

The book is written in a clear and accessible way and will go a long way in demystifying the view that science and technology is irrelevant to development. It elegantly demonstrates that even the most basic of daily activities of local communities are based on science and innovation. Even the most stubborn critics of the role of science and innovation in development can hardly miss the glaring power of the core message and the sparkling examples.

But to appreciate the importance of this book one has to revisit history. The late 1950s were a turning point in the history of economic thought. In the process of mapping out the economic future of emerging nations, many industrialised countries have recognised the role that science and innovation have played in their own development. For example, in a seminal paper published in 1957, Nobel laureate Robert Solow showed that over the previous 40 years technical change had contributed more than 87 % of gross output per person while the increase in capital investment explained only about 12 %. [1]

But as such studies laid the foundation for our current understanding of the role of science and innovation in economic growth, new organisations, guided by the experiences of post-World War II relief efforts in Europe, were charting out strategies for extending their work to emerging developing nations. The 1960s saw a clear divergence where industrialized countries increasingly adopted innovation-oriented policies while development cooperation programmes focused on relief efforts.

One of the most damaging legacies of this divergence was the consistent downplaying of technological innovation as a force in economic development. In fact, many development agencies exhibited outright hostility towards proposals that sought to integrate innovation in development cooperation strategies. *Science and Innovation for Development* is not just an effort to add a new dimension to development cooperation activities. It is a challenge to the international community to jettison traditional development approaches that focus on financial flows without attention to the role of science and innovation in economic transformation.

There have been many exhortations of the importance of science and innovation in development. But this book differs from previous studies in at least four fundamental ways. First, it uses clear and practical examples to illustrate the importance of science and innovation in development. Second, the examples provided in the book are not just compelling, but they are inspirational and demonstrate the practical utility of putting science and innovation to the service of development. Third, unlike other studies on "appropriate technology", the book takes into account the important role that institutional innovation plays in economic growth. Finally, the book recognizes emerging critical challenges such as climate change. Concern over global warming has moved from the level of scientific debate to a challenge of epochal proportions and addressing its consequences will require equally extraordinary efforts to deploy the most relevant scientific and technical knowledge available in the shortest time possible. This opens the door for a more pragmatic view of the role of engineering in development, a field that has so far received little attention in development cooperation activities.[2]

But above all, the importance of this book lies in its timing. The traditional relief-based model of development assistance no longer works except in emergency situations. But even here the pressure to move from emergency to sustainable economic recovery calls for greater investment in science and innovation. Recent challenges, such as rising food prices, are focusing international attention on the importance of increasing investment in science and innovation. But more importantly, the entry of new role models such as China, India, Brazil and Israel are helping to underscore the importance of innovation in development. Indeed, developing countries are increasingly seeking to place science and innovation at the centre of their development strategies.

The recent financial crisis has forced a large number of industrialized countries to introduce stimulus packages which include emphasis on infrastructure, technical training, business incubation and international trade. These priorities are similar to the technology-led policies that are increasingly being pursued by developing countries. In effect, economic growth policies in industrialized and developing countries are converging around the idea of science and innovation. This book will therefore provide guideposts for international cooperation in the application of science and innovation and help support ongoing efforts to incorporate science and innovation in the activities of international development programmes.[3]

The book will play a key role in helping the development community relate their work more closely to the pioneering concepts laid out by Robert Solow and others 50 years ago. It is only by doing so that the community can bring reasoned practicality to their otherwise worthy efforts. *Science and Innovation for Development* is the most important book on development since Fritz Schumacher's 1973 classic book, *Small is Beautiful*. It will silence the critics of the role of technology in development and embolden its champions.

1 Solow, R., (1957) "Technical Change and the Aggregate Production Function," *The Review of Economics and Statistics*, **39**, 3, 312-320.

2 Juma, C., (2006) *Redesigning African Economies: The Role of Engineering in International Development*. Hinton Lecture, Royal Academy of Engineering, London.

3 House of Commons Science and Technology Committee. (2004) *The Use of Science in UK International Development Policy*, Vol. 1, Stationery Office Limited, London; National Research Council. (2006). *The Fundamental Role of Science and Technology in International Development: An Imperative for the US Agency for International Development*, National Academies Press, Washington, DC.

## About the authors

**Professor Sir Gordon Conway**

Gordon Conway is Professor of International Development at Imperial College. He trained in agricultural ecology, attending the universities of Bangor, Cambridge, West Indies (Trinidad) and California (Davis).

In the 1960's he was a pioneer of sustainable agriculture, developing integrated pest management programmes for the State of Sabah in Malaysia. He joined Imperial College in 1970 setting up the Centre for Environmental Technology in 1976. In the 1970s and 1980s he lived and worked extensively in Asia and the Middle East, for the Ford Foundation, the World Bank and USAID. He directed the Sustainable Agriculture Programme at IIED and then became representative of the Ford Foundation in New Delhi. Subsequently he became Vice-Chancellor of the University of Sussex and Chair of the Institute of Development Studies.

From 1998-2004 he was President of the Rockefeller Foundation and from 2004-2009 Chief Scientific Adviser to DFID and President of the Royal Geographical Society. Between 2006 and 2009 he was Chairman of the UK Collaborative on Development Sciences (UKCDS) and is now currently heading the Gates funded project 'Africa and Europe: Partnerships in Food and Farming.'

He is a KCMG, Deputy Lieutenant of East Sussex, Hon Fell RAEng and FRS. He holds five honorary degrees and fellowships. He is the author of *'The Doubly Green Revolution: Food for all in the 21st Century'*, published by Penguin and Cornell.

**Professor Jeff Waage**

Jeff Waage is the Director of the London International Development Centre (LIDC), a Professor at the School of Oriental and African Studies (SOAS), University of London and a Visiting Professor at Imperial College London, the London School of Hygiene and Tropical Medicine (LSHTM) and the Royal Veterinary College (RVC).

He trained in entomology, and taught ecology at Imperial College London before joining CABI in 1986 where he headed the International Institute of Biological Control and later CABI Bioscience. At Imperial and CABI he contributed to ecological theory in integrated pest management, helped the spread of farmer field schools in Asia and Africa, and led the successful development of a biological pesticide for the desert locust.

He has been President of the International Organisation of Biological Control and Chair of the Global Invasive Species Programme. Jeff returned as Director of Imperial College at Wye in 2001, contributing to UK agricultural research through advisory roles with BBSRC and Defra, and joined

LIDC as its first Director in 2007. Today his passion is stimulating inter-disciplinary and inter-sectoral research to address complex development issues, including the integration of health and agricultural research sectors.

**Sara Delaney**

Sara Delaney joined Imperial College in July 2009 to work on the Gates Foundation funded project 'Africa and Europe: Partnerships in Food and Farming.' She studied biological and environmental engineering at Cornell University and 'Science, Society and Development' at the Institute of Development Studies (IDS).

From 2005-2007 she served as a US Peace Corps volunteer in Mali working in the water and sanitation sector. Since leaving IDS she has worked for the London International Development Centre (LIDC) and the UK Collaborative on Development Sciences (UKCDS).

## About the publisher

UK Collaborative on Development Sciences (UKCDS) and its members work together to maximise the impact of UK research funding on international development outcomes. It prioritises facilitation and networking activities that lead to better coordination of development relevant research and encourages UK funders to reflect good practice in development in their research policies and practices. UKCDS is committed to ensuring that the UK is a global leader in development sciences and their impact.

UKCDS members are currently:

**Research Councils UK**

Biotechnology and Biological Sciences Research Council (BBSRC)

Economic and Social Research Council (ESRC)

Engineering and Physical Sciences Research Council (EPSRC)

Medical Research Council (MRC)

Natural Environment Research Council (NERC)

**Departments of State and Government**

Department for Business Innovation and Skills (BIS)

Department for Environment, Food and Rural Affairs (DEFRA)

Department for International Development (DFID)

Department of Energy and Climate Change (DECC)

Department of Health (DH)

The Scottish Government

**UK Charity**

Wellcome Trust

In partnership with the Bill & Melinda Gates Foundation

UKCDS
UK Collaborative on Development Sciences

**www.ukcds.org.uk**

## Preface and acknowledgments

We have written this book to help people understand how science can contribute to international development. People interested in international development often have very different views about the value of science. At one extreme, some see science and technology providing the principle means for reducing poverty, eliminating disease and improving well being. At another extreme, science is seen as part of an imposed, external regime, associated with industrial exploitation and suppression of indigenous knowledge.

Fluctuations over recent decades in perspectives on development create a similar diversity of roles for science. When development theory and practice have focused on generating economic growth, as in the days of the Washington Consensus, we have seen support for programmes that extend technological advances to poor countries which would make a workforce more efficient, raise GDP and improve incomes. When, instead, theory and practice swing towards the view that development is being prevented largely by social and political forces, e.g. education, social exclusion, poor governance and corruption, we see the agronomists, engineers and health specialists vacate their development advisor's offices, to be replaced by social scientists. Development policy makers seem to listen to social scientists or natural scientists, but rarely both.

Today the issue of the role of science could not be more alive, as we sit between cycles of development thinking. Having pursued a welfare-oriented agenda in the Millennium Development Goals (MDGs), we now face a global economic crisis which is focusing attention again on economic growth. Foundations, businesses and civil society organisations are becoming more important development players, and we are seeing them take very different views on the role of science. One needs only to look at recent dialogue on genetically modified (GM) crops to see how polarized communities have become, in both rich and poor countries, about the value of science and innovation in a development context.

We hope that this book will give anyone who is interested in international development a clearer picture of the role that science and innovation can play. We firmly believe that science is only one of many factors which can contribute to development, but we want that factor to be well understood, particularly as science is often presented in a way which is not easily accessible to the non-specialist. We have used the MDGs as a framework for our exploration, because they address a wide range of development issues where science is particularly active: agriculture, health, and the environment.

This book would not have been possible without the help and support of a large number of individuals and organisations. In particular, we would like to thank staff at DFID, UKCDS and LIDC who helped with gathering material and administering the project; Steve Hillier, Mandy Cook, Angela May, Kate O'Shea, Charlie McLaren and Guy Collender. Special thanks to Andrée Carter for providing the persistent leadership to make sure we did indeed deliver a book in the end! In addition, we would like to acknowledge the work of Rebecca Pankhurst and Hayaatun Sillem, who assisted with earlier versions of the manuscript. The text of this book was reviewed and enriched by a number of busy colleagues to whom we are most grateful, including John Mumford, Paul van Gardingen, Steve Hillier, Camilla Toulmin, Peter Piot, Chris Whitty, Jonathan Wadsworth, Tim Wheeler, Hayaatun Sillemand and Calestous Juma. Finally, we are grateful to Moira Hart of Dewpoint Marketing for her tireless and skilful management of editing and logistics, and to the team at m360° Ltd for their patience, hard work and brilliant, colourful presentation of the material.

A very large number of people contributed resources to this book, checking our stories and correcting our facts and figures. Thank you, your time helped to make our examples as up-to-date and as detailed as possible. Any errors or omissions are however the responsibility of the authors alone.

As we ranged across agriculture, health and environment, we found ourselves constantly making use of SciDev.net. They are an extraordinarily valuable and authoritative resource for development science, and we would like to thank them for being there. Finally, we thank DFID for providing funding for much of this book's production.

**Gordon Conway, Jeff Waage and Sara Delaney**