UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

UNCTAD

# THE ROLE OF SCIENCE, TECHNOLOGY AND INNOVATION IN ENSURING FOOD SECURITY BY 2030





UNITED NATIONS

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

UNCTAD

# THE ROLE OF SCIENCE, TECHNOLOGY AND INNOVATION IN ENSURING FOOD SECURITY BY 2030





UNITED NATIONS New York and Geneva, 2017

#### 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 UNCTAD work programme is based on the mandates set at quadrennial conferences, as well as on the decisions of the General Assembly of the United Nations and the United Nations Economic and Social Council that draw upon the recommendations of the United Nations Commission on Science and Technology for Development (CSTD), which is served by the UNCTAD secretariat. The UNCTAD 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. In addition, the designations of country groups are intended solely for statistical or analytical convenience and do not necessarily express a judgment about the stage of development reached by a particular country or area. Mention of firms, organizations or policies does not imply endorsement by the United Nations.

The designations employed and the presentation of the material do not imply the expression of any opinion on the part of the United Nations concerning the legal status of any country, territory, city or area, or of authorities or concerning the delimitation of its frontiers or boundaries.

Material in this publication may be freely quoted or reprinted, but acknowledgement is requested, together with a copy of the publication containing the quotation or reprint to be sent to the UNCTAD secretariat.

This publication has not been formally edited.

Reference to dollars (\$) means United States dollars.

UNCTAD/DTL/STICT/2017/5 Copyright © United Nations, 2017

#### ACKNOWLEDGEMENTS

Under the overall direction of Shamika N. Sirimanne, Director of the Division on Technology and Logistics of UNCTAD, this study was prepared by Bob Bell (UNCTAD); and Ulrich Hoffmann, Bernadette Oehen, Adrian Muller and Lin Bautze (Research Institute of Organic Agriculture).

UNCTAD appreciates valuable inputs provided by the Governments of Austria, Brazil, Bulgaria, Canada, Chile, China, Costa Rica, Cuba, the Islamic Republic of Iran, the Netherlands, Nigeria, Pakistan, Peru, Portugal, Sri Lanka, Switzerland, Thailand, Turkey, Uganda, the United Kingdom of Great Britain and Northern Ireland and the United States of America; as well as from the following organizations and agencies: Chinese Academy of Science Institute of Remote Sensing and Digital Earth, Global Open Data for Agriculture and Nutrition (GODAN), International Telecommunication Union (ITU), N2Africa (Wageningen University), United Nations Economic, Scientific and Cultural Organization, United Nations Framework Convention on Climate Change and United Nations Major Group for Children and Youth. Other contributors include Olivia Yambi (International Panel of Experts on Sustainable Food Systems), David Souter (ICT Development Associates) and Elenita (Neth) Daño (ETC Group).

Comments and feedback were provided at various stages of preparation by Katalin Bokor, Claudia Contreras, Angel Gonzalez-Sanz, Marta Perez Cuso and Dong Wu (UNCTAD).

UNCTAD wishes to acknowledge comments and suggestions provided by Sununtar Setboonsarng (Asian Development Bank) and Nadia Scialabba (FAO). The publication benefited significantly from discussions and inputs during the Inter-sessional Panel of the CSTD held in January 2017 in Geneva.

Nadège Hadjémian designed the cover. Stephanie Kermoal provided administrative support.

### ACRONYMS

CFS	Committee on World Food Security			
GHG	greenhouse gas			
HLPE	High-level Panel of Experts on Food Security and Nutrition			
ICT	information and communications technology			
IFAD	International Fund for Agricultural Development			
IP	innovation platform			
IPES	International Panel of Experts on Sustainable Food Systems			
NGO	Non-governmental organization			
STI	science, technology and innovation			
UNCTAD	United Nations Conference on Trade and Development			
UNDP	United Nations Development Programme			
UNESCO	United Nations Educational, Scientific and Cultural Organization			
WFP	World Food Programme			
WRI	World Resources Institute			

### **TABLE OF CONTENTS**

NO	TE		ii
AC	KNOWL	EDGEMENTS	iii
ΙΝΤ	RODUC		viii
Cha	apter 1.	The challenge of food security	4
1.1	Wha	at is food security?	4
1.2	The	geography of food insecurity	4
1.3	The	importance of smallholder farmers in food security	4
1.4	Wha	at are the challenges of food security?	6
	1.4.1	Agriculture, economic development, and international trade	6
	1.4.2	Environmental change and agriculture	7
1.5	Mill	ennium Development Goals to halve hunger	7
1.6	Sus	tainable Development Goals to achieve zero hunger	8
1.7	Cor	nclusion	8
Cha	apter 2.	Science and technology for food security	9
2.1	Foo	d availability: Science and technology to improve agricultural productivity	11
	2.1.1	Conventional cross-breeding for improved plant varieties and increased crop yields	11
	2.1.2	Improving agricultural productivity through transgenic crops	12
	2.1.3	Soil management for increasing agricultural yields	13
	2.1.4	Irrigation technologies: Technologies that make water available for food production	14
2.2	Foo	d access: Technologies for food accessibility	16
2.3	Foo	d use and utilization: Science for nutrition	18
2.4	Foo	d stability: New ways to combat acute and chronic food insecurity	18
	2.4.1	Adapting food production to climate change	19
	2.4.2	Using big data and the Internet of things for precision agriculture	19
	2.4.3	Early warning systems	20
2.5	Cor	nvergence of new and emerging technologies	21
2.6	Cor	nclusion	25
Cha	apter 3.	Developing innovative food systems	25
3.1	Pro	moting a smallholder farmer-focused research agenda	26
3.2	2 Enabling infrastructure for food systems		28
3.3	Gov	verning agricultural innovation and policy coherence	29
3.4	Fac hun	ilitating farmer–scientist knowledge flows: Strengthening agricultural extension and nan capacity	29

000000

#### <sup>vi</sup> The role of science, technology and innovation in ensuring food security by 2030

	3.4.1	Participatory cooperative research among farmers and scientists	29
	3.4.2	Information and communications technologies for extension services	30
	3.4.3	Sharing plant genetic resources	30
3.5	Ma	king innovative food systems gender-sensitive	31
Cha	pter 4	Policy considerations	31
4.1	Inc	rease investments in agricultural R&D at the global and national levels	31
4.2	Pro	mote sustainable food systems	32
4.3	Enc sec	courage development of science, technology, and innovation applications on key food surity challenges	32
4.4	Sup	port policy coherence for food security	33
4.5	Imp	prove extension services and the farmer-scientist interface	33
4.6	Imp	prove access to agricultural technologies and data for smallholder farmers	34
4.7	Bui	ld human capacity for agricultural innovation	34
4.8	Col foo	laborate with international partners to harness science, technology, and innovation for discurrity	34
4.9	Stre	engthen the enabling environment for agriculture and food security	35
Арр	endix		36
Refe	erence	S	42

#### **LIST OF FIGURES**

Figure 1.	Projected number and proportion of undernourished people in developing regions from 1990/1992–2014/2016	5
Figure 2.	Undernourishment trends: Progress made in almost all regions, but at very different rates	8
Figure 3.	Global water scarcity	15
Figure 4.	Agricultural losses in sub-Saharan Africa across the value chain for different types of crops	16
Figure 5.	Example: Application of the Internet of things, robotics, and artificial intelligence to farming	23
Figure 6.	Agricultural innovation system	25

### **LIST OF BOXES**

Bulgaria's Institute of Plant Physiology and Genetics	12
Information and communications technologies for improved soil quality in Bangladesh	14
Purchase for Progress and scaling up nutrition in Guatemala	18
Big data for sustainable food production in Colombia	19
Crop Watch: Cloud-based global crop monitoring system	20
The potential of synthetic biology: CRISPR/Cas9	21
	Bulgaria's Institute of Plant Physiology and Genetics Information and communications technologies for improved soil quality in Bangladesh Purchase for Progress and scaling up nutrition in Guatemala Big data for sustainable food production in Colombia Crop Watch: Cloud-based global crop monitoring system The potential of synthetic biology: CRISPR/Cas9

#### 000000

Box 7.	The need for an international technology assessment and foresight mechanism	24
Box 8.	Bulgaria's Agricultural Academy	26
Box 9.	A new CGIAR strategy and results framework for 2016-2030	27
Box 10.	Employing ICTs to build farmer communities in the United Republic of Tanzania	28
Box 11.	Improving cotton-farming systems in Western Africa through participatory research	29
Box 12.	Portuguese information system for plant genetic resources	31

#### **LIST OF TABLES**

Table 1.	Examples of science,	technology, and innovatio	on for food security	ç
	1 ,	0,7,	, , , , , , , , , , , , , , , , , , ,	

#### **APPENDIX**

Glossary	у	41
Table 2	Sustainable Development Goal targets related to Goal 2: End hunger with a relation to science, technology and innovation	40
Table 1	Relationship between the four dimensions of food security and the Sustainable Development Goals	39
Box 2	Sustainable Development Goals and food security	37
Box 1	The four dimensions of food security	36

## 预览已结束,完整报告链接和二

https://www.yunbaogao.cn/report/index/report?rep