FOOD POLICY INDICATORS: TRACKING CHANGE

DECISIONMAKERS AND POLICY ANALYSTS NEED SOLID EVIDENCE and timely information to develop and implement effective food policies. The International Food Policy Research Institute (IFPRI) develops and shares global public goods—including datasets, indicators, and indexes—as part of its mission to provide research-based policy solutions that sustainably reduce poverty and end hunger and malnutrition. This information can be used to gauge the impact of policy changes and the progress made on specific aspects of development.

This section provides updates on data generated by IFPRI research. Indicators include investments in agricultural research, public spending on agriculture, capacity for food policy research, agricultural total factor productivity, and projections for agricultural production, food consumption, and risk of hunger to 2030 and 2050. All indicators are available online with an interactive display of the data.

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Agricultural Science and Technology Indicators (ASTI)

Policymakers recognize that increased investment in agricultural research is key to increasing agricultural productivity. Despite this, many low- and middle-income countries struggle with capacity and funding constraints in their agricultural research systems.

Agricultural Science and Technology Indicators (ASTI), facilitated by the International Food Policy Research Institute (IFPRI) within the portfolio of the CGIAR Research Program on Policies, Institutions, and Markets, works with national, regional, and international partners to collect time series data on the funding, human resource capacity, and outputs of agricultural research in low- and middle-income countries. Based on this information, ASTI produces analysis, capacity-building tools, and outreach products to help facilitate policies for effective and efficient agricultural research.

TRENDS IN CAPACITY AND INVESTMENT

Global investment in agricultural research, once heavily weighted toward the developed world, has shifted dramatically in recent years toward the developing world. Whereas spending growth in high-income countries as a group has stalled since the turn of the millennium, the developing world has accelerated its agricultural research investments at a rapid pace, driven by high growth rates in China and India.

Agricultural research spending and capacity in Latin America and the Caribbean and in Asia have grown rapidly since 2000, but considerable differences remain across countries. Brazil's world-class research infrastructure and outputs contrast sharply with the lagging infrastructure, investment levels, and capacity in many Central American and Caribbean island nations. China accounts for most of the agricultural research spending growth in Asia, with India close behind. But underinvestment in countries such as Cambodia, Lao PDR, and Pakistan impedes their ability to respond to the threats to food security associated with widespread poverty, rapid population growth, climate change, and environmental degradation.

Although agricultural research spending and human resource capacity in Africa south of the Sahara have grown considerably, this growth has been uneven and trends are driven by large countries such as Ethiopia, Nigeria, and South Africa. Furthermore, many countries are overly dependent on volatile and unsustainable donor funds. The region is dealing with serious challenges on the human capacity side: long-term recruitment restrictions have left many research agencies with aging pools of researchers.

Female scientists remain severely underrepresented in agricultural research, despite their being in a unique position to address the pressing challenges of African farmers, the majority of whom are women. ASTI's Women in African Agricultural Research Data Portal—developed in partnership with African Women for Agricultural Research and Development (AWARD) and released in 2017—features detailed sex-disaggregated data on human resources in agricultural research, as well as graphic tools for country comparisons and analysis that allow researchers and policymakers to set priorities, establish benchmarks, and monitor progress over time. These data are currently for African countries, with plans to expand to other ASTI countries in the future. Such information is needed to understand the underlying obstacles facing female agricultural researchers, and how to overcome them.

The West Asia and North Africa region has made valuable progress in agricultural research investment since the 2008 global food crisis, but inadequate systems, funding, and human resource capacity—coupled with a lack of political stability—hamper food security. Many national agricultural research institutes need to improve pay, working conditions, and incentives to compete with universities and attract, retain, and motivate well-qualified researchers.

In all regions, the imminent retirement of highly experienced agricultural researchers without adequate plans for their replacement creates concern about the quality of future research outputs.

INDICATORS

“Agricultural research” includes government, higher education, and nonprofit agencies, but excludes the private for-profit sector. Total agricultural research spending includes salaries, operating and program costs, and capital investments for all agencies, excluding the private for-profit sector, involved in agricultural research in a country. Expenditures are adjusted for inflation and expressed in 2011 prices. Purchasing power parities (PPPs) measure the relative purchasing power of currencies across countries by eliminating national differences in pricing levels for a wide range of goods. PPPs are relatively stable over time, whereas exchange rates fluctuate considerably. In addition to looking at absolute levels of agricultural research investment and capacity, another way of comparing commitment to agricultural research is to measure research intensity—that is, total agricultural research spending as a percentage of agricultural output (AgGDP).

“Total agricultural researchers” (excluding the private for-profit sector) are reported in full-time equivalents (FTEs) to account for the proportion of time researchers actually spend on research activities. A critical mass of qualified agricultural researchers is crucial for implementing a viable research agenda, for effectively communicating with stakeholders, and for securing external funding. Therefore, it is important to look at the share of PhD-qualified researchers. Gender balance in agricultural research is important, given that women researchers offer different insights and perspectives that can help research agencies more effectively

address the unique and pressing challenges of female farmers. Age imbalances among research staff should be minimized to ensure the continuity of future research as researchers retire.

MORE INFORMATION

Only a fraction of the available ASTI indicators are presented here. The ASTI website offers additional indicators, including national-level time series data on researcher capacity by qualification level, age bracket, discipline mix, and commodity, as well as a detailed breakdown of agricultural research investment. Interactive pages on the ASTI website allow users to access country-level time series data, make cross-country comparisons, create graphs, and download country datasets. The country pages also feature recent ASTI factsheets, other country-level publications, and detailed institutional information on agencies involved in agricultural research. ASTI's regional interactive benchmarking tools are convenient map-based instruments that allow users to make cross-country comparisons and rankings based on a wide set of financial and human resource indicators. The detailed ASTI datasets are available in an easy-to-use data download tool. Detailed information on definitions, methodology, and calculation procedures are available on ASTI's website.

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TABLE 1 Agricultural science and technology indicators

Countries by region	Year	Agricultural research spending			Agricultural researchers (FTEs)				
		2011 PPP dollars (million)	2011 US dollars (million)	As share of AgGDP (%)	Total	Government (%)	Female (%)	PhD-qualified (%)	Older than 50 (%)
AFRICA SOUTH OF THE SAHARA									
Benin	2016	30.5	13.8	0.60	201.5	39.2	16.8	62.1	32.7
Botswana	2016	17.5	9.6	2.27	116.0	59.0	29.1	30.3	23.5
Burkina Faso	2014	48.5	21.9	1.01	310.8	88.6	19.3 ^a	52.5	39.1
Burundi	2016	10.9	3.7	0.39	134.0	63.4	15.2	18.7	23.8
Cabo Verde	2016	3.3	2.0	1.17	24.7	89.1	37.2	13.4	72.9
Cameroon	2014	45.9	22.1	0.34	240.1	80.7	20.9	40.8	34.0
Central African Rep.	2016	4.9	2.6	0.40	123.1	64.7	16.0	9.7	25.7
Chad	2016	5.9	3.2	0.05	89.1	79.3	4.3	18.4	22.4
Congo, Dem. Rep.	2016	27.7	15.7	0.24	553.0	64.3	10.7	16.4	26.6
Congo, Rep.	2016	6.3	3.9	0.26	79.2	63.8	18.3	37.9	35.4
Côte d'Ivoire	2014	82.1	39.7	0.53	253.2	62.1	16.9	71.3	36.3
Eritrea	2011	2.9	1.1	0.30	40.8	5.9	7.1	28.4	22.5
eSwatini	2016	6.7	3.6	0.70	26.2	39.7	27.9	38.2	34.7
Ethiopia	2016	162.1	47.2	0.29	3,024.6	88.4	10.5	7.8	6.7
Gabon	2016	1.6	1.1	0.10	65.0	73.7	21.4	25.2	29.4
Gambia	2016	4.8	1.6	0.88	58.8	84.4	13.4	11.5	21.2
Ghana	2016	178.6	82.6	0.91	598.9	66.9	21.3	44.8	36.2
Guinea	2016	3.9	1.5	0.17	262.4	85.2	8.1	14.7	57.8
Guinea-Bissau	2011	0.2	0.1	0.02	9.0	100.0	-	-	66.7
Kenya	2016	222.4	85.9	0.48	1,156.2	69.5	29.8	39.6	45.8
Lesotho	2016	2.8	1.5	0.94	33.2	81.3	54.2	13.9	15.1
Liberia	2011	6.7	3.5	0.51	45.1	71.0	20.4	10.6	24.6
Madagascar	2016	10.4	3.4	0.14	214.3	72.4	36.7	44.9	56.2
Malawi	2014	28.1	13.7	0.53	158.3	55.5	20.5	32.8	na
Mali	2016	57.8	25.7	0.44	295.6	85.2	14.5	39.1	60.5
Mauritania	2016	18.5	7.6	0.49	102.0	85.7	17.4	20.0	3.5
Mauritius	2016	37.3	20.7	4.82	141.8	70.7	42.0	15.2	43.9
Mozambique	2016	31.8	17.5	0.43	386.1	76.1	37.0	13.0	18.5
Namibia	2014	38.8	24.9	3.09	99.7	70.0	44.0	13.8	22.2
Niger	2016	22.2	10.4	0.32	199.9	77.5	14.9	39.1	33.6
Nigeria	2014	433.5	209.5	0.22	2,975.5	na	29.4 ^b	23.7 ^b	21.7 ^b
Rwanda	2016	27.3	11.8	0.44	148.9	63.1	23.7	24.1	14.6
Senegal	2016	51.5	25.8	0.89	144.7	71.5	22.7 ^a	76.5 ^a	38.2 ^a
Sierra Leone	2014	15.3	5.5	0.24	123.7	88.1	20.2 ^b	13.7	24.8 ^b
South Africa	2014	417.4	274.4	2.78	811.3	76.5	na	na	na
Tanzania, United Rep.	2016	68.5	23.0	0.17	785.0	69.8	29.4	26.9	32.0
Togo	2016	8.7	3.9	0.20	109.6	69.8	6.8	35.5	36.8
Uganda	2016	99.4	32.8	0.62	558.7	60.4	29.9	35.5	19.6
Zambia	2014	26.9	13.2	0.51	245.6	76.7	28.5 ^a	14.1	18.1
Zimbabwe	2014	43.4	21.9	1.44	208.7	57.5	31.0	17.6	15.8

Table 1 continued

Countries by region	Year	Agricultural research spending			Agricultural researchers (FTEs)				
		2011 PPP dollars (million)	2011 US dollars (million)	As share of AgGDP (%)	Total	Government (%)	Female (%)	PhD-qualified (%)	Older than 50 (%)
ASIA									
Bangladesh	2012	250.6	78.2	0.37	2,121.0	78.0	12.4	35.3	28.8
Cambodia	2010	22.4	7.4	0.18	284.4	55.1	21.9	5.9	4.0
China	2013	9,366.2	5,081.5	0.62	na	na	na	na	na
India	2014	3,298.4	1,067.8	0.30	12,746.6	38.7	18.3	73.2	32.8
Lao PDR	2010	na	na	na	227.2	84.1	na	6.5	21.8
Malaysia	2010	592.3	282.5	0.99	1,609.4	84.1	49.2	24.9	29.3
Nepal	2012	53.4	17.8	0.28	403.4	85.8	12.5	14.8	43.0
Pakistan	2012	332.5	93.7	0.18	3,678.3	85.5	10.8	20.7	27.6
Sri Lanka	2009	61.8	21.6	0.34	618.8	88.5	46.9	24.2	na
Viet Nam	2010	136.0	44.5	0.18	3,744.2	74.4	na	17.8	na
LATIN AMERICA AND THE CARIBBEAN									
Antigua and Barbuda	2012	1.0	0.7	2.98	7.5	93.3	27.2	31.6	47.4
Argentina	2013	732.1	474.7	1.29	5,824.5	50.2	45.2	20.8	38.7
Barbados	2012	1.3	1.3	2.01	9.9	70.7	na	na	na
Belize	2012	2.3	1.3	0.66	12.6	35.7	23.0	1.6	23.3
Bolivia	2013	58.9	25.0	0.93	190.3	28.0	17.7	11.0	33.3
Brazil	2013	2,704.0	2,377.9	1.82	5,869.4	71.3	37.1	72.5	44.4
Chile	2013	186.4	134.1	1.65	715.7	66.7	33.3	36.8	29.2
Colombia	2013	253.7	159.5	0.79	1,102.9	40.3	36.1	22.5	25.5
Costa Rica	2012	37.1	25.5	1.06	241.5	25.9	34.3	14.0	53.1
Dominica	2012	0.2	0.1	0.18	3.0	-	33.3	33.3	66.7
Dominican Rep.	2012	20.3	10.3	0.30	199.6	75.5	24.2	10.3	44.5
Ecuador	2013	27.3	14.4	0.18	149.4	72.6	17.3 ^a	9.6	23.4 ^a
El Salvador	2006	6.6	0.4	0.15	76.9	78.0	na	na	na
Grenada	2012	0.4	0.3	0.71	1.8	83.3	na	na	na
Guatemala	2012	15.6	7.3	0.14	141.8	54.3	20.0	9.6	41.5
Honduras	2012	7.5	3.9	0.17	87.6	24.3	13.6	5.7	34.1
Jamaica	2012	11.8	7.4	0.89	62.1	66.2	47.2	21.6	na
Mexico	2013	710.4	438.8	1.05	3,967.4	38.7	25.3	47.5	54.8
Nicaragua	2012	17.5	7.0	0.38	131.5	60.9	29.7	8.8	35.8
Panama	2012	15.5	8.5	0.74	133.0	87.8	17.7	7.5	56.1
Paraguay	2013	26.8	14.2	0.26	209.5	57.8	37.2	5.4	28.1 ^b
Peru	2013	83.4	46.1	0.35	339.1	34.3	27.2	13.1	52.9
St. Kitts and Nevis	2012	0.8	0.5	5.13	4.5	2.2	82.2	4.4	41.1
St. Lucia	2012	0.3	0.2	0.63	2.2	-	9.1	-	50.0
St. Vincent and the Gren.	2012	0.7	0.5	1.07	2.5	80.0	na	na	na
Trinidad and Tobago	2012	18.0	11.0	7.82	83.0	58.1	43.3	22.7	25.7 ^b
Uruguay	2013	77.4	61.3	1.40	371.9	50.9	40.5	26.1	36.3
Venezuela	2013	86.2	54.5	0.31	503.1	83.1	48.2	16.3	39.9

Table 1 continued

Countries by region	Year	Agricultural research spending			Agricultural researchers (FTEs)				
		2011 PPP dollars (million)	2011 US dollars (million)	As share of AgGDP (%)	Total	Government (%)	Female (%)	PhD-qualified (%)	Older than 50 (%)
WEST ASIA AND NORTH AFRICA									
Algeria	2012	91.6	38.3	0.21	593.4	69.8	51.3	23.0	37.5 ^b
Egypt	2012	528.4	144.7	0.44	8,419.7	86.1	36.3	67.6	na
Jordan	2012	36.2	15.0	1.84	272.3	72.5	18.3	35.5	39.7
Lebanon	2012	38.2	21.3	0.95	209.2	58.4	48.2	44.6	13.0
Morocco	2012	147.3	442.3	0.49	556.3	72.4	23.3	40.0	39.0
Oman	2012	110.0	2.6	6.51	243.6	91.5	31.1	25.5	10.1
Sudan	2012	57.3	26.3	0.14	932.8	72.9	na	36.9	20.3 ^b
Tunisia	2012	63.0	97.1	0.64	541.6	80.0	32.7	61.8	38.3
Turkey	2012	537.3	376.7	0.51	3,009.4	60.4	32.5	41.6	11.1
Yemen	2012	38.7	13.7	0.56	526.7	78.7	7.1	28.7	27.0

Notes: na = not available. PPP = purchasing power parity. AgGDP = agricultural gross domestic product. (-) = zero. FTE = full-time equivalent.

Table only includes countries where ASTI has conducted survey rounds since 2002 (with the exception of China, for which data is based on official Science and Technology statistics). Agricultural research includes government, higher education, and nonprofit agencies, but excludes the private for-profit sector.

a = data exclude the nonprofit sector. b = data exclude the higher education sector.

Statistics on Public Expenditures for Economic Development (SPEED)

The Statistics on Public Expenditures for Economic Development (SPEED) database is a resource of the International Food Policy Research Institute (IFPRI) that contains information on agricultural and other sectoral public expenditures in 147 countries from 1980 to 2016.

Policymakers, researchers, and other stakeholders can use this robust database to examine both historical trends and the allocation of government resources across sectors. It also allows for comparisons among countries within a region or at a similar level of development. Because the SPEED database covers many countries for a long time period, it allows analysts of government spending to examine national policy priorities, as reflected in the allocation of public expenditures, and track development goals and the cost-effectiveness of public spending both within and across countries. In addition to the dataset in the form of spreadsheets, SPEED includes user-friendly tools that enable stakeholders to generate charts and geographic expenditure maps using menu-driven options.

Indicators reported include total agricultural expenditure, agricultural spending per capita, and the ratio of agricultural spending to agricultural gross domestic product (GDP) for the period 1980 to 2016. IFPRI researchers have compiled data from multiple sources, including the International Monetary Fund, World

Bank, United Nations, and national governments, and conducted extensive data checks and adjustments to ensure consistent spending measurements over time that are free of exchange-rate fluctuations and currency denomination changes.

Agricultural spending in recent years has been highest in East Asia and the Pacific, largely driven by rapid growth in agricultural spending in China since 2005, as reflected by three key indicators of government expenditures: per capita agricultural spending, agricultural spending as a share of agricultural GDP, and agricultural spending as a share of total spending (Table 2). The Middle East and North Africa as well as Europe and Central Asia regions have spent large amounts on agriculture both per capita and as a share of agricultural GDP, but not as a share of total spending. Among developing countries, agricultural spending per capita and as a share of agricultural GDP in 2016 was lowest in Africa south of the Sahara; as a share of total spending, agricultural spending was lowest in Latin America and the Caribbean.

DOWNLOAD DATA

<https://doi.org/10.7910/DVN/F7IOM2>

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TABLE 2 Agricultural public expenditure for economic development, by country

Region/country	Agricultural expenditure (billions 2011 constant US dollars)			Agricultural expenditure (billions 2011 PPP dollars)			Per capita agricultural expenditure (2011 constant US dollars)			Per capita agricultural expenditure (2011 PPP dollars)			Ratio of agricultural expenditure to agricultural GDP (%)			Share of agriculture in total expenditure (%)		
	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016
EAST ASIA AND THE PACIFIC	30.78	63.55	280.49	65.43	123.60	523.02	18.30	34.26	170.66	38.91	66.64	318.22	6.44	9.20	26.02	8.11	6.08	9.28
China	15.71	52.92	269.25	28.96	97.54	496.28	13.04	40.59	195.30	24.03	74.82	359.97	4.79	11.24	29.18	8.43	7.22	9.90
Fiji ^c	0.03	0.03	0.01	0.06	0.05	0.02	42.32	38.49	15.24	72.81	66.21	26.22	6.74	7.45	3.31	4.01	3.26	1.24
Indonesia ^a	6.74	2.83	5.32	16.39	6.89	12.94	34.22	12.50	20.61	83.21	30.41	50.12	8.07	3.40	3.57	9.43	2.53	2.71
Malaysia	1.60	1.88	1.33	3.36	3.95	2.79	78.09	73.37	42.65	163.75	153.86	89.44	8.66	10.02	4.04	5.10	3.83	2.04
Mongolia	0.02	0.03	0.05	0.04	0.07	0.12	7.87	12.26	16.55	18.53	28.89	38.99	1.34	2.41	2.93	2.12	1.90	0.90
Myanmar	0.28	0.36	1.40	0.64	0.84	3.24	6.39	7.46	26.45	14.82	17.27	61.29		1.63	4.54	14.90	9.25	5.37
Papua New Guinea	0.13	0.08		0.17	0.11		27.27	13.19		34.77	16.82		3.26			3.97	1.63	
Philippines	1.41	0.78	2.31	3.42	1.88	5.61	20.20	9.00	22.38	49.00	21.83	54.29	5.72	3.61	7.76	6.90	2.66	4.30
Singapore	0.04	0.06	0.17	0.06	0.08	0.24	11.76	13.26	30.34	16.59	18.70	42.81	25.51	54.79	173.10	0.24	0.21	0.29
Thailand	4.01	3.00	5.98	9.88	7.40	14.74	67.38	45.87	86.83	166.08	113.07	214.03	19.50	10.67	15.97	11.30	5.42	6.46
Tonga ^b	0.00	0.01	0.01	0.00	0.01	0.01	8.63	66.41	52.55	10.27	79.05	62.54	1.12	8.97	7.29	0.80	3.42	3.13
Vanuatu	0.00	0.00		0.00	0.00		26.27	22.15		23.38	19.72		5.45	3.39		3.13	4.51	
Viet Nam ^d	0.80	1.56	1.50	2.46	4.77	4.57	10.69	18.52	16.54	32.67	56.62	50.56	6.15	8.63	5.45	8.20	5.78	8.37
SOUTH ASIA	6.11	10.55	23.97	18.78	32.51	73.87	4.92	6.97	15.58	15.12	21.49	48.02	2.86	3.76	5.18	4.42	4.40	5.37
Afghanistan ^a		0.08	0.24		0.22	0.64		3.30	7.09		8.89	19.11		2.54	5.15		4.68	1.91
Bangladesh	0.37	0.44	1.14	1.18	1.42	3.67	3.11	3.09	7.02	9.97	9.89	22.50	2.54	2.76	4.83	4.93	4.96	5.74
Bhutan	0.04	0.04	0.10	0.11	0.10	0.27	76.64	53.58	121.05	212.20	148.35	335.17	23.75	14.69	24.58	19.69	10.97	11.80
India	4.94	9.30	21.22	15.25	28.72	65.53	5.14	8.13	16.02	15.88	25.10	49.49	3.15	4.43	4.99	5.26	4.98	5.26
Maldives	0.05	0.01		0.09	0.01		200.52	22.44		343.38	38.43		38.51	5.36		12.07	1.07	
Nepal	0.15	0.18	0.56	0.46	0.54	1.70	7.17	6.94	19.47	21.54	20.87	58.53	4.08	3.67	8.73	9.64	8.23	9.53
Pakistan ^b	0.12	0.08	0.95	0.43	0.29	3.38	0.99	0.53	5.14	3.51	1.88	18.24	0.45	0.23	1.68	0.46	0.28	1.90
Sri Lanka	0.44	0.42	0.95	1.26	1.21	2.71	24.18	21.73	44.62	69.17	62.16	127.63	6.68	8.12	14.90	5.28	4.04	5.65
EUROPE AND CENTRAL ASIA	1.85	12.88	13.62	5.17	24.80	25.21	9.41	50.90	56.76	26.23	98.04	105.04	2.94	12.15	10.65	0.54	1.90	1.42
Albania	0.07	0.06	0.12	0.16	0.14	0.28	22.33	20.45	41.98	51.36	47.04	96.57	2.16	3.26	4.27	3.95	2.14	2.95
Azerbaijan ^a	0.20	0.24	0.76	0.43	0.52	1.67	25.66	28.17	79.03	56.22	61.73	173.16	6.73	8.42	16.73	8.01	4.63	2.79
Belarus	0.42	1.90	1.46	1.10	5.01	3.85	41.00	196.77	154.00	107.96	518.10	405.49	12.56	54.24	35.06	5.96	9.51	5.97
Bulgaria	0.03	0.45	0.37	0.05	0.90	0.75	3.09	58.54	52.17	6.21	117.44	104.66	0.56	12.97	14.50	0.25	2.56	1.68
Georgia	0.00	0.04	0.12	0.00	0.09	0.23	0.24	10.40	31.96	0.47	20.42	62.76	0.04	2.82	8.75	0.50	1.81	2.27
Kazakhstan		0.97	1.86		1.78	3.41		64.24	104.68		117.49	191.44		11.53	17.92		3.67	4.07
Kyrgyzstan	0.03	0.04	0.04	0.08	0.10	0.10	6.41	7.76	6.33	16.65	20.17	16.44	2.41	2.99	3.87	3.54	4.50	1.35
Latvia ^a	0.21	0.83	0.20	0.21	0.84	0.20	83.08	372.06	98.86	83.54	374.10	99.40	12.76	56.07	11.85	2.83	6.25	1.17
Lithuania ^a	0.42	0.12	0.14	2.30	0.68	0.75	115.46	37.04	46.89	633.91	203.33	257.46	68.60	25.38	27.67	29.69	3.22	2.72
Moldova	0.02	0.10	0.08	0.05	0.22	0.17	6.07	28.88	23.17	12.87	61.26	49.15	1.69	11.29	8.18	1.38	4.98	2.77
Russian Federation	0.46	6.85	9.22	0.78	11.60	15.62	3.12	47.73	63.90	5.28	80.85	108.24	0.62	9.83	10.44	0.15	1.32	1.16
Serbia ^b			0.50			1.00			68.97			139.24			14.33			2.30
Ukraine		1.26	0.34		2.93	0.79		26.83	7.60		62.24	17.64		9.38	2.09		1.97	0.60
MIDDLE EAST AND NORTH AFRICA	8.28	16.48	11.60	20.43	36.97	20.17	29.82	49.88	122.18	73.58	111.89	212.35	5.91	10.77	16.48	2.44	3.27	2.68
Algeria	0.85	2.01		2.04	4.82		29.55	60.52		70.67	144.71		7.97	15.26		2.42	4.23	

Table 2 continued

Region/country	Agricultural expenditure (billions 2011 constant US dollars)			Agricultural expenditure (billions 2011 PPP dollars)			Per capita agricultural expenditure (2011 constant US dollars)			Per capita agricultural expenditure (2011 PPP dollars)			Ratio of agricultural expenditure to agricultural GDP (%)			Share of agriculture in total expenditure (%)		
	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016
Bahrain	0.02	0.02		0.04	0.03		34.98	21.37		62.41	38.13		16.86			0.54	0.41	
Egypt	1.62	1.74		5.93	6.37		25.50	22.73		93.09	82.99		9.42	7.42		4.39	3.33	
Iran	2.78	5.40		6.34	12.31		45.90	76.72		104.62	174.87		6.67	17.22		4.22	5.08	
Jordan	0.18	0.16	0.07	0.44	0.39	0.17	39.67	28.03	7.21	96.01	67.83	17.45	37.78	27.94	5.49	4.46	1.95	0.72
Kuwait ^a	0.24	0.27	0.51	0.39	0.43	0.81	149.34	118.51	128.74	239.64	190.16	206.58			56.09	0.59	0.66	0.51
Lebanon	0.03	0.02	0.05	0.05	0.04	0.10	9.24	6.15	8.91	16.61	11.05	16.01	1.97	2.53	3.50	0.40	0.31	0.42
Morocco	0.57	0.51		1.25	1.13		21.01	16.82		46.22	37.01		8.67	5.76		4.21	2.09	
Oman ^c	0.24	0.13	0.20	0.49	0.26	0.40	110.43	51.85	53.20	221.65	104.07	106.77	20.84	15.53	19.57	1.56	0.72	0.57
Qatar		0.37			0.56			432.73			651.25			445.08			1.89	
Syrian Arab Republic													9.03	8.37		10.24	6.06	
Tunisia ^d	0.63	0.57	0.74	1.49	1.36	1.76	68.97	56.42	67.97	163.96	134.13	161.59	23.53	16.62	17.09	8.17	5.22	4.16
Turkey	0.95	5.04	11.48	1.65	8.74	19.91	16.31	74.21	144.41	28.28	128.65	250.36	1.46	8.52	17.07	1.03	3.54	2.79
United Arab Emirates ^c	0.09	0.07	0.09	0.12	0.10	0.13	34.78	15.47	9.85	50.21	22.32	14.21	2.78	1.74	3.58	0.67	0.69	0.09
Yemen	0.07	0.15		0.20	0.42		4.52	7.25		12.76	20.44		1.77	4.67		1.68	1.43	
LATIN AMERICA AND THE CARIBBEAN	21.61	18.53	14.54	27.04	24.81	17.82	55.58	37.93	42.80	69.55	50.80	52.47	10.23	7.98	6.72	4.14	2.05	1.59
Argentina	0.31	0.33	0.60	0.48	0.51	0.93	8.87	8.51	13.68	13.68	13.12	21.10	1.84	1.06	1.79	0.58	0.58	0.41
Bahamas ^a	0.02	0.02	0.01	0.03	0.02	0.01	85.94	47.75	28.33	90.53	50.30	29.84	11.32	14.58	12.84	1.67	1.26	0.62
Barbados	0.03	0.03		0.03	0.03		121.67	105.27		120.65	104.39		28.30	41.57		2.80	2.17	
Belize	0.01			0.01			40.57			70.57			7.13			4.61		
Bolivia	0.01	0.07		0.01	0.15		0.83	7.16		1.95	16.87		0.32	3.05		0.35	1.39	
Brazil	16.40	10.93	11.72	18.65	12.43	13.33	101.03	58.48	56.45	114.88	66.50	64.20	20.70	11.62	9.33	5.70	2.55	1.86
Chile	0.26	0.56	1.08	0.36	0.78	1.50	18.20	34.54	60.25	25.30	48.00	83.74	3.35	6.82	9.20	1.18	1.52	1.57
Colombia ^a	0.47	0.35	0.79	0.75	0.56	1.25	12.57	8.15	16.31	20.00	12.97	25.94	1.69	1.81	3.31	1.77	0.32	0.90
Costa Rica	0.16	0.10	0.20	0.23	0.15	0.29	44.24	24.52	41.52	64.51	35.76	60.55	5.62	3.74	7.68	3.15	1.33	1.28
Dominican Republic	0.24	0.17	0.24	0.47	0.33	0.48	30.28	18.32	22.88	59.53	36.01	44.97	9.31	5.54	5.50	7.83	2.53	1.93
Ecuador ^c		0.25	0.32		0.47	0.61		17.97	20.44		34.16	38.85		4.19	4.15		1.95	1.40
El Salvador	0.04	0.05	0.05	0.07	0.10	0.09	6.64	8.47	7.29	13.20	16.84	14.50	2.13	4.60	3.40	1.69	1.15	0.80
Grenada	0.01			0.02			102.99			155.95			30.53			9.65		
Guatemala	0.07	0.17	0.11	0.14	0.35	0.23	6.31	12.62	6.38	13.54	27.10	13.69	1.00	3.49	1.86	2.72	3.15	1.54
Jamaica ^a	0.09	0.07	0.09	0.14	0.11	0.15	34.76	25.43	32.43	55.16	40.35	51.46	7.60	9.25	10.04	2.13	1.49	2.19
Mexico	3.24	4.77	5.70	5.25	7.73	9.22	34.45	44.00	48.56	55.78	71.24	78.62	9.64	14.67	15.55	3.36	2.58	2.32
Panama ^c	0.05	0.08	0.12	0.08	0.15	0.21	16.93	23.91	30.23	30.94	43.68	55.24	5.15	6.08	9.68	1.64	1.76	1.35
Paraguay																		
Peru		0.24	0.54		0.44	0.97		8.75	16.90		15.85	30.59		3.04	3.61		1.39	1.91
St. Vincent and the Grenadines	0.00	0.00		0.01	0.01		34.98	36.64		55.85	58.49		9.17	11.47		3.46	2.33	
Trinidad and Tobago ^b	0.13	0.18	0.08	0.20	0.29	0.14	99.80	136.78	61.87	162.43	222.63	100.70	54.56	174.04	92.55	4.49	3.38	0.86
Uruguay	0.09	0.16		0.11	0.21		27.39	49.11		34.61	62.07		3.49	5.47		1.04	1.72	
AFRICA SOUTH OF THE SAHARA	3.59	6.66	9.50	7.84	14.44	19.48	7.44	10.14	12.62	16.27	21.97	25.86	3.15	3.75	3.85	2.74	3.16	2.19
Angola	0.12	0.35	0.28	0.17	0.49	0.38	8.48	18.07	9.66	11.66	24.85	13.29	7.11			1.74	2.00	0.98

Table 2 continued

Region/country	Agricultural expenditure (billions 2011 constant US dollars)			Agricultural expenditure (billions 2011 PPP dollars)			Per capita agricultural expenditure (2011 constant US dollars)			Per capita agricultural expenditure (2011 PPP dollars)			Ratio of agricultural expenditure to agricultural GDP (%)			Share of agriculture in total expenditure (%)		
	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016
Benin	0.06	0.07	0.23	0.13	0.15	0.50	10.09	8.34	20.84	22.24	18.38	45.95	4.44	4.28	9.85	7.26	5.47	11.78
Botswana	0.17	0.18	0.31	0.30	0.34	0.57	106.06	99.48	139.91	192.68	180.72	254.18	46.66	85.33	78.86	5.96	4.49	5.07
Burkina Faso	0.39	0.15	0.29	0.86	0.34	0.64	38.67	11.46	15.50	85.41	25.30	34.24	28.75	5.64	7.19	45.68	9.01	8.18
Burundi ^c	0.03	0.00	0.02	0.08	0.01	0.05	4.58	0.28	1.92	13.57	0.84	5.67	3.71	0.28	1.98	5.10	0.33	2.79
Cabo Verde ^d	0.00	0.02	0.03	0.00	0.03	0.05	5.04	36.25	65.28	8.22	59.15	106.50	2.48	14.15	21.06		3.32	4.93
Cameroon													2.45	4.17		4.16	3.76	
Central African Republic ^c	0.02	0.01	0.02	0.04	0.01	0.04	7.05	1.57	4.76	13.00	2.89	8.77	3.47	0.68	3.38	9.94	2.04	9.91
Congo, Rep. ^d	0.01	0.05	0.12	0.01	0.07	0.19	3.15	12.15	25.68	5.13	19.82	41.88	1.08	9.19	20.25	0.34	1.90	2.20
Côte d'Ivoire	0.17	0.10	0.48	0.36	0.22	1.00	12.01	5.69	20.38	24.83	11.76	42.13	3.46	1.94	5.88	3.56	2.34	4.52
Democratic Rep. of Congo ^d	0.00	0.03	0.42	0.00	0.05	0.74	0.07	0.49	6.06	0.12	0.86	10.68	0.03	0.67	7.39	0.18	0.70	6.16
Equatorial Guinea	0.01	0.04		0.01	0.06		14.68	52.52		23.52	84.13							
eSwatini	0.04	0.06	0.09	0.07	0.11	0.16	36.60	55.13	63.90	68.13	102.63	118.97	12.06	13.87	16.29	5.68	5.56	4.07
Ethiopia	0.16	0.63	0.88	0.54	2.16	3.01	2.74	8.20	8.55	9.40	28.18	29.37	3.15	9.34	5.24	9.72	15.93	9.23
Gambia	0.01	0.01	0.01	0.02	0.02	0.03	4.85	4.48	5.59	14.36	13.29	16.57	4.68	3.20	6.27	7.88	6.91	3.20
Ghana	0.04	0.04	0.11	0.09	0.09	0.24	2.45	1.96	3.91	5.30	4.23	8.45	0.66	0.44	1.20	0.73	0.53	0.92
Guinea-Bissau ^c	0.00	0.00	0.00	0.00	0.00	0.00	0.40	1.05	0.83	0.86	2.26	1.79	0.10	0.38	0.29	1.19	7.77	0.88
Kenya	0.45	0.24	0.31	1.18	0.61	0.80	16.59	6.58	6.34	42.97	17.05	16.41	7.37	3.16	1.75	7.00	3.87	1.77
Lesotho	0.09	0.03	0.06	0.16	0.06	0.11	50.33	16.35	25.93	93.16	30.25	48.00	65.16	27.23	33.75	12.41	3.80	3.75
Liberia ^d	0.00	0.00	0.00	0.02	0.00	0.02	0.06	0.01	0.03	8.04	1.10	4.27	3.97	0.28	1.43	2.76	1.34	1.97
Madagascar	0.07	0.17	0.01	0.20	0.52	0.04	4.94	9.36	0.57	14.86	28.14	1.70	4.28	7.89	0.57	6.10	9.49	1.17
Malawi	0.10	0.08	0.49	0.21	0.17	1.01	10.32	6.20	27.12	21.18	12.73	55.67	9.61	4.62	19.84	8.85	6.86	17.43
Mali	0.22	0.38	0.40	0.50	0.86	0.89	23.02	29.92	22.11	51.69	67.16	49.65	10.47	11.74	6.57	17.28	18.27	12.31
Mauritius	0.07	0.08	0.08	0.13	0.14	0.14	63.56	62.15	60.96	114.46	111.92	109.77	14.07	17.03	17.60	5.86	3.70	1.93
Mozambique		0.15	0.39		0.27	0.72		7.04	13.68		12.76	24.81		7.33	9.78		7.66	7.26
Namibia	0.12	0.14	0.26	0.19	0.21	0.41	71.99	67.91	105.02	112.09	105.75	163.53	19.94	14.03	27.29	6.04	5.14	4.45
Niger ^b	0.07	0.19	0.36	0.16	0.42	0.77	7.76	14.29	18.75	16.56	30.50	40.03	5.26	16.17	12.09	13.17	20.02	12.30
Nigeria	0.44	1.82	0.17	0.92	3.77	0.36	4.10	13.10	0.94	8.49	27.11	1.94	1.00	2.02	0.17	3.60	4.99	0.63
Rwanda		0.05	0.27		0.11	0.61		5.08	22.29		11.71	51.32		2.92	9.76		4.85	10.55
Senegal	0.07	0.22	0.51	0.14	0.44	1.03	8.24	19.45	33.31	16.46	38.84	66.53	4.92	12.61	18.44	5.23	7.85	10.60
Seychelles	0.01	0.01	0.01	0.01	0.02	0.02	85.62	122.24	137.73	158.45	226.22	254.87	25.15	39.02	49.48	1.99	3.05	2.61
Sierra Leone ^e	0.00	0.01	0.05	0.01	0.02	0.14	0.87	1.50	7.35	2.44	4.20	20.57	0.64	0.80	2.60	1.57	0.90	5.93
South Africa	0.35	0.72	2.86	0.53	1.09	4.36	8.22	14.72	51.14	12.51	22.39	77.78	3.91	8.69	29.06	0.51	0.82	1.10
Sudan													0.05	4.74		3.59	6.77	
Tanzania, United Rep.	0.19	0.24	0.27	0.58	0.71	0.79	6.49	6.04	4.77	19.35	18.01	14.22	3.33	3.56	1.94	8.55	6.26	2.98
Togo	0.03	0.02	0.08	0.07	0.05	0.18	7.56	3.73	10.87	16.58	8.19	23.86	3.65	1.76	4.14	6.13	3.52	7.39
Uganda	0.01	0.07	0.17	0.04	0.21	0.51	0.58	2.48	4.04	1.77	7.50	12.23	0.43	2.45	3.05	1.87	3.06	3.91
Zambia	0.06	0.31	0.48	0.11	0.63	0.98	6.16	25.67	29.04	12.59	52.46	59.35	4.40	14.49	26.09	2.80	8.30	6.76
HIGH-INCOME EUROPEAN COUNTRIES	102.33	73.59	49.67	95.00	70.95	45.48	215.08	148.58	102.85	199.66	143.26	94.17	25.85	24.65	17.84	1.44	0.89	0.53
Austria	3.94	2.22	1.60	3.41	1.92	1.38	495.73	269.40	182.82	428.94	233.10	158.19	58.80	44.83	32.30	2.32	1.10	0.70

Table 2 continued

Region/country	Agricultural expenditure (billions 2011 constant US dollars)			Agricultural expenditure (billions 2011 PPP dollars)			Per capita agricultural expenditure (2011 constant US dollars)			Per capita agricultural expenditure (2011 PPP dollars)			Ratio of agricultural expenditure to agricultural GDP (%)			Share of agriculture in total expenditure (%)		
	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016	1995	2005	2016
Belgium	0.65	0.33	0.35	0.56	0.28	0.30	64.32	31.15	30.46	55.62	26.94	26.33	13.11	8.09	10.13	0.33	0.13	0.12
Croatia	0.23	0.47	0.42	0.33	0.67	0.60	49.17	106.05	100.51	70.01	151.02	143.14	9.26	18.25	19.16	2.50	2.33	1.39
Cyprus	0.24	0.30	0.20	0.25	0.31	0.20	280.89	296.20	169.06	289.23	305.00	174.07	30.07	46.03	42.04	4.61	3.27	1.98
Czech Republic ^b	4.08	1.13	0.95	5.41	1.50	1.26	395.37	110.66	90.61	524.26	146.74	120.14	68.66	25.73	16.63	5.27	1.36	0.98
Denmark	0.55	0.59	0.55	0.40	0.43	0.40	105.15	109.40	96.32	75.60	78.66	69.26	7.12	15.41	18.80	0.35	0.34	0.28
Estonia	0.07	0.12	0.12	0.10	0.17	0.17	48.84	89.29	89.26	68.67	125.56	125.51	11.95	17.76	20.25	1.47	1.62	1.10
Finland	8.33	2.94	2.13	6.67	2.35	1.70	1,630.82	560.26	386.87	1,306.29	448.77	309.89	124.67	50.27	33.78	7.75	2.33	1.40
France	10.40	11.26	5.79	8.89	9.63	4.95	174.71	178.27	86.54	149.38	152.42	73.99	19.76	24.85	13.40	0.89	0.79	0.34
Germany	17.93	8.76	7.25	16.36	7.99	6.61	219.56	106.21	88.01	200.25	96.86	80.27	62.86	37.42	32.66	1.09	0.56	0.41
Greece	3.05	0.08	0.65	3.07	0.08	0.66	288.42	6.99	60.77	290.93	7.05	61.29	18.56	0.56	7.32	3.11	0.06	0.51
Hungary	1.89	1.76	0.74	3.06	2.86	1.20	183.35	174.97	75.30	296.64	283.07	121.82	27.29	34.31	12.74	3.51	2.56	1.02
Iceland		0.17	0.14		0.14	0.12		562.80	414.27		482.86	355.43		25.36	15.29	7.22	2.95	1.73
Ireland	1.21	1.28	0.98	1.05	1.11	0.85	335.75	308.30	206.68	290.46	266.72	178.81	19.22	55.45	30.58	2.71	1.72	1.05
Italy	9.17	8.77	5.75	8.69	8.32	5.46	161.23	151.35	94.91	152.87	143.50	89.99	15.57	18.81	13.72	0.89	0.81	0.53
Luxembourg	0.19	0.22	0.20	0.15	0.18	0.16	466.51	480.40	341.59	370.77	381.81	271.49	62.15	121.25	117.99	1.44	1.01	0.68
Malta	0.01	0.09	0.05	0.02	0.11	0.07	35.32	222.44	115.53	44.25	278.70	144.75	8.97	54.62	35.54	0.53	2.50	1.11
Netherlands	2.02	1.67	1.01	1.73	1.43	0.87	130.40	102.13	59.11	112.19	87.87	50.86	10.52	11.28	6.55	0.60	0.48	0.25
Norway	5.28	3.20	3.27	3.26	1.97	2.01	1211.33	692.21	623.78	747.46	427.14	384.91	57.67	48.39	28.12	2.99	1.62	1.18
Poland	2.69	2.91	2.48	4.42	4.79	4.07	69.66	76.30	65.23	114.57	125.49	107.28	18.32	25.19	17.31	2.68	1.65	1.00
Portugal	1.73	1.21	0.59	2.00	1.40	0.68	172.54	115.31	56.83	199.20	133.12	65.61	19.03	21.81	12.75	2.14	1.07	0.54
Romania ^b	2.79	2.01	1.61	5.49	3.96	3.16	123.11	94.50	80.73	242.14	185.86	158.77	12.78	15.21	17.08	6.77	3.81	2.32
Slovakia		0.26	0.34		0.37	0.48		49.06	62.49		69.69	88.77		10.81	9.14		0.88	0.73
Slovenia	0.50	0.32	0.24	0.58	0.37	0.28	251.21	158.64	116.97	289.61	182.89	134.85	42.69	29.69	23.95	3.61	1.51	1.00
Spain	6.28	9.06	5.13	6.32	9.13	5.16	158.04	207.62	110.28	159.20	209.14	111.09	16.34	23.44	13.28	1.43	1.66	0.79
Sweden	2.51	1.14	0.83	1.84	0.84	0.61	284.07	126.56	84.00	208.57	92.92	61.68	27.39	22.45	11.53	1.06	0.43	0.27
Switzerland	15.03	5.42	5.45	9.55	3.45	3.47	2,134.22	729.33	651.39	1,356.19	463.46	413.93	198.78	101.97	110.46	9.24	2.59	2.10
United Kingdom	1.56	5.87	3.43	1.38	5.19	3.03	26.94	97.18	52.32	23.82	85.90	46.25	6.40	39.94	21.91	0.22	0.56	0.28
OTHER HIGH-INCOME COUNTRIES	44.44	62.04	26.51	41.20	58.71	24.74	90.05	115.92	74.43	83.50	109.69	69.47	17.95	19.05	12.09	1.25	1.32	0.58
Australia	3.06	3.71	4.78	1.96	2.38	3.06	169.45	181.89	197.23	108.72	116.70	126.54	11.83	10.39	11.70	1.24	1.14	0.76
Canada ^b	4.78	5.13	6.44	3.81	4.10	5.14	162.70	158.86	181.13	129.84	126.78	144.55			23.55	1.93	2.14	0.96
Israel	0.90	0.35	0.62	0.82	0.32	0.56	162.51	50.46	72.29	147.41	45.77	65.57	35.87	10.95	17.17	1.49	0.38	0.52
Japan ^b	13.69	13.31	7.13	10.17	9.88	5.30	109.12	104.15	56.06	81.04	77.35	41.63	14.79	19.27	10.55	1.69	1.33	0.60
Rep. of Korea ^b	8.39	8.82	10.12	10.88	11.44	13.12	185.99	183.15	199.40	241.20	237.52	258.60	27.27	32.80	36.38	10.02	4.74	2.37
New Zealand ^d	0.36	0.88	1.03	0.31	0.75	0.88	97.48	213.98	234.67	83.04	182.29	199.91	4.38	10.34	8.28	1.06	1.38	1.32
United States	13.26	29.84	21.12	13.26	29.84	21.12	49.81	100.96	65.30	49.81	100.96	65.30		17.83	12.05	0.64	1.07	0.56

Note: PPP (purchasing power parity) dollars measure the relative purchasing power of currencies across countries by eliminating national differences in pricing levels for a wide range of goods and services.

a = last year of data available is 2015; b = last year of data available is 2014; c = last year of data available is 2013; d = last year of data available is 2012;

e = last year of data available is 2013, with the exception of the estimated share of agriculture in total expenditure, which is for 2012.

Regional totals and averages are calculated for the countries for which observations are available in the years 1995, 2005, and 2016. Averages are weighted by the denominator of the indicator being used (population, agricultural GDP, or total spending).

Food Policy Research Capacity Indicators (FPRCI)

Food policy research plays a crucial role in guiding the agricultural transformation of developing countries. To achieve food security goals, countries need to strengthen their capacity to conduct food policy research. Strong local policy research institutions help in shaping an evidence-based policymaking process. Measuring national capacity for food policy research is important for identifying capacity gaps in food policy research and guiding the allocation of resources to fill those gaps.

"Food policy research capacity" is defined as any socioeconomic or policy-related research capacity in the area of food, agriculture, nutrition, or natural resources. To measure this capacity, the International Food Policy Research Institute (IFPRI) developed a set of indicators of the quantity and quality of policy research at the country level.

INDICATORS

IFPRI created the FPRCI database in 2010 and has continued to expand and refine it. The data presented in Table 3 are currently collected for 33 countries; data for Myanmar was added in 2017. A consistent methodology is followed to enable comparison of values across time and countries. The database was most recently updated with numbers for 2018.

Analysts/researchers is a head count of professionals employed at local organizations whose work involves food policy research or analysis. To introduce some uniformity, IFPRI also presents a modified quantification of the head-count: full-time equivalent analysts/researchers with PhD. To obtain an indicator of per capita food policy research capacity, this research capacity is then divided by the country's rural population (full-time equivalent researchers per million rural residents). This helps to illustrate the level of effort invested in local food policy research in a country. This indicator was last updated in 2015.

The quality of a country's food policy research capacity is estimated by tallying the number of relevant international publications in peer-reviewed

journals. IFPRI views this as a reflection of the local enabling environment for food policy research. This indicator allows for comparison across countries, as it ensures an internationally accepted standard of quality for publications. The final indicator is derived by dividing the number of international publications by the number of full-time equivalent researchers with a PhD, providing a measure of productivity.

TRENDS IN FOOD POLICY RESEARCH

Overall food policy research capacity across all countries did not change from last year's level, but there was substantial variation across countries and regions. For instance, the number of food policy research publications in Colombia had been steadily declining until 2017 but increased in 2018. Other countries, including Nepal, Bangladesh, and Ghana have seen a steady increase since 2014.

Most Asian countries showed little change in number of publications, with the exception of Bangladesh, Lao PDR, and Nepal, which saw an increase in publications in 2018. In Africa, Ethiopia, Ghana, Malawi, Mali, and Tanzania saw an increase in the number of publications. In Latin America, apart from Guatemala, all countries experienced either a slight increase or no change in the number of publications. A few countries, notably South Africa, Indonesia, and Kenya, saw a decrease in the number of publications produced.

To better understand long-term trends in food policy research, we calculated five-year moving averages of the number of publications for the period 2009–2018. For the Asia region, except China, the moving average for most countries remained unchanged. In Africa, the moving average for all countries increased or remained the same, with the exception of Liberia, Madagascar, South Africa, and Swaziland (eSwatini).

IFPRI will continue to update and expand this database to include additional countries to better facilitate cross-country comparisons. This will also facilitate identification of the minimum food policy research capacity

threshold for a country. It is hoped that such data will aid in informing national policymakers of the importance of investing in local food policy research capacity. This data will also provide donors with a framework for prioritizing investments to strengthen food policy research capacity across as well as within countries.

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TABLE 3 Food policy research capacity indicators, 2011–2018

Country	Analysts/researchers (head count) in 2015	FTE analysts/researchers with PhD in 2015	International publications produced from 2011–2018	FTE analysts/researchers with PhD per million rural population in 2017	Publications per FTE researcher with PhD
Afghanistan	43	3.0	6	0.11	2.02
Bangladesh	66	22.9	88	0.22	3.84
Benin	38	4.3	31	0.72	7.21
Burundi	39	5.1	5	0.54	0.98
China	2,000	1,332.5	1,632	2.29	1.22
Colombia	85	6.5	33	0.67	5.12
Ethiopia	141	30.4	37	0.36	1.22
Ghana	153	23.3	93	1.81	3.99
Guatemala	45	11.9	4	1.43	0.34
Honduras	33	6.1	6	1.52	0.98
Indonesia	146	42.4	25	0.35	0.59
Kenya	155	31.6	88	0.87	2.78
Lao PDR	9	1.8	13	0.39	7.43
Liberia	34	3.1	2	1.32	0.65
Madagascar	187	11.5	11	0.71	0.95
Malawi	68	18.2	38	1.17	2.09
Mali	60	10.1	13	0.93	1.29
Mozambique	37	3.3	15	0.17	4.51
Myanmar	97	46.5	10	1.25	0.22
Nepal	27	3.7	26	0.15	7.12
Niger	29	8.8	7	0.49	0.79
Nigeria	349	77.4	53	0.80	0.68
Peru	54	7.2	24	1.00	3.36
Rwanda	64	5.5	12	0.54	2.18
Senegal	71	9.3	19	1.10	2.04
South Africa	198	50.3	268	2.60	5.33
Swaziland* (eSwatini)	32	2.9	1	0.27	0.35
Tanzania, United Rep.	91	20.8	51	0.54	2.46
Togo	81	6.8	5	1.49	0.73
Uganda	34	10.9	33	0.33	3.02
Viet Nam	175	32.5	17	0.53	0.52
Zambia	29	5.3	22	0.54	4.15
Zimbabwe	42	8.9	18	0.79	2.03

Note: * = rural population from 2016 is used. FTE = full-time equivalent.

Agricultural Total Factor Productivity (TFP)

Increasing the efficiency of agricultural production—getting more output from the same amount of resources—is critical for improving food security. To measure the efficiency of agricultural systems, we use total factor productivity (TFP). TFP is an indicator of how efficiently agricultural land, labor, capital, and materials (agricultural inputs) are used to produce a country's crops and livestock (agricultural output). It is calculated as the ratio of total agricultural output to total production inputs. When more output is produced from a constant amount of resources, meaning that resources are being used more efficiently, TFP increases. Measures of land and labor productivity—partial factor productivity (PFP) measures—are calculated as the ratio of total output to total agricultural area (land productivity) and to the number of economically active persons in agriculture (labor productivity). Because PFP measures are easy to estimate, they are often used to measure agricultural production performance. These measures normally show higher rates of growth than TFP, because growth in land and labor productivity can result not only from increases in TFP but also from a more intensive use of other inputs (such as fertilizer or machinery). Indicators of both TFP and PFP contribute to the understanding of agricultural systems needed for policy and investment decisions by enabling comparisons across time and across countries and regions.

TRENDS IN PRODUCTIVITY

Table 4 presents estimates of TFP and land and labor productivity measures for developing countries and regions for three periods between 1991 and 2015. It uses the most recent data on outputs and inputs from the Economic Research Service of the United States Department of Agriculture (ERS-USDA), an internationally consistent and comparable dataset on production and input quantities built using data from the FAOSTAT database of the Food and Agriculture Organization of the United Nations (FAO), supplemented with data from national statistical sources.¹

Average TFP growth for all developing regions in 2011–2015 shows lower values than average growth rates of the previous decade (2001–2010). Sluggish TFP growth in Africa south of the Sahara in 2001–2010 decreased to 0.4 percent in 2011–2015. TFP growth in Latin America and the Caribbean is the highest among developing regions in recent years at 1.9 percent in 2011–2015, but below the 2.3 percent growth in the region in 2001–2010, largely because of slower growth in Brazil (1.6 percent in 2011–2015 compared with 3.3 percent in 2001–2010). Growth in Asia and the Pacific and the Middle East and North Africa for 2011–2015 is similar to growth of these regions in 2001–2010, with growth in China slowing to less than 2 percent, and India's growth accelerating from 1.1 percent in 2001–2010 to 1.7 for 2011–2015.

DATA AND METHODOLOGY

The output values from the ERS-USDA dataset used to estimate TFP are gross agricultural outputs. Inputs are agricultural land, in hectares of “rainfed cropland equivalents,” measured as the sum of rainfed cropland (weight equals 1.00), irrigated cropland (weight varies from 1.00 to 3.00 depending on region), and permanent pasture (weight varies from 0.02 to 0.09 depending on region); a measure of labor is approximated using the number of economically active persons in agriculture; fertilizer is expressed in tons of fertilizer nutrients used; total stock of farm machinery is measured as the number of “40-CV tractor equivalents”; total livestock capital on farms is in “cattle equivalents,” calculated using FAO estimates of animal stocks on farms, with species weighted by their respective size (nondairy cattle taking a weight of 1.00). Finally, total animal feed from crops and crop processing residues is measured in “dry-matter equivalents.”

Land and labor productivity measures for the regions (such as Africa south of the Sahara) reflect a

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weighted average of individual country productivity measures using average outputs (1991–2014) of each country as weights. TFP is calculated using a growth accounting approach. This approach defines TFP as the ratio of

an output index and an input index. As input prices are not available, input shadow prices were obtained for each country and year by estimating the parameters of distance functions through linear programming.

TABLE 4 Average annual growth of agricultural output and total factor productivity (TFP), and levels of land and labor productivity, various years

Region/country	Land productivity (in constant 2004–2006 US dollars)				Labor productivity (in constant 2004–2006 US dollars)				Output growth (%)			TFP growth (%)		
	1990	2000	2010	2015	1990	2000	2010	2015	1991–2000	2001–2010	2011–2015	1991–2000	2001–2010	2011–2015
AFRICA SOUTH OF THE SAHARA	190	239	319	335	1,084	1,438	1,887	2,078	4.1	3.7	2.1	1.5	1.0	0.4
Angola	15	24	62	67	252	315	605	567	4.9	9.8	1.6	0.5	4.6	0.0
Benin	471	582	656	669	780	1,109	1,243	1,485	6.0	2.7	4.4	1.8	0.9	3.3
Botswana	9	12	15	14	1,071	1,090	1,264	1,114	3.2	2.5	-1.5	3.1	1.8	5.8
Burkina Faso	111	145	196	207	297	294	387	335	2.8	6.0	0.4	-0.5	1.4	-1.8
Burundi	526	607	693	642	406	344	301	250	-0.4	2.3	-1.4	-0.5	0.2	-1.9
Cameroon	444	534	661	703	713	842	1,398	1,612	3.1	5.7	3.2	0.9	3.9	1.4
Cabo Verde	256	448	543	440	816	1,263	1,468	1,467	4.4	0.6	-2.0	3.7	1.8	-0.4
Central African Republic	148	197	228	235	526	667	754	758	3.6	1.8	0.9	1.5	0.8	0.3
Chad	18	28	46	45	446	553	759	677	4.8	5.5	-0.8	1.3	2.0	0.0
Comoros	596	606	581	547	409	401	346	311	2.2	1.0	0.4	-2.6	-0.1	0.9
Congo, Dem. Rep.	179	159	160	167	493	347	293	281	-1.5	0.2	1.0	-0.4	-1.4	-1.4
Congo, Republic	20	27	39	43	466	550	761	819	2.8	3.9	2.1	0.8	0.8	1.9
Côte d'Ivoire	208	290	295	315	1,520	1,943	2,259	2,717	3.4	0.9	3.8	1.1	-0.3	0.8
Djibouti	39	29	37	42	267	201	236	250	-1.0	3.1	2.8	-2.2	1.6	3.7
Equatorial Guinea	168	181	231	249	363	277	258	244	0.0	1.4	1.1	-1.8	0.8	0.9
Ethiopia	133	146	253	303	255	218	302	324	8.8	6.5	4.1	-1.5	2.0	1.5
Gabon	41	52	60	65	949	1,245	1,550	1,595	2.4	1.4	1.7	1.1	1.6	1.5
Gambia	129	256	296	268	233	323	328	210	6.0	3.1	-5.6	2.5	0.0	-4.3
Ghana	178	312	458	536	567	904	1,134	1,191	7.5	4.8	3.4	4.4	0.5	1.0
Guinea	82	114	145	154	415	433	507	498	3.8	3.4	1.9	-1.0	0.1	1.0
Guinea-Bissau	114	160	224	236	450	609	753	742	4.7	3.7	1.8	1.6	2.5	1.7
Kenya	158	177	285	287	513	418	561	523	1.1	5.1	0.7	0.0	2.4	-1.8
Lesotho	56	77	79	75	436	528	529	464	3.1	0.2	-1.8	2.5	0.6	2.9
Liberia	108	153	156	167	457	525	443	437	3.9	0.5	1.4	0.5	-0.9	1.7
Madagascar	70	66	91	88	610	491	497	408	0.5	3.3	-0.9	1.0	1.1	-0.8
Malawi	245	408	540	513	302	495	625	530	6.4	4.6	-0.5	3.5	0.7	-3.5
Mali	44	61	95	114	822	1,052	1,359	1,501	4.3	5.1	4.5	2.8	1.7	1.7
Mauritania	9	12	15	17	767	830	747	756	3.6	1.8	2.9	0.8	-0.5	2.6
Mauritius	2,528	2,749	3,372	3,506	3,174	3,951	5,556	6,437	0.3	0.4	-0.9	-1.2	1.0	0.5
Mozambique	24	37	63	62	221	249	356	303	4.3	5.8	-0.8	0.8	1.7	0.1
Namibia	10	10	11	11	1,689	1,529	1,611	1,596	0.4	0.6	0.6	-1.9	2.5	1.6
Niger	35	49	77	87	500	545	816	747	4.2	7.4	1.9	1.2	3.5	-0.1
Nigeria	291	387	505	500	1,305	2,137	2,480	2,495	5.0	2.6	2.6	3.2	0.3	0.7

Table 4 continued

Region/country	Land productivity (in constant 2004–2006 US dollars)				Labor productivity (in constant 2004–2006 US dollars)				Output growth (%)			TFP growth (%)		
	1990	2000	2010	2015	1990	2000	2010	2015	1991–2000	2001–2010	2011–2015	1991–2000	2001–2010	2011–2015
Réunion (France)	2,061	3,206	3,203	3,023	8,487	16,648	30,201	43,703	2.0	0.8	-0.7	2.6	0.9	0.6
Rwanda	599	675	1,040	1,010	459	424	536	503	0.8	5.1	1.4	0.7	2.3	0.2
Sao Tome and Principe	289	517	572	607	512	926	752	705	7.1	0.5	1.4	4.9	-1.0	-0.6
Senegal	111	146	197	205	374	395	427	384	3.0	3.5	1.0	0.1	0.5	-0.3
Seychelles	1,773	1,648	2,701	3,375	236	264	143	155	2.2	-4.8	1.6	-0.3	1.5	6.6
Sierra Leone	147	127	297	351	400	330	858	935	-2.5	11.8	2.7	0.2	5.1	3.8
Somalia	33	33	38	39	816	707	654	600	-0.1	1.3	0.9	1.4	0.2	4.1
South Africa	96	110	135	141	5,713	7,280	10,846	12,926	1.6	1.9	0.8	3.4	1.5	0.4
Sudan, former	32	55	95	89	732	1,106	1,168	976	6.4	2.3	-2.1	3.1	-0.1	-5.5
Swaziland (eSwatini)	220	205	249	264	1,958	1,672	2,151	2,342	-1.0	1.9	1.4	-1.6	3.3	2.7
Tanzania, United Rep.	139	144	216	278	374	332	473	606	1.3	5.8	7.7	-0.4	-1.0	3.9
Togo	223	272	329	329	512	579	667	698	3.0	3.3	2.9	1.5	1.4	1.2
Uganda	384	435	447	441	584	591	455	416	2.6	0.2	1.0	-0.2	-0.3	0.5
Zambia	39	46	89	100	339	362	610	587	2.5	7.2	2.1	2.5	3.3	-2.3
Zimbabwe	127	135	108	111	551	574	497	431	1.7	-1.5	-0.4	0.3	-0.3	0.2
LATIN AMERICA AND THE CARIBBEAN	255	336	468	526	5,710	7,903	12,404	15,447	3.2	3.4	2.5	1.3	2.3	1.9
Argentina	190	251	285	329	16,647	22,096	29,888	35,954	2.8	2.7	3.1	0.2	0.9	3.4
Bahamas	1,656	1,777	2,234	2,522	3,312	4,621	6,702	8,828	1.5	3.7	1.0	0.1	3.7	3.6
Belize	725	1,054	1,062	1,088	5,076	6,544	5,377	4,974	5.4	0.6	0.9	2.6	-0.8	-1.2
Bolivia	48	65	92	113	1,388	1,509	1,719	1,909	3.6	3.7	4.2	0.6	-0.3	2.5
Brazil	253	342	514	568	4,341	6,699	12,710	16,631	3.8	4.5	2.6	1.6	3.3	1.6
Chile	279	414	519	535	4,736	6,487	8,457	8,914	3.4	2.7	0.7	0.9	2.7	-1.7
Colombia	216	255	310	351	2,907	3,184	3,720	4,609	1.6	1.4	3.5	1.6	1.2	2.7
Costa Rica	707	1,234	1,563	1,740	5,292	6,942	8,831	10,197	3.3	2.3	2.1	2.4	1.9	1.3
Cuba	694	567	442	523	5,594	5,060	4,865	6,190	-2.3	-2.6	2.7	0.3	-1.8	2.2
Dominican Republic	630	750	1,149	1,350	2,563	3,423	5,972	7,670	1.6	3.8	2.9	1.7	2.8	4.4
Ecuador	410	556	869	1,119	2,922	3,652	5,117	5,141	3.3	3.7	-0.1	0.3	2.7	-0.4
El Salvador	599	676	736	681	1,287	1,529	1,905	1,938	1.8	1.1	-0.7	0.5	1.2	-0.6
French Guiana (France)	875	960	897	900	1,671	2,008	1,817	2,347	1.8	-0.1	5.1	1.2	1.2	4.5
Guatemala	469	634	1,168	1,538	1,355	1,901	2,251	2,547	3.4	4.9	4.6	1.7	2.2	4.4
Guyana	105	185	210	284	3,138	5,650	6,656	9,346	5.5	1.1	6.0	3.1	1.1	5.7
Haiti	582	561	703	863	521	479	584	670	0.2	3.3	3.8	-1.5	2.9	4.2
Honduras	355	442	616	674	1,747	1,762	2,982	3,302	1.0	4.3	1.8	0.5	3.5	1.9
Jamaica	1,031	1,117	1,226	1,265	1,785	2,158	2,531	2,754	0.9	0.2	0.6	0.2	2.8	1.8
Lesser Antilles	1,904	2,015	1,567	1,674	3,790	4,169	3,586	3,670	-0.6	-2.5	0.0	-0.2	-0.6	0.6
Mexico	216	278	341	378	2,640	3,348	4,497	5,289	2.6	2.1	2.0	2.2	2.0	2.2
Nicaragua	162	208	299	319	1,667	2,729	4,263	4,882	4.9	3.4	1.4	3.3	3.1	0.3
Panama	383	367	403	434	3,202	3,058	3,515	3,922	0.1	1.1	1.4	-2.0	1.0	2.3
Paraguay	156	143	245	279	4,638	4,070	6,253	6,943	0.9	5.8	3.2	-2.5	1.6	0.6
Peru	156	255	366	415	1,223	1,754	2,364	2,648	5.5	4.0	2.8	2.2	2.1	1.7

Table 4 continued

Region/country	Land productivity (in constant 2004–2006 US dollars)				Labor productivity (in constant 2004–2006 US dollars)				Output growth (%)			TFP growth (%)		
	1990	2000	2010	2015	1990	2000	2010	2015	1991–2000	2001–2010	2011–2015	1991–2000	2001–2010	2011–2015
Puerto Rico (USA)	990	1,433	1,734	1,664	8,790	11,811	20,998	27,417	-2.0	-0.5	-0.4	0.4	3.2	3.6
Suriname	1,343	1,061	1,741	1,623	4,076	3,112	4,132	4,337	-2.4	3.8	1.0	-1.3	4.7	3.2
Trinidad and Tobago	1,743	2,188	2,664	2,674	2,632	2,992	3,061	3,358	0.9	-0.2	0.1	0.9	-0.2	-1.0
Uruguay	146	191	280	302	11,776	14,487	21,719	23,953	2.7	3.5	1.5	0.9	1.3	-0.1
Venezuela	196	261	299	322	4,914	6,945	8,931	10,510	2.8	1.4	1.4	2.7	0.5	1.5
ASIA AND THE PACIFIC	646	909	1,219	1,355	803	1,104	1,738	2,298	3.8	3.4	2.5	1.7	1.7	1.5
Afghanistan	54	68	93	96	823	643	648	599	2.2	3.1	0.6	2.5	-1.6	-0.6
Armenia	560	509	566	854	2,523	1,188	2,146	3,779	-0.6	3.8	7.6	4.6	2.7	5.6
Azerbaijan	558	335	528	627	2,058	1,051	1,522	1,760	-4.0	4.6	3.4	2.6	0.2	0.7
Bangladesh	1,073	1,610	2,332	2,583	355	466	661	747	3.1	3.5	1.9	-0.5	0.7	0.7
Bhutan	229	306	377	387	650	959	636	582	4.4	1.9	0.8	4.3	0.4	-0.9
Cambodia	275	406	698	836	411	489	755	834	4.6	6.8	3.6	2.4	1.7	-0.2
China	433	691	970	1,093	582	1,053	1,921	2,788	5.2	3.5	2.6	2.8	2.2	1.9
Fiji	608	542	443	464	2,150	1,855	1,493	1,529	-0.7	-2.1	0.9	-1.4	-2.4	0.6
India	719	931	1,292	1,473	624	710	874	951	2.6	3.2	2.6	0.3	1.1	1.7
Indonesia	669	811	1,084	1,224	726	806	1,211	1,396	2.4	4.6	2.9	-0.1	2.0	0.2
Kazakhstan	52	26	36	44	6,803	2,903	3,371	6,122	-7.2	3.1	4.1	3.7	1.6	2.3
Korea, DPR	1,532	1,294	1,417	1,554	1,065	995	1,231	1,412	-1.6	1.4	1.5	2.6	1.3	2.7
Korea, Republic	3,661	5,252	5,703	5,997	2,299	4,699	7,899	10,879	2.6	-0.2	0.6	1.9	-0.1	1.7
Kyrgyzstan	152	161	177	194	2,786	1,841	2,692	2,978	0.8	0.9	1.7	5.3	0.2	1.9
Lao PDR	428	647	829	1,247	472	618	754	1,058	5.0	4.5	9.5	2.7	-0.9	2.6
Malaysia	1,100	1,403	1,868	1,961	3,894	5,327	8,904	10,745	2.7	3.5	2.0	1.1	1.8	0.7
Micronesia	392	380	370	390	558	526	542	573	-0.9	-0.4	0.8	0.3	-2.3	0.1
Mongolia	7	7	7	9	3,827	3,991	3,471	4,930	0.1	-2.3	5.9	3.1	-2.3	-2.4
Myanmar	596	1,000	1,671	1,656	401	587	1,030	990	5.5	6.6	0.1	2.2	3.9	-5.9
Nepal	704	912	1,241	1,508	463	470	474	518	2.8	2.8	3.9	0.3	1.3	-0.8
New Caledonia (France)	84	91	113	128	646	698	699	764	1.4	0.0	1.1	0.8	-0.2	1.8
Pakistan	595	808	1,059	1,193	1,398	1,587	1,519	1,628	3.5	2.3	3.0	1.1	0.3	1.2
Papua New Guinea	1,908	2,181	2,248	2,431	1,178	1,271	1,268	1,237	2.7	2.0	1.6	0.8	-0.4	0.3
Philippines	1,150	1,454	1,758	1,769	1,175	1,312	1,584	1,596	2.4	2.6	0.7	0.6	1.5	-1.2
Polynesia	704	749	969	1,011	1,283	1,331	1,790	1,983	0.1	1.6	1.2	1.1	2.0	1.2
Solomon Islands	945	1,110	1,070	1,111	706	709	773	732	2.7	3.1	1.0	0.4	0.5	-0.5
Sri Lanka	900	998	1,156	1,142	589	645	757	782	1.1	2.6	0.7	-1.1	1.2	-1.2
Taiwan (China)	5,958	6,651	6,201	6,384	4,984	7,669	9,166	9,163	0.7	-1.2	0.2	1.3	0.4	1.2
Tajikistan	313	173	320	422	1,687	697	1,035	1,295	-5.8	6.6	5.5	0.6	2.1	4.0
Thailand	844	1,265	1,486	1,515	856	1,265	1,688	1,942	3.3	2.2	1.4	1.2	1.1	1.5
Timor-Leste	339	311	396	354	433	441	436	362	-0.3	3.4	-1.9	-1.8	-0.4	-5.5
Turkmenistan	40	54	81	83	2,788	2,117	2,488	2,334	1.1	3.6	0.3	0.0	0.2	0.8
Uzbekistan	259	255	431	568	2,351	2,254	3,684	4,221	-0.5	5.0	5.6	2.0	1.3	2.4
Vanuatu	453	348	418	400	2,296	1,846	2,059	1,920	-1.2	2.5	-0.9	-2.2	0.1	-0.6
Viet Nam	1,590	2,137	2,680	2,890	459	704	960	1,086	5.6	4.3	3.2	-1.0	1.1	1.4

Table 4 continued

Region/country	Land productivity (in constant 2004–2006 US dollars)				Labor productivity (in constant 2004–2006 US dollars)				Output growth (%)			TFP growth (%)		
	1990	2000	2010	2015	1990	2000	2010	2015	1991– 2000	2001– 2010	2011– 2015	1991– 2000	2001– 2010	2011– 2015
MIDDLE EAST AND NORTH AFRICA	1,073	1,344	1,596	1,738	2,565	3,491	4,484	5,240	2.7	2.5	1.8	1.3	1.5	1.2
Algeria	74	102	194	224	1,438	1,440	2,417	2,731	3.6	6.8	3.0	2.8	3.9	-1.2
Bahrain	2,424	2,831	2,925	4,933	4,849	8,683	6,290	14,141	2.9	-0.3	10.4	4.0	-0.2	8.7
Egypt	4,179	5,235	5,996	6,399	1,719	2,780	3,455	3,953	4.4	2.5	2.1	1.4	0.9	0.5
Iran	217	301	531	580	2,568	3,251	3,750	4,035	3.5	2.7	1.5	2.1	0.7	3.8
Iraq	332	313	349	219	4,833	4,861	6,729	5,162	-1.6	1.0	-6.9	-0.2	0.0	-8.9
Jordan	554	722	1,260	1,410	5,760	6,592	10,610	12,845	2.9	4.9	3.3	1.3	4.0	1.3
Kuwait	643	996	1,639	2,412	10,072	13,402	15,574	21,197	4.9	5.2	7.4	3.3	1.5	4.9
Lebanon	1,762	2,082	1,832	1,737	16,654	30,209	40,422	45,724	1.5	-0.6	-0.5	-0.7	-0.3	-0.4
Libya	53	65	77	81	6,557	9,904	17,704	24,301	2.1	1.6	0.9	2.6	-0.7	8.7
Morocco	167	170	305	336	1,557	1,552	3,066	3,608	0.3	5.6	2.3	-1.1	4.1	0.7
Oman	173	264	280	337	749	1,091	1,287	1,054	5.1	2.8	3.7	4.8	-0.9	0.8
Qatar	448	708	801	1,014	3,902	11,687	6,560	8,317	5.4	1.2	4.7	5.6	-2.3	1.8
Saudi Arabia	20	16	20	19	2,491	4,109	6,599	8,022	1.2	2.3	-0.3	-0.2	2.7	-1.5
Syria	272	408	448	370	3,803	4,888	4,423	3,824	4.2	1.1	-3.8	2.0	-0.4	2.5
Tunisia	282	302	363	483	3,771	3,780	4,465	5,936	1.7	2.3	5.8	-0.7	0.9	4.9
Turkey	677	785	943	1,115	2,600	3,506	4,594	5,734	1.7	1.5	3.1	1.2	2.0	0.9
United Arab Emirates	880	3,222	2,130	1,995	3,196	13,518	4,508	4,587	16.2	-4.4	-2.1	10.7	-7.2	-0.5
West Bank and Gaza	-	1,672	1,873	1,811	-	4,975	4,260	5,343	5.6	-2.9	3.0	-1.9	-0.3	-0.8
Yemen	33	48	79	77	583	606	847	824	3.8	4.9	-0.4	2.2	2.4	1.7

Note: Land productivity is agricultural gross production per hectare of agricultural land; labor productivity is agricultural gross production per economically active person in agriculture.

Projections of Food Production, Consumption, and Hunger

INTERNATIONAL MODEL FOR POLICY ANALYSIS OF AGRICULTURAL COMMODITIES AND TRADE (IMPACT)

Policymakers, analysts, and civil society face increasing challenges to reducing hunger and improving food security in a sustainable way. Modeling alternative future scenarios and assessing their outcomes can help inform policy choices. The International Food Policy Research Institute's IMPACT model is an integrated system of linked economic, climate, water, and crop models that allows for exploration of such scenarios.

METHODOLOGY

At IMPACT's core is a partial equilibrium, multimarket economic model that simulates national and international agricultural markets. Links to climate, water, and crop models support the integrated study of changing environmental, biophysical, and socioeconomic trends, allowing for in-depth analysis of a variety of critical issues of interest to policymakers at national, regional, and global levels. IMPACT benefits from close interactions with scientists at all 15 CGIAR research centers through the Global Futures and Strategic Foresight (GFSF) program, and with other leading global economic modeling efforts around the world through the Agricultural Model Intercomparison and Improvement Project (AgMIP).

Tables 5 and 6 summarize results from the latest IMPACT projections to 2030 and 2050. These results update previous projections by incorporating feedback from the GLOBE general equilibrium model, which captures interactions between the agriculture sector and the wider economy. Results are shown for production, consumption, and trade of major food commodity groups, as well as for the population at risk of hunger, by region and for selected countries. Results are shown for two "baseline" scenarios—one considers the impacts of climate change, while the other assumes no climate change (for comparison). Results for additional countries can be found at the IMPACT website.

KEY FINDINGS FROM THE LATEST IMPACT PROJECTIONS

The baseline projections from IMPACT indicate that global food production will grow by about 59 percent over 2010 levels by 2050 in the context of climate change—8 percentage points less than would be the case without climate change (Table 5). Production will grow more rapidly in developing countries, particularly in Africa, than in developed countries. Even with population growth and climate change, per capita consumption (assumed equivalent to per capita availability) is projected to increase by about 10 percent globally to more than 3,000 kilocalories per day. But differences in access to food within and between countries mean that nearly 500 million people will remain at risk of hunger. In Africa south of the Sahara, an additional 41 million people are projected to be at risk of hunger in 2050 as a result of climate change—27 percent more than would be at risk in the absence of climate change.

Despite the impacts of climate change, meat production is projected to grow by 65 percent globally by 2050, and by 77 percent in developing countries. Per capita consumption levels in developing countries, however, will remain under half of those in developed countries (Table 6). Production of fruits and vegetables, pulses, and oilseeds will grow even more rapidly, by about 80 percent globally and more than doubling in some regions. Per capita consumption of fruits and vegetables in developing countries is projected to surpass that of developed countries by 2050, with important benefits for nutrition and health. Production of cereals and roots and tubers will grow more slowly, by around 40 percent globally but roughly doubling in Africa south of the Sahara. Developing countries as a group will become larger net importers of food from developed countries.

In addition to the indicators presented here, IMPACT also explores changes in prices, land and water use, greenhouse gas emissions, and other socioeconomic and environmental indicators. For example, when the impacts of climate change are considered, prices are projected to rise by about 50 percent for most food commodity groups by 2050—about double the increase projected in the absence of climate change.

MORE INFORMATION

More information on these results, and on the results of alternative scenarios exploring different population, income, policy, investment, and technology pathways, can be found online. Results for all 158 countries and regions modeled are available as well as information on IMPACT, the GFSF program, and recent publications.

VISIT ONLINE

IFPRI IMPACT:

<https://www.ifpri.org/program/impact-model>

Global Futures and Strategic Foresight:

<http://globalfutures.cgiar.org/>

IMPACT documentation:

<http://www.ifpri.org/publication/international-model-policy-analysis-agricultural-commodities-and-trade-impact-model-0>

DOWNLOAD DATA

<https://dataverse.harvard.edu/dataverse/impact>

CONTACT

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TABLE 5 IMPACT projections of food production, consumption, and hunger to 2050, with and without climate change

	Aggregate food production (index, 2010 = 1.00)					Per capita food consumption (KCAL per capita per day)					Hunger (millions of people at risk)				
	2010	Without climate change		With climate change		2010	Without climate change		With climate change		2010	Without climate change		With climate change	
		2030	2050	2030	2050		2030	2050	2030	2050		2030	2050	2030	2050
WORLD	1.00	1.37	1.67	1.33	1.59	2,795	3,032	3,191	2,979	3,070	838.1	528.2	405.8	598.0	482.6
Developing countries	1.00	1.42	1.77	1.40	1.71	2,683	2,961	3,137	2,904	3,008	823.3	513.3	392.2	582.4	466.9
Developed countries	1.00	1.22	1.42	1.15	1.27	3,384	3,439	3,513	3,407	3,441	14.8	14.9	13.6	15.6	15.7
ASIA AND THE PACIFIC	1.00	1.39	1.68	1.39	1.66	2,656	3,003	3,185	2,948	3,057	539.8	249.8	181.8	285.0	207.4
East Asia	1.00	1.26	1.39	1.28	1.43	3,009	3,509	3,628	3,453	3,507	187.2	59.2	54.7	60.3	56.8
China	1.00	1.26	1.38	1.28	1.43	3,044	3,604	3,733	3,545	3,606	173.4	44.8	41.0	44.7	41.0
Japan	1.00	1.20	1.41	1.25	1.53	2,770	2,787	2,842	2,757	2,776	2.3	2.0	1.2	2.3	1.9
Korea, Rep.	1.00	1.26	1.46	1.27	1.45	3,139	3,347	3,429	3,310	3,348	0.6	0.4	0.4	0.4	0.4
South Asia	1.00	1.60	2.10	1.54	1.97	2,361	2,669	2,959	2,617	2,826	268.5	138.3	87.7	165.2	99.0
Afghanistan	1.00	1.37	1.85	1.38	1.87	2,149	2,239	2,452	2,199	2,332	7.0	9.4	7.9	10.3	10.9
Bangladesh	1.00	1.44	1.70	1.36	1.53	2,426	2,714	2,911	2,652	2,776	26.0	11.3	6.9	14.9	8.9
India	1.00	1.68	2.25	1.62	2.11	2,354	2,697	2,998	2,644	2,860	189.7	73.9	45.0	93.1	44.9
Nepal	1.00	1.36	1.69	1.39	1.77	2,425	2,695	3,186	2,613	2,984	2.7	2.0	0.8	2.4	1.6
Pakistan	1.00	1.24	1.45	1.20	1.35	2,379	2,540	2,862	2,507	2,766	37.6	38.0	24.4	40.5	29.2
Southeast Asia and Pacific	1.00	1.47	1.87	1.44	1.81	2,551	2,852	3,051	2,791	2,920	84.1	52.3	39.4	59.5	51.7
Indonesia	1.00	1.62	2.02	1.63	2.03	2,540	2,990	3,281	2,902	3,090	32.4	12.9	7.2	15.6	11.4
Malaysia	1.00	1.83	2.94	1.78	2.81	2,838	3,173	3,462	3,141	3,380	0.9	0.8	0.9	0.8	0.9
Philippines	1.00	1.33	1.68	1.31	1.65	2,503	2,641	2,777	2,598	2,682	12.1	12.2	11.0	13.4	13.3
Thailand	1.00	1.18	1.27	1.12	1.14	2,742	3,012	3,183	2,972	3,099	6.2	3.1	1.8	3.5	2.3
Viet Nam	1.00	1.25	1.36	1.20	1.24	2,512	2,710	2,828	2,649	2,699	12.9	9.5	7.2	11.0	9.9

Table 5 continued

	Aggregate food production (index, 2010 = 1.00)					Per capita food consumption (KCAL per capita per day)					Hunger (millions of people at risk)				
	2010	Without climate change		With climate change		2010	Without climate change		With climate change		2010	Without climate change		With climate change	
		2030	2050	2030	2050		2030	2050	2030	2050		2030	2050	2030	2050
AFRICA AND MIDDLE EAST	1.00	1.60	2.23	1.55	2.10	2,623	2,795	3,002	2,731	2,866	238.7	229.8	185.0	260.2	229.9
Africa south of the Sahara	1.00	1.65	2.36	1.57	2.16	2,358	2,587	2,853	2,513	2,703	209.5	195.7	150.5	224.4	191.5
Congo, Dem. Rep.	1.00	1.72	2.49	1.67	2.38	1,943	2,392	2,998	2,326	2,852	37.6	20.3	6.6	25.1	6.6
Ethiopia	1.00	1.66	2.46	1.66	2.47	2,066	2,307	2,614	2,261	2,519	32.7	32.3	22.5	35.0	27.3
Kenya	1.00	1.69	2.84	1.72	2.84	2,133	2,395	2,708	2,293	2,504	10.2	8.9	5.0	11.0	8.7
Nigeria	1.00	1.62	2.31	1.56	2.15	2,751	2,943	3,136	2,857	2,964	9.7	8.5	11.6	10.9	11.8
South Africa	1.00	1.49	1.84	1.48	1.78	2,962	3,229	3,397	3,155	3,256	1.9	1.5	1.6	1.5	1.6
Sudan	1.00	1.68	2.39	1.48	1.91	2,329	2,465	2,714	2,430	2,635	11.4	12.7	9.0	13.7	10.9
Tanzania, United Rep.	1.00	1.63	2.39	1.55	2.19	2,178	2,396	2,602	2,305	2,432	15.6	17.8	17.8	20.6	23.3
Uganda	1.00	1.88	3.01	1.76	2.66	2,391	2,585	2,796	2,519	2,664	8.5	10.4	11.3	11.8	13.9
Middle East and North Africa	1.00	1.52	2.03	1.51	2.01	3,125	3,250	3,377	3,207	3,275	29.3	34.2	34.5	35.8	38.4
Algeria	1.00	1.55	2.05	1.44	1.77	2,977	3,098	3,163	3,062	3,075	1.9	1.9	1.9	2.0	2.2
Egypt	1.00	1.49	2.00	1.44	1.92	3,395	3,580	3,783	3,518	3,641	1.6	2.2	2.5	2.2	2.5
Iran	1.00	1.47	1.92	1.50	1.99	3,079	3,109	3,228	3,068	3,129	4.7	5.2	4.4	5.7	5.3
Iraq	1.00	1.80	3.19	1.77	3.11	2,342	2,651	2,773	2,616	2,681	7.8	7.5	8.5	7.9	9.6
Morocco	1.00	1.62	2.29	1.44	1.86	3,287	3,592	3,856	3,548	3,744	1.7	1.9	2.0	1.9	2.0
Saudi Arabia	1.00	1.74	2.68	1.73	2.63	2,936	3,055	3,128	3,022	3,054	1.3	1.4	1.5	1.5	1.8
Turkey	1.00	1.44	1.68	1.46	1.75	3,596	3,661	3,698	3,620	3,599	1.8	2.2	2.4	2.2	2.4
THE AMERICAS	1.00	1.35	1.65	1.26	1.46	3,188	3,290	3,392	3,244	3,299	42.5	35.7	27.7	39.4	32.8
Latin America and the Caribbean	1.00	1.44	1.79	1.40	1.68	2,878	3,036	3,184	2,984	3,080	39.5	32.1	24.0	35.9	28.8
Argentina	1.00	1.42	1.73	1.42	1.72	3,171	3,327	3,426	3,297	3,355	0.7	0.6	0.7	0.6	0.7
Brazil	1.00	1.51	1.92	1.41	1.65	3,142	3,336	3,492	3,292	3,399	3.7	3.2	3.1	3.2	3.1
Colombia	1.00	1.37	1.62	1.43	1.76	2,645	2,804	2,957	2,758	2,867	5.0	3.9	2.7	4.5	3.6
Mexico	1.00	1.33	1.56	1.29	1.48	3,040	3,134	3,240	3,055	3,099	5.3	5.4	5.3	6.1	6.1
Peru	1.00	1.47	1.79	1.69	2.38	2,472	2,752	2,886	2,697	2,776	3.6	2.0	1.4	2.3	1.9
Venezuela	1.00	1.39	1.72	1.29	1.49	2,536	2,626	2,763	2,578	2,669	1.4	1.3	0.7	1.6	1.2
North America	1.00	1.28	1.54	1.16	1.28	3,714	3,725	3,735	3,690	3,660	3.0	3.6	3.7	3.6	4.0
EUROPE & FORMER SOVIET UNION	1.00	1.16	1.26	1.13	1.21	3,275	3,390	3,491	3,360	3,417	17.1	13.0	11.4	13.4	12.4
Former Soviet Union	1.00	1.21	1.32	1.17	1.27	3,092	3,321	3,423	3,287	3,339	9.7	5.9	5.2	6.2	5.5
Russia	1.00	1.20	1.32	1.18	1.31	3,227	3,450	3,532	3,417	3,454	1.8	1.2	1.1	1.2	1.2
Ukraine	1.00	1.16	1.23	1.08	1.11	3,201	3,434	3,581	3,399	3,499	0.6	0.4	0.3	0.4	0.3
Uzbekistan	1.00	1.30	1.49	1.28	1.46	2,563	2,849	3,024	2,819	2,934	2.4	0.8	0.8	0.9	0.8
Europe	1.00	1.14	1.24	1.11	1.18	3,370	3,424	3,523	3,396	3,454	7.4	7.0	6.2	7.3	6.9

Note: World and regional figures include other regions and countries not reported separately. Country-level details are available online. Aggregate food production is an index, by weight, of cereals, meats, fruits and vegetables, oilseeds, pulses, and roots and tubers (which are reported separately in Table 6). Per capita food consumption is a projection of daily dietary energy supply. Estimates of the number of people at risk of hunger are based on a quadratic specification of the relationship between national-level calorie supply and the share of population that is undernourished as defined by the FAO. Values reported for 2010 are calibrated model results. Projections for 2030 and 2050 assume changes in population and income as reflected in the IPCC's Shared Socioeconomic Pathway 2. Climate change impacts are simulated using the IPCC's Representative Concentration Pathway 8.5 and the HadGEM general circulation model. Further documentation is available at www.ifpri.org/program/impact-model.

TABLE 6 IMPACT projections of production, consumption, and net trade to 2050 by commodity group, with and without climate change

	Total production (million metric tons)					Per capita food consumption (kg per capita per year)					Net trade (million metric tons)				
	2010	Without climate change		With climate change		2010	Without climate change		With climate change		2010	Without climate change		With climate change	
		2030	2050	2030	2050		2030	2050	2030	2050		2030	2050		
CEREALS															
WORLD	2,155	2,746	3,235	2,622	2,986	143.5	146.7	148.3	143.4	140.4	0.0	0.0	0.0	0.0	0.0
Developing countries	1,390	1,826	2,154	1,802	2,106	148.7	151.6	153.0	148.0	144.5	-86.6	-124.0	-224.3	-60.8	-93.0
Developed countries	765	920	1,081	820	880	116.3	118.3	120.4	116.7	115.6	86.6	124.0	224.3	60.8	93.0
ASIA AND PACIFIC	859	1,067	1,195	1,048	1,164	148.7	152.1	154.3	148.9	146.1	-39.7	-69.7	-129.4	-28.7	-8.7
East Asia	393	451	479	464	511	145.2	148.2	147.3	145.4	140.3	-43.3	-63.3	-74.5	-6.9	61.9
South Asia	279	384	454	362	414	148.5	150.7	154.1	147.5	145.9	-5.1	-8.3	-52.7	-21.7	-65.9
Southeast Asia and Pacific	187	232	262	221	239	158.1	164.6	167.6	159.7	157.2	8.6	1.9	-2.2	0.0	-4.6
AFRICA AND MIDDLE EAST	229	337	428	328	408	149.3	151.0	151.5	146.6	142.4	-91.5	-157.6	-261.3	-152.8	-239.1
Africa south of the Sahara	114	184	254	179	239	121.8	129.3	134.4	124.0	124.3	-32.2	-63.5	-119.9	-57.6	-102.4
West	49	79	110	75	99	143.5	152.4	155.3	146.6	144.5	-13.7	-29.8	-60.3	-28.9	-56.5
Central	7	12	18	12	16	59.3	65.4	68.9	62.3	63.0	-3.1	-6.3	-11.8	-5.9	-10.5
East	39	65	91	64	91	115.7	125.6	134.1	119.5	122.8	-8.7	-17.1	-31.9	-13.6	-21.6
Southern	13	18	21	19	23	182.8	194.8	201.5	187.3	187.3	-3.5	-7.1	-12.5	-4.6	-7.2
Middle East and North Africa	114	153	174	149	169	201.4	198.3	194.4	195.9	187.6	-59.3	-94.1	-141.4	-95.1	-136.7
North Africa	42	55	62	49	50	204.7	202.5	198.7	199.6	191.3	-30.6	-46.4	-68.5	-49.9	-73.0
Middle East	78	107	126	108	129	183.2	179.1	175.8	177.1	169.8	-31.8	-50.9	-76.1	-49.7	-70.1
THE AMERICAS	600	817	1,033	714	806	120.6	121.7	121.5	118.9	115.3	100.8	189.9	312.3	132.5	131.5
Latin America and the Caribbean	164	245	322	236	295	128.0	129.6	129.8	126.0	122.8	-23.4	-18.4	-5.8	-17.6	-57.1
Caribbean	2	2	3	2	3	103.7	104.9	105.3	102.4	100.1	-5.6	-7.3	-9.1	-6.9	-8.0
Central America	38	52	66	51	64	156.9	156.6	155.2	150.2	144.0	-23.4	-28.3	-29.0	-25.0	-25.3
South America	125	191	254	182	227	118.7	120.5	120.9	118.1	115.6	5.6	17.2	32.3	14.3	-23.9
North America	436	572	711	478	511	108.2	108.3	107.8	106.6	102.9	124.3	208.3	318.1	150.0	188.7
EUROPE AND FORMER SOVIET UNION	467	525	579	532	609	135.9	140.6	144.2	139.1	139.1	30.4	37.4	78.4	49.0	116.2
Former Soviet Union	156	206	244	217	271	162.1	170.8	174.5	169.3	168.9	21.5	62.3	101.5	77.2	136.7
Europe	311	319	334	315	338	122.3	125.5	129.6	124.1	124.8	8.9	-24.9	-23.1	-28.2	-20.5
MEATS															
WORLD	274	381	460	379	453	39.4	45.6	49.5	45.3	48.8	0.0	0.0	0.0	0.0	0.0
Developing countries	174	254	312	252	307	30.5	37.7	41.9	37.4	41.1	-3.6	-14.4	-21.5	-14.0	-19.6
Developed countries	100	127	148	127	145	86.5	91.1	95.8	90.8	95.2	3.6	14.4	21.5	14.0	19.6
ASIA AND PACIFIC	109	150	166	149	164	30.3	39.6	43.3	39.3	42.4	-7.0	-25.3	-34.7	-25.1	-33.3
East Asia	79	99	93	98	91	56.5	76.3	81.3	75.7	80.2	-9.2	-22.5	-25.6	-22.8	-26.0
South Asia	10	19	31	19	31	6.0	10.7	17.8	10.5	17.0	0.2	-2.9	-11.4	-2.6	-9.9
Southeast Asia and Pacific	20	32	43	32	42	28.8	41.6	49.6	41.3	48.8	2.0	0.1	2.3	0.3	2.6
AFRICA AND MIDDLE EAST	22	40	66	40	65	18.3	23.7	31.3	23.5	30.7	-2.7	-6.1	-12.9	-6.0	-12.1
Africa south of the Sahara	11	20	35	20	34	13.0	18.1	26.8	17.9	26.2	-0.4	-3.6	-13.5	-3.4	-12.6
West	3	6	11	6	11	10.2	16.2	26.6	15.9	25.5	-0.3	-1.9	-7.3	-1.8	-6.6

Table 6 continued

	Total production (million metric tons)					Per capita food consumption (kg per capita per year)					Net trade (million metric tons)				
	2010	Without climate change		With climate change		2010	Without climate change		With climate change		2010	Without climate change		With climate change	
		2030	2050	2030	2050		2030	2050	2030	2050		2030	2050	2030	2050
Central	1	1	2	1	2	9.1	12.2	17.0	12.1	16.7	-0.4	-1.0	-2.1	-1.0	-2.0
East	3	6	10	6	10	10.3	14.4	22.5	14.3	22.1	0.0	-1.1	-4.9	-1.1	-4.7
Southern	2	4	5	4	5	45.2	61.0	73.3	60.6	72.4	-0.2	-0.1	-0.1	-0.1	-0.1
Middle East and North Africa	11	20	31	19	31	28.3	36.0	42.4	35.8	41.9	-2.3	-2.5	0.7	-2.5	0.4
North Africa	5	10	17	10	16	22.6	32.0	42.9	31.8	42.4	0.0	0.3	2.0	0.3	2.0
Middle East	7	13	20	13	20	31.2	38.0	43.5	37.8	43.0	-1.9	-2.2	-0.5	-2.2	-0.7
THE AMERICAS	89	127	158	126	155	82.2	88.0	93.0	87.6	92.3	11.5	29.1	44.5	28.6	42.6
Latin America and the Caribbean	44	67	85	66	83	61.4	69.9	76.6	69.4	75.7	7.2	16.7	25.9	16.5	25.3
Caribbean	1	2	2	2	2	34.5	43.3	52.4	43.0	51.7	-0.1	-0.2	0.0	-0.1	0.0
Central America	7	10	13	10	13	51.0	58.4	65.8	58.0	65.0	-0.9	-0.9	-0.8	-0.8	-0.7
South America	36	55	69	54	68	68.1	76.9	83.2	76.5	82.3	8.2	17.7	26.7	17.5	26.0
North America	45	61	73	60	72	117.6	119.0	120.2	118.7	119.6	4.4	12.5	18.7	12.1	17.3
EUROPE AND FORMER SOVIET UNION	54	64	69	64	69	67.5	72.0	76.3	71.6	75.7	-1.8	2.3	3.0	2.5	2.8
Former Soviet Union	10	12	14	12	13	46.0	55.3	59.5	55.0	59.0	-3.0	-3.3	-3.2	-3.3	-3.2
Europe	44	52	56	52	55	78.6	80.3	84.4	79.9	83.7	1.2	5.6	6.2	5.7	6.1
FRUITS AND VEGETABLES															
WORLD	1,592	2,334	3,044	2,290	2,913	196.2	240.0	284.7	235.5	272.2	0.0	0.0	0.0	0.0	0.0
Developing countries	1,304	1,952	2,554	1,918	2,447	191.2	239.7	290.6	235.0	277.2	15.1	-20.1	-90.5	-14.4	-76.9
Developed countries	288	383	490	372	466	222.8	241.4	248.6	238.0	242.0	-15.1	20.1	90.5	14.4	76.9
ASIA AND PACIFIC	868	1,259	1,586	1,258	1,562	209.7	278.7	358.7	273.1	341.1	-44.8	-141.4	-279.9	-114.4	-213.0
East Asia	609	800	938	820	978	351.0	432.7	430.1	426.4	419.0	-20.4	-5.4	192.7	26.5	252.5
South Asia	158	318	467	300	411	104.7	197.7	366.8	192.2	342.6	-29.7	-127.5	-466.1	-132.9	-460.6
Southeast Asia and Pacific	101	141	181	138	173	134.0	176.0	205.1	171.9	195.3	5.3	-8.5	-6.6	-8.0	-4.9
AFRICA AND MIDDLE EAST	251	436	661	421	617	155.9	171.4	190.1	168.2	182.7	1.9	33.1	77.8	26.1	57.2
Africa south of the Sahara	101	188	301	173	258	95.4	119.7	150.0	116.7	142.7	-1.0	-9.3	-34.1	-18.9	-59.7
West	40	74	118	70	105	117.2	145.3	174.4	141.6	165.7	0.3	-3.5	-14.8	-5.7	-21.3
Central	10	17	27	16	22	66.0	82.4	103.1	80.1	97.5	0.1	-1.3	-4.4	-2.5	-7.6
East	36	70	121	65	106	82.2	105.5	138.5	102.9	131.6	-1.2	-5.4	-12.9	-8.2	-20.6
Southern	9	15	21	14	17	76.2	89.2	98.3	87.3	94.2	2.9	6.4	10.1	5.2	7.1
Middle East and North Africa	150	248	361	248	359	270.2	284.3	290.5	280.5	283.0	3.0	42.4	111.9	45.1	116.9
North Africa	57	99	149	89	124	228.9	250.1	270.3	246.6	262.8	0.0	16.5	44.1	8.1	22.8
Middle East	98	160	226	167	243	278.0	287.3	291.0	283.5	283.5	-0.2	20.3	55.6	29.2	76.8
THE AMERICAS	255	351	447	338	419	187.0	212.1	226.7	208.4	219.0	49.2	74.6	123.8	66.6	107.1
Latin America and the Caribbean	164	236	299	224	271	159.6	182.9	202.9	179.6	195.5	46.3	76.3	108.3	66.9	86.8
Caribbean	12	15	18	14	15	192.6	218.7	245.0	216.1	239.1	2.3	3.4	4.6	1.9	1.8
Central America	46	59	67	55	58	165.5	180.0	196.8	176.7	189.6	15.4	18.6	18.1	15.1	10.9
South America	107	162	214	156	198	154.2	181.0	202.0	177.6	194.5	28.7	54.3	85.7	49.9	74.0

Table 6 continued

	Total production (million metric tons)					Per capita food consumption (kg per capita per year)					Net trade (million metric tons)				
	2010	Without climate change		With climate change		2010	Without climate change		With climate change		2010	Without climate change		With climate change	
		2030	2050	2030	2050		2030	2050	2030	2050		2030	2050	2030	2050
North America	91	114	147	114	148	233.6	262.4	265.9	257.9	257.7	2.9	-1.7	15.4	-0.3	20.3
EUROPE AND FORMER SOVIET UNION	218	289	351	274	314	209.2	230.9	241.8	227.8	235.7	-6.3	33.7	78.4	21.7	48.7
Former Soviet Union	62	81	95	79	89	181.6	223.0	239.5	219.7	232.5	0.1	5.0	14.0	3.8	10.4
Europe	156	208	255	195	225	223.5	234.8	242.9	231.8	237.2	-6.4	28.7	64.4	17.9	38.2
OILSEEDS															
WORLD	673	1,033	1,293	1,014	1,246	6.8	8.2	7.8	7.9	7.3	0.0	0.0	0.0	0.0	0.0
Developing countries	525	842	1,079	830	1,047	7.0	8.6	8.2	8.3	7.6	-3.0	-8.5	-11.5	-7.2	-9.1
Developed countries	148	191	214	184	199	5.6	5.9	5.9	5.6	5.5	3.0	8.5	11.5	7.2	9.1
ASIA AND PACIFIC	322	536	713	532	700	8.1	10.4	9.5	10.0	8.9	-35.4	-59.6	-69.9	-55.7	-61.5
East Asia	49	63	68	64	70	10.9	15.9	15.1	15.4	14.3	-44.3	-62.8	-66.7	-59.1	-59.2
South Asia	41	52	57	50	52	3.6	4.5	4.3	4.3	4.0	0.5	-4.5	-9.7	-4.6	-9.6
Southeast Asia and Pacific	231	421	589	417	578	13.1	14.7	14.6	14.3	13.9	8.4	7.7	6.4	8.0	7.3
AFRICA AND MIDDLE EAST	61	101	126	98	118	5.5	6.4	7.2	6.1	6.5	-6.1	-8.8	-13.5	-8.1	-11.5
Africa south of the Sahara	53	90	113	86	104	5.9	6.8	7.7	6.5	6.9	0.2	-1.2	-4.6	-1.0	-3.8
West	43	74	94	72	87	8.1	9.3	10.1	8.8	9.1	0.3	-0.5	-2.7	-0.4	-2.4
Central	4	6	8	6	7	9.0	10.0	10.6	9.4	9.5	0.1	0.1	0.1	0.2	0.4
East	4	6	7	6	7	3.7	4.4	5.3	4.2	4.8	0.1	-0.3	-1.3	-0.2	-0.9
Southern	1	1	2	1	1	1.9	2.1	2.1	2.0	2.0	-0.2	-0.3	-0.3	-0.2	-0.2
Middle East and North Africa	9	12	14	12	14	4.7	5.5	6.0	5.3	5.5	-6.3	-7.6	-8.8	-7.0	-7.6
North Africa	4	6	7	5	6	4.6	5.3	5.7	5.1	5.2	-1.5	-1.8	-2.2	-1.7	-2.1
Middle East	5	7	9	8	9	4.6	5.2	5.6	5.0	5.2	-5.0	-6.1	-7.2	-5.7	-6.2
THE AMERICAS	235	323	371	313	348	6.8	6.7	6.5	6.5	6.0	58.7	83.7	97.5	77.8	84.7
Latin America and the Caribbean	126	184	215	179	205	6.6	6.4	6.0	6.2	5.5	27.2	46.3	56.6	43.4	49.4
Caribbean	1	1	1	1	1	7.8	8.0	7.8	7.7	7.4	-0.3	-0.3	-0.4	-0.3	-0.4
Central America	6	9	10	8	9	3.2	3.1	3.1	3.0	2.9	-5.5	-6.0	-6.5	-5.7	-5.9
South America	119	174	204	170	195	7.9	7.7	7.1	7.3	6.5	33.0	52.6	63.5	49.4	55.6
North America	110	139	155	133	144	7.1	7.2	7.2	7.0	6.7	31.5	37.3	40.8	34.4	35.3
EUROPE AND FORMER SOVIET UNION	55	72	83	71	80	2.6	2.7	2.9	2.6	2.7	-17.2	-15.3	-14.1	-14.0	-11.7
Former Soviet Union	14	19	22	19	23	1.1	1.2	1.2	1.2	1.2	-0.4	0.5	1.4	0.7	1.8
Europe	40	53	60	52	58	3.3	3.5	3.6	3.3	3.4	-16.8	-15.8	-15.4	-14.8	-13.5
PULSES															
WORLD	66	94	121	92	117	6.2	7.5	8.9	7.5	8.8	0.0	0.0	0.0	0.0	0.0
Developing countries	52	74	97	72	91	6.7	8.2	9.8	8.1	9.6	-2.8	-6.5	-9.9	-7.6	-12.7
Developed countries	14	19	24	20	26	3.5	3.8	4.0	3.8	4.0	2.8	6.5	9.9	7.6	12.7
ASIA AND PACIFIC	28	37	44	36	42	5.2	6.2	7.3	6.2	7.2	-0.5	-3.3	-5.2	-3.1	-5.2
East Asia	6	8	11	8	12	1.5	1.9	2.1	1.9	2.1	0.5	1.8	4.7	2.2	5.6
South Asia	16	21	24	20	23	9.4	10.6	11.7	10.5	11.4	-2.9	-6.1	-10.1	-6.2	-10.5

Table 6 continued

	Total production (million metric tons)					Per capita food consumption (kg per capita per year)					Net trade (million metric tons)				
	2010	Without climate change		With climate change		2010	Without climate change		With climate change		2010	Without climate change		With climate change	
		2030	2050	2030	2050		2030	2050	2030	2050		2030	2050	2030	2050
Southeast Asia and Pacific	7	8	8	8	8	3.1	3.6	3.9	3.5	3.8	1.9	1.0	0.2	0.8	-0.3
AFRICA AND MIDDLE EAST	16	25	35	23	32	9.7	11.3	13.4	11.2	13.1	-1.9	-5.6	-11.6	-6.4	-13.4
Africa south of the Sahara	12	19	28	18	27	10.4	12.3	14.7	12.1	14.3	-0.9	-4.0	-9.4	-3.9	-9.2
West	5	9	16	9	14	8.5	9.8	11.6	9.6	11.0	0.3	0.1	-0.3	0.0	-0.6
Central	1	2	2	2	2	6.7	7.4	8.7	7.3	8.4	-0.1	-0.2	-0.3	-0.2	-0.2
East	5	7	9	7	10	15.3	18.2	22.0	18.0	21.5	-0.7	-3.3	-7.9	-3.1	-7.4
Southern	0	0	0	0	0	3.8	4.2	4.5	4.1	4.4	-0.1	-0.1	0.0	-0.1	0.0
Middle East and North Africa	4	6	7	5	5	8.2	9.2	10.0	9.2	10.0	-1.0	-1.7	-2.3	-2.5	-4.2
North Africa	1	2	2	1	2	8.2	9.7	11.4	9.8	11.4	-1.1	-1.8	-2.6	-2.1	-3.2
Middle East	3	4	5	4	4	8.3	8.8	9.2	8.8	9.2	-0.2	-0.4	-0.6	-1.0	-2.0
THE AMERICAS	14	21	28	21	30	8.9	9.7	10.4	9.7	10.3	3.2	7.2	12.5	8.0	14.4
Latin America and the Caribbean	7	11	16	10	15	11.4	12.6	13.8	12.5	13.6	-0.7	1.1	4.4	0.7	3.0
Caribbean	0	0	1	0	1	12.4	13.4	14.8	13.3	14.6	-0.2	-0.2	0.0	-0.2	-0.1
Central America	2	3	4	3	3	12.5	13.6	15.2	13.5	15.0	-0.4	-0.2	0.0	-0.4	-0.4
South America	5	8	12	7	11	10.8	12.1	13.1	12.0	12.9	0.0	1.5	4.4	1.2	3.6
North America	7	10	12	11	15	4.6	4.8	4.9	4.8	4.9	3.8	6.0	8.0	7.3	11.3
EUROPE AND FORMER SOVIET UNION	8	11	14	11	14	2.6	2.7	2.8	2.7	2.8	-0.8	1.7	4.4	1.6	4.2
Former Soviet Union	3	4	5	4	5	1.5	1.6	1.6	1.6	1.6	0.4	1.3	2.4	1.3	2.5
Europe	5	7	9	7	8	3.1	3.3	3.4	3.3	3.4	-1.2	0.5	2.0	0.3	1.7
ROOTS AND TUBERS															
WORLD	780	1,006	1,185	962	1,101	65.0	70.5	73.4	67.7	68.9	0.0	0.0	0.0	0.0	0.0
Developing countries	682	897	1,068	857	995	65.8	72.4	75.7	69.5	71.1	5.6	-0.6	-5.4	-0.6	-0.6
Developed countries	97	109	118	105	106	61.2	59.8	59.3	57.5	56.1	-5.6	0.6	5.4	0.6	0.6
ASIA AND PACIFIC	298	351	365	356	379	46.9	50.9	49.5	48.3	45.6	-4.9	-23.4	-18.8	1.4	28.7
East Asia	181	201	185	201	182	71.4	76.3	73.5	72.9	68.7	-18.5	-14.2	-0.1	-3.4	11.6
South Asia	50	75	103	79	119	27.3	35.7	38.0	33.0	33.8	-6.2	-24.2	-30.6	-12.1	2.2
Southeast Asia and Pacific	67	76	77	76	78	37.5	39.4	39.9	38.6	38.6	19.9	15.0	11.9	16.9	14.9
AFRICA AND MIDDLE EAST	245	377	524	361	485	109.3	117.3	123.1	113.8	116.9	-1.8	-13.0	-31.6	-16.5	-39.4
Africa south of the Sahara	224	349	490	332	449	146.4	152.7	156.1	149.0	149.1	-1.1	-11.0	-29.0	-17.7	-42.8
West	133	207	297	201	280	197.5	199.0	198.8	194.7	190.8	1.5	-4.3	-11.7	-4.1	-9.8
Central	37	59	80	56	72	172.5	170.6	166.7	167.2	160.2	1.0	2.6	-2.2	0.1	-8.2
East	50	78	107	71	91	129.6	138.5	142.0	134.5	134.4	-3.2	-9.4	-15.3	-13.9	-24.6
Southern	3	4	5	4	5	36.8	37.7	38.7	36.5	37.0	0.0	0.7	1.3	0.9	1.3
Middle East and North Africa	21	28	34	29	36	39.0	39.9	40.5	37.0	36.3	-0.8	-2.1	-2.6	1.2	3.4
North Africa	9	14	18	15	20	33.7	38.3	42.1	35.6	37.8	-0.1	0.2	-0.3	2.0	4.0
Middle East	13	15	18	15	17	38.8	36.6	35.2	34.0	31.7	-1.1	-2.8	-3.4	-1.6	-2.1
THE AMERICAS	86	112	130	110	127	55.7	54.5	53.0	52.4	50.0	-0.3	10.2	19.1	14.1	26.1

Table 6 continued

	Total production (million metric tons)					Per capita food consumption (kg per capita per year)					Net trade (million metric tons)				
	2010	Without climate change		With climate change		2010	Without climate change		With climate change		2010	Without climate change		With climate change	
		2030	2050	2030	2050		2030	2050	2030	2050		2030	2050	2030	2050
Latin America and the Caribbean	60	82	97	83	98	51.1	49.9	47.9	48.3	45.7	0.2	11.5	20.4	16.1	29.5
Caribbean	3	5	7	5	6	61.4	59.0	56.6	58.2	55.2	0.1	1.7	3.5	1.3	2.6
Central America	3	5	7	5	6	17.4	18.5	19.9	17.5	18.2	-0.2	0.2	0.8	0.2	0.3
South America	53	72	83	74	87	63.6	62.1	59.3	60.3	56.7	0.3	9.6	16.1	14.6	26.5
North America	26	29	33	27	28	63.3	62.5	61.5	59.3	57.1	-0.4	-1.4	-1.3	-2.0	-3.3
EUROPE AND FORMER SOVIET UNION	150	166	166	134	111	89.0	86.5	85.3	83.4	80.9	7.0	26.3	31.3	0.9	-15.5
Former Soviet Union	82	89	84	63	42	115.3	112.1	109.6	107.3	102.9	8.5	18.7	18.3	-4.2	-19.6
Europe	68	77	82	72	69	75.3	73.8	73.6	71.6	70.4	-1.5	7.7	13.0	5.1	4.2

Note: World and regional figures include other regions and countries not reported separately. Country-level details are available online. Total production is aggregated across irrigated and rainfed systems at the national level and aligned with years as reported in FAOSTAT. Per capita food consumption is based on food availability at the national level. Net trade includes negative and positive numbers indicating that a region is a net importer or exporter, respectively, and balances to zero at the global level. Cereals include barley, millet, rice, sorghum, wheat, and aggregated other cereals. Meats include beef, pork, poultry, and sheep and goats. Fruits and vegetables include banana, plantain, aggregated temperate fruits, aggregated tropical fruits, and aggregated vegetables. Oilseeds include groundnuts, rapeseed, soybean, sunflower, and aggregated other oilseeds. Pulses include beans, chickpeas, cowpeas, lentils, pigeonpeas, and aggregated other pulses. Roots and tubers include cassava, potato, sweet potato, yams, and aggregated other roots and tubers. Values reported for 2010 are calibrated model results. Projections for 2030 and 2050 assume changes in population and income as reflected in the IPCC's Shared Socioeconomic Pathway 2. Climate change impacts are simulated using the IPCC's Representative Concentration Pathway 8.5 and the HadGEM general circulation model. Further documentation is available at www.ifpri.org/program/impact-model.

Source: IFPRI, IMPACT Model version 3.3, October 2016.