

**Per Pinstруп-Andersen**



**Suggested Priorities  
for Policy Research  
to Improve Food Security  
and Nutrition in Eurasia**

Suggested Priorities for Policy Research to Improve Food Security and Nutrition in Eurasia by Per Pinstrup-Andersen is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

Technical editor: Hope Steele



The content, findings, interpretations, and conclusions of this publication are the sole responsibility of the author and can in no way be taken to reflect the views of the Eurasian Center for Food Security or The World Bank.

This paper was prepared for the Eurasian Center for Food Security (ECFS) and the World Bank, May 19, 2017. Per Pinstrup-Andersen is Professor Emeritus, Cornell University; Adjunct Professor, University of Copenhagen; and Senior Consultant to the World Bank.

The author is grateful to Artavazd Hakobyan, Kamiljon Akramov, Julia Mitusova, Suresh Babu, and David Nielson for assisting in identifying relevant literature and data and for their reviews of an earlier draft. The paper benefitted greatly from their comments and suggestions. The full responsibility for the content of the paper rests with the author.

ISBN: 978-5-9908414-2-0

© Eurasian Center for Food  
Security and The World Bank, 2017

## Executive Summary

This paper suggests priorities for policy research to support action to improve food security and nutrition in Eurasia. The paper has benefitted from expert consultations and a review of available literature. The paper does not make recommendations about priority policy action, but instead it attempts to identify important knowledge gaps for which new policy research is needed. The suggested priority policy research is organized into the following four sets of challenges and opportunities:

1. Improving the diets of the Eurasian population
2. Meeting future food demands; enhancing agricultural incomes; and improving national, regional, and international supply chains
3. Sustainably managing natural resources
4. Managing risk and uncertainty

Seventeen subjects for priority policy research are suggested. They cut across the four challenges mentioned above, and are listed below in order of perceived priority:

### High Priority

1. A political economy analysis of food self-sufficiency versus trade-based transformation of food and agriculture systems and a related analysis of the state's role in on-farm decision-making.<sup>1</sup> A set of country studies focusing on the impact of past, current, and potential future state action and choice of transformation design on food security, nutrition, and sustainability in natural resource management, followed by a cross-country synthesis, is proposed. It is expected that this work can be done with existing data and interviews of key decision makers in the food and agriculture systems, including agricultural leaders, government officials, and policy makers.
2. Microeconomic research to improve the understanding of household behavior and related gender-specific decision-making processes with a focus on how to guide diet transitions toward food security and good nutrition. A set of case studies followed by a cross-case synthesis is proposed. This work should be based on primary data collected from households and individual household members.
3. A political economy analysis comparing the nutrition effects of a set of existing food production and processing systems with an emphasis on how to change food and agriculture systems to merge economic, political, and nutritional goals. A set of five to six case studies for specified production and processing systems is proposed. Causal links between the production for the farm family's own consumption and household food security and nutrition and similar links

---

1 The term political economy is used in this paper to signify analyses that take into account both economic efficiency and allocation of benefits and costs among stakeholder groups as well as estimates of how decision-making processes respond to and influence the expected outcomes of policy interventions.

for production for sale should be considered. All the studies could be done in one country and might subsequently be repeated in other countries if needed to generate location-specific evidence.

4. A political economy feasibility analysis of the introduction of biofortified crops into Eurasian production systems. This would include an assessment of any political opposition, farmer and consumer acceptance, and requirements for seed distribution. This research could be performed with existing data and interviews with relevant stakeholder groups.
5. A political economy analysis of why governments and other relevant stakeholder groups in Eurasia responded as they did to past economic and political shocks that affected food systems. This work, which should be based on available information about how governments have responded to past shocks, should consist of country studies and a cross-country synthesis and be based on primary data from interviews of stakeholder representatives.
6. Agriculture sector risk assessments for Uzbekistan and Turkmenistan. These assessments should use the same methodology that was used in completed studies for Tajikistan, the Kyrgyz Republic, and Kazakhstan (Broka et al. 2016a, 2016b, 2016c).
7. A political economy analysis of the food security and nutrition effects of existing and alternative land and water tenure arrangements and farm sizes. Emphasis should be on the role of government in resource property rights and economies of scale in primary production under different tenure arrangements. The impact on farm productivity and incomes would be estimated both because they are goals in their own right and also because they are key links to food security and nutrition. This priority may be relevant for only some of the region's countries. It is unclear whether the required data are available for this work or additional primary data would have to be collected.
8. A synthesis of results of completed policy-related economic analyses of land and water management in Eurasian countries. The emphasis should be on identifying knowledge gaps to support policy to improve irrigation management, taking into account both economic and environmental goals.
9. A political economy analysis of how to ensure sustainable management of pastures currently suffering from exploitation and inappropriate management and tenure arrangements. This research, which would build on results from past agronomic research, should analyze existing stakeholder goals and pursue opportunities for removing conflicts among them through compensation of losers and enforceable regulations.

## Medium Priority

10. A synthesis of existing results from past policy research on the food security and nutrition implications of strengthening the Eurasian Economic Union. This can be based on Mogilevskii and Akramov (2014) and Yakubovich and Enikeyeva (2017).

11. An analysis of the comparative social benefit/cost of government investment in each of a set of public goods to promote food security and good nutrition. This analysis would probably be relevant for all the Eurasian countries. It could be undertaken with secondary data.
12. A political economy analysis of food supply chains to assist policy makers in designing and implementing value chains that meet both economic and nutrition goals. The emphasis should be on multi-commodity supply chains and potential conflicts. Trade-offs between economic and nutrition objectives in value chain development should be analyzed. One or two preliminary studies are proposed to develop appropriate analytical methods and identify data requirements.
13. A review of the analytical methods applied in a recent study of access to clean drinking water and good sanitation in Uzbekistan (World Bank 2015c). The review would incorporate the study's empirical results and policy recommendations to assess whether the recommendations would be relevant for other countries and, if not, to undertake similar studies in the other countries.
14. A cross-country synthesis of the experiences, efficiencies, costs, and political economy aspects of the existing food safety regulations and institutions in each of the Eurasian countries. The aim would be to develop lessons for policy interventions to develop best practices.
15. Testing and evaluating the food security and nutrition impact of conditional cash transfer programs in a few cohorts of low-income households. This could be developed as action research using an experimental design that includes cohorts of households that receive conditional cash transfers and cohorts that do not.

## Low Priority

16. An assessment of the economic feasibility of vertical indoor production of vegetables in or near a large city in the Eurasian region and identification of related political economy issues. Emphasis should be on the costs of production—including energy and capital costs as well as the emission of CO<sub>2</sub>—relative to traditional production. The impact on the consumption of micronutrients by at-risk populations groups should also be assessed.
17. A political economy analysis of the creation of a futures markets institution in one of the countries. Emphasis should be on the development of an institution that would help manage risk and uncertainty in food production caused by climate change and market price volatility.

In addition to the subjects above, there are other areas where new knowledge about Eurasia's food and agriculture sectors is needed. For example, an assessment of the adequacy of the current agricultural research and research institutions to support current and expected future technological change as well as an assessment of the effectiveness of agricultural advisory services in the context of the increasing number of small and medium-size farms appear to be required. Expanded research on how the Eurasian agriculture is likely to be affected

by climate change and what measures for mitigation or adaptation could be designed and implemented, as well as an assessment of the qualities of the region's soils and productive capacities (building on Krasilnikov et al. 2016). Although improved knowledge of Eurasian soils is very important as an input into policy research, its nature and focus go beyond food security and nutrition.

The above-mentioned policy research will be effective in providing the evidence needed to help guide policy action only if it is based on relevant primary and secondary data. A cursory review of the currently available data yielded very disappointing results. Except for the Russian Federation, it appears that Eurasian countries have placed much less emphasis on data collection than other Asian and European countries. Without sound data, policy research runs the risk of becoming nothing more than speculation or ideological advocacy. There is a pressing and important need to take stock of what data are currently available for policy advice and to develop a plan for expanding the collection of relevant data, both for specific studies and for longitudinal and cross-sectional monitoring.

Panel data collected from both urban and rural households on an annual basis is one area where data collection is urgently needed. Such data should take in all relevant aspects of food systems, including food and agricultural production, trade and consumption data, and household incomes as well as nutrition data. The Eurasian Center for Food Security (ECFS) is well placed to take regional leadership in such stocktaking and planning for the enhanced production, storage, and use of regional data. Collaboration with international organizations such as the Food and Agriculture Organization of the United Nations (FAO) and the International Food Policy Research Institute (IFPRI) could facilitate such work.

Although sound data are essential for empirical policy research, they are useful only if applied in sound analytical frameworks. It is critically important that each country develop and maintain a strong analytical capacity focused on the development of evidence to assist policy makers and decision makers in other stakeholder groups in making informed decisions. ECFS could play a major role in strengthening national and regional analytical capacity through graduate training, periodic workshops, and research networks, with support from international organizations such as IFPRI, as required.

The ultimate purpose of the policy research proposed in this paper is to improve human and environmental health in Eurasia, including better household and individual food security, good nutrition for all, and sustainable management of natural resources. This will be achieved only if the research results are relevant and only if they are applied by decision makers. It is argued here that the use of a political economy approach enhances both relevance and the probability of sound application. In addition, institutions may need to change at national levels to implement the policy research. That, however, is considered beyond the scope of this paper.

## Introduction

This paper is about policy research to improve food security and nutrition in the Eurasian region in a manner compatible with the sustainable management of natural resources. The purpose of the paper is not to suggest priorities for policy interventions. Rather, it is to

identify knowledge gaps and suggest priority policy research that will help fill the gaps and assist governments and other stakeholder groups in decision-making, including the design and implementation of policy interventions. The paper does not pretend to provide the ultimate truth about priority policy research to improve food security and nutrition for Eurasia. The aim is the more modest one of serving to initiate or contribute to a debate about which policy research topics should take priority. The priorities are based on expert consultations and review of available literature.

The analyses in this paper focus on the Central Asian region,<sup>2</sup> while recognizing that there is a lot of variation between countries. The policy-related challenges, opportunities, knowledge gaps, and priorities for policy research for food security vary across countries. Policy research must take the context into account. The policy research priorities suggested in this paper are likely to be relevant for most, but not necessarily all, the countries in the Eurasian region. In addition to country-specific research, cross-country syntheses may be suitable for generating lessons useful for policy makers in several countries.

Why is policy research needed? The Eurasian region is perhaps the least covered by food policy research in both domestic and international research programs. This is a legacy of Soviet Union, where food policy was centralized and many newly independent republics either did not inherit food policy research capacity or the capacity that remained was not suitable for the new economic reality.

As a result, the food policy in the region is largely based on ad-hoc government capacities or at best on the recommendations of external researchers (through donor programs). Neither of these base their decisions and advice on robust domestic research, but instead use globally available evidence or data to guide local policy decisions. Insufficient policy capacity was reflected in the food crisis in 2008–09, when the countries were searching for policy tools to address increasing food prices. The required context-specific knowledge was missing or in very short supply. Some of the countries were urgently requesting assistance from the donor community, which in turn was constrained by competing demands from other regions.

The knowledge gaps and suggested policy research priorities are presented for each of the following four challenges and opportunities confronting food security, nutrition, and natural resource management in the Eurasian countries:

1. Improving the diets of the Eurasian population
2. Meeting future food demands; enhancing agricultural incomes; and improving national, regional, and international supply chains
3. Sustainably managing natural resources
4. Managing risk and uncertainty

---

2 In addition to the Central Asian countries of Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan, the Russian Federation and Armenia are included in this assessment.

## Improving the Diets of the Eurasian Population

Like most other countries, the region's population suffers from the triple burden of malnutrition: deficient consumption of dietary energy, micronutrient deficiencies, and excessive intake of dietary energy resulting in overweight and obesity. In addition to human suffering and negative economic effects for individuals and societies, all three burdens increase the probability of serious health effects, which in turn are costly for societies.

The nature of the malnutrition burden differs among countries. As shown in Table 1, the prevalence of undernourishment has dropped to very low levels over the last 25 years, except for Tajikistan where about one-third of the population is estimated to suffer from undernourishment.<sup>3</sup> However, in spite of impressive improvements in access to sufficient food in the region, a large share of children below the age of 5 years suffers from stunting, a measure of past and current malnutrition and poor health.<sup>4</sup> As shown in Table 2, the prevalence of stunting varies from 12.9 percent in the Kyrgyz Republic to 26.8 in Tajikistan. Uzbekistan and the Kyrgyz Republic have made impressive gains in this regard. Wasting prevalence is high in Tajikistan and improved very significantly in Uzbekistan.<sup>5</sup>

---

3 Sometimes referred to as *food insecurity*, the term *undernourishment* is an estimate of the percentage of the population not having access to the food required for a healthy and productive life. Although the estimate is defined by some as "lack of access to sufficient dietary energy," it is likely that it covers both lack of energy and lack of protein, fats, and micronutrients.

4 Stunting is an anthropometric measure of low height-for-age measured by the Z-score, or the standard deviation from a norm. A child is considered stunted with a height-for-age Z-score of -2 or lower.

5 Wasting is an anthropometric indicator of low weight-for-height measured by the Z-score, or standard deviation from a norm. A child with a weight-for-height Z-score of -2 or lower is considered wasted.



**TABLE 1: Prevalence of Undernourishment (%), 1990–92 to 2014–16**

	1990–92	2000–02	2010–12	2014–16	Average annual percentage change <sup>a</sup>
<b>Caucasus and Central Asia</b>	<b>14.1</b>	<b>15.3</b>	<b>8.9</b>	<b>7.0</b>	<b>–2.9</b>
Armenia	27.3	23.0	6.8	5.8	–6.3
Kazakhstan	<5.0	<5.0	<5.0	<5.0	n.a.
Kyrgyz Republic	15.9	16.7	7.2	6.0	–4.0
Tajikistan	28.1	39.5	36.8	33.2	–1.2
Turkmenistan	8.6	8.4	<5.0	<5.0	n.a.
Uzbekistan	<5.0	14.4	7.7	<5.0	n.a.
Russian Federation	<5.0	<5.0	n.a.	<5.0	n.a.
<b>Developing country average</b>	<b>23.3</b>	<b>18.2</b>	<b>14.1</b>	<b>12.9</b>	<b>–2.4</b>

**Source:** FAO 2017.

*Note:*

*a* The average percentage change per year is calculated from the end points, except for Tajikistan, for which the calculation is from 2000–02 to 2014–16, since the civil war there lasted from 1992 to 1997. n.a. = not applicable.

**TABLE 2: Selected Indicators of Undernourishment**

		Stunting (percentage of children < 5 years old)		Wasting (percentage of children < 5 years old)	
Country	Years	First Year	Last Year	First Year	Last Year
Armenia	1998, 2010	15.1	20.8	3.3	4.2
Kazakhstan	1999, 2013	13.9	13.1	2.5	4.1
Kyrgyz Republic	1997, 2014	32.6	12.9	3.3	2.8
Tajikistan	2005, 2012	33.1	26.8	8.7	9.9
Turkmenistan	2000	28.1	n.a.	7.1	n.a.
Uzbekistan	1996, 2006	39.0	19.6	13.7	4.5
Correlation with income per capita, 2010		–0.45	–0.29	–0.48	–0.33

**Source:** FAO 2017.

*Note:*

*n.a.* = not applicable.

Micronutrient deficiencies in the Eurasian diet are a serious problem (Table 3). Between one-third and one-half of the children under 5 years of age in all the countries suffer from anemia. This is caused primarily by an iron deficiency in the diet. Iron deficiency is also high among women, particularly pregnant women in the Eurasian region (WHO 2015). Vitamin A and zinc deficiencies are also very widespread among children and adults.

**TABLE 3: Major Micronutrient Deficiencies (%)**

	Anemia in preschool-aged children <sup>a</sup>		Vitamin A deficiency in preschool-aged children <sup>b</sup>	Prevalence of zinc deficiency in total population <sup>c</sup>
Country	1998	2010	1995–2005	2004
Armenia	27	33	0.6	49.4
Kazakhstan	45	30	27.1	9.6
Kyrgyz Republic	44	36	26.3	13.8
Tajikistan	42	29	26.8	66.8
Turkmenistan	55	44	28.0	24.2
Uzbekistan	55	44	53.1	24.4
Russian Federation	26	26	14.1	11.7
Correlation with income per capita, 2010	<b>-0.77</b>	<b>-0.83</b>	<b>-0.26</b>	<b>-0.60</b>

*Note:*

*a* Estimated percentage of preschool-aged children with hemoglobin less than 110 grams per liter of blood. Data from FAOSTAT 2016.

*b* Estimated percentage of children 0 to 5 with serum retinol less than 0.70  $\mu\text{mol}$  per liter of blood. Data from WHO 2009, Table A3.3.

*c* Estimated percent of population at risk for inadequate zinc intake. The recommended daily allowance of zinc consumption for a male of 65 kilograms was estimated to be between 13 and 19 milligrams per day, depending on the type of diet. Data from Brown et al. 2004.

Overweight and obesity and related chronic diseases are a very serious public health problem in Eurasia. As shown in Tables 4 and 5, the prevalence of overweight and obesity has increased rapidly during the last 25 years: the current prevalence of overweight is roughly 50 percent of the population, of whom 9–26 percent are obese. The prevalence of both overweight and obesity is lowest in Tajikistan and highest in Kazakhstan and the Russian Federation.

**TABLE 4: Prevalence of Overweight<sup>a</sup> (%), ages 18+ <sup>b</sup>, 1990–2014**

Country	1990		2000		2010		2014		Percentage change from 1990 to 2014	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Armenia	38.0	42.3	39.9	44.1	50.5	51.1	54.9	53.2	44%	26%
Kazakhstan	42.2	43.4	45.8	46.8	55.9	53.4	59.9	55.5	42%	28%
Kyrgyz Republic	34.7	35.7	36.6	38.8	42.2	45.1	45.2	47.9	30%	34%
Tajikistan	33.5	35.6	31.8	36.1	36.4	43.4	39.4	46.5	18%	31%
Turkmenistan	37.7	39.1	40.8	43.3	48.2	50.3	52.6	53.7	40%	37%
Uzbekistan	36.3	36.5	38.5	40.3	43.5	47.2	46.8	50.7	29%	39%
Russian Federation	45.1	53.8	47.7	52.6	56.7	54.5	60.3	54.8	34%	2%

**Source:** WHO 2017.

*Note:*

*a* Body Mass Index  $\geq 25$  kg/m<sup>2</sup>.

*b* Age standardized estimate.

**TABLE 5: Prevalence of Obesity<sup>a</sup> (%), ages 18+ <sup>b</sup>, 1990–2014**

	1990		2000		2010		2014		Percentage change from 1990 to 2014	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
<b>Armenia</b>	8.2	13.0	8.7	14.1	13.8	19.6	16.1	23.1	96%	78%
<b>Kazakhstan</b>	10.0	14.9	12.2	17.0	18.5	22.0	21.3	23.9	113%	60%
<b>Kyrgyz Republic</b>	6.1	9.3	7.0	10.7	9.8	14.7	11.4	16.7	87%	80%
<b>Tajikistan</b>	5.6	9.4	5.2	9.0	7.6	13.5	9.2	15.6	64%	66%
<b>Turkmenistan</b>	7.3	11.5	9.1	13.9	13.4	19.0	16.4	21.8	125%	90%
<b>Uzbekistan</b>	6.4	9.4	7.5	11.4	10.4	16.1	12.5	18.6	95%	98%
<b>Russian Federation</b>	10.4	24.1	12.0	23.4	17.3	25.7	19.6	26.2	88%	9%

**Source:** WHO 2017.

*Note:*

*a* Body Mass Index  $\geq 30$ kg/m<sup>2</sup>.

*b* Age standardized estimate.

A recent study in the Khatlon Province of Tajikistan (IFPRI 2016) illustrates the prevalence of widespread under- and over-nutrition in the same cohort of households. Based on primary data collected from 2,000 households, the study found that 35.5 percent of women between the age of 15 and 49 years were overweight and an additional 12.6 percent were obese, while 5.5 percent were underweight. In the same cohort, 29.3 percent of the preschool-aged children were stunted, 9.2 percent were wasted, and 16 percent underweight. The design and implementation of policy actions to reduce malnutrition in such a situation, which may be representative of low-income populations throughout Eurasia, is likely to be successful only if based on solid knowledge of household behavior.

The nature of the dietary transition differs among countries in the region. In the poorer countries such as the Kyrgyz Republic, cereal consumption remains stable while the consumption of meats decreases and the consumption of sugar, sweeteners, and oils increases. In wealthier countries such as the Russian Federation, cereal consumption is falling while the consumption of meats, oils, fish, and vegetables is increasing. Excessive intake of dietary energy relative to the energy expended is causing widespread and increasing overweight, obesity, and related chronic diseases such as diabetes, hypertension, and heart disease in all the Eurasian countries. Much of the blame for this very serious public health problem goes to unhealthy diets, which at the same time leaves a large share of the Eurasian population deficient in essential micronutrients. The dominance of wheat and other cereals in the Eurasian diet is partly to blame for the excessive calorie intake, which reaches an average daily per capita intake of 2,600 calories in Uzbekistan and 2,800 calories in the Kyrgyz Republic. Sixty percent of the average calorie intake in Tajikistan, Uzbekistan, and the Kyrgyz Republic comes from wheat and other cereals.

Much evidence to support policy interventions to increase food security and reduce malnutrition is available but it is almost all from outside Eurasia. Research is essential to improve the understanding of household behavior and related gender-specific decision-making processes in each of the Eurasian countries. In particular, more research is needed to help guide a diet transition toward more nutrient-dense foods—particularly foods with micronutrients such as fruits, vegetables, dairy products, and meats—and away from calorie-dense foods including processed foods high in sugar, sweeteners, oils, and fats. Such research should be based on primary data collected from representative samples of households most at risk of food insecurity and/or malnutrition, and it should be based on conceptual and empirical pathways showing how policy interventions might affect household behavior. In addition to the study mentioned above, another study for Tajikistan (Akramov and Malek 2014) illustrates the kind of research needed to improve the understanding of household-level issues that can be undertaken when household data are available.

Poverty is an important cause of food insecurity and malnutrition. About one-third of the population in Tajikistan and a quarter of the population of Armenia and the Kyrgyz Republic fall below the poverty line of PPP\$ 2.15/day. With a Gini coefficient around 0.3, income distribution in the Eurasian countries is more equitable than it is in most other Asian countries. Remittances have played an important role in some countries over some time periods. Policies to increase household purchasing power through food or cash transfers and food subsidies are widespread throughout the world. Conditional cash transfers have been successful in several countries. The degree of success in improving food security and nutrition, as well as the best design and the choice of conditions, are context-specific. Testing and

evaluating conditional cash transfer programs in a few cohorts of low-income households could help determine whether such programs should be promoted for Eurasia and, if so, how they are best designed and implemented.

Commodity-specific taxes and subsidies have been implemented both within and outside the region to guide dietary changes to reduce deficiencies and excesses. Their impact on food security and nutrition has been mixed. Food subsidies targeted toward low-income households have been more cost-effective than untargeted programs, but sharply targeted programs often suffer from insufficient political support. Untargeted commodity-specific taxes to guide consumers toward a more healthy diet and reduced micronutrient deficiencies and obesity have been successful in a few countries, particularly if they are combined with information campaigns. However, commodity-specific subsidies and taxes are difficult to implement and government-enforced price controls are generally not effective as tools to guide food demands and diets.

During the last 10 years there has been a very significant increase in the international debate about how to change food systems to enhance their positive effects and reduce their negative ones on nutrition and health. The promotion of biofortified food commodities has been the most successful outcome. Contrary to industrial fortification, in which nutrients are added post-harvest, biofortification enhances the content of specific micronutrients in the seed through agricultural research. The program HarvestPlus, which is part of the Consultative Group for International Agricultural Research (CGIAR), has successfully developed and field tested several food commodities with an enhanced content of iron, zinc, and vitamin A. Efficacy trials have shown a significant positive nutrition impact. In view of the high prevalence of deficiencies of the three micronutrients covered by HarvestPlus, the introduction of the biofortified varieties into Eurasian food systems should be considered. Feasibility studies may be needed to promote successful design and implementation.

Vertical indoor farming offers an opportunity to produce large amounts of micronutrient-dense foods in urban and peri-urban locations with a large prevalence of micronutrient deficiencies. The productivity per unit of land, water, and plant nutrients is high and pesticides are not needed. This is of particular importance in the Eurasian region because of the very limited amount of available arable land and the high dependence on limited water resources for irrigation. Furthermore, as further discussed in the section about risk management, vertical indoor farming eliminates volatilities and losses in the production of micronutrient-dense foods caused by climate change and related extreme weather events as well as pests. Vertical indoor production of vegetables is expanding globally, and large-scale commercial production units appear to be able to compete in the marketplace of some countries, including parts of the United States and Singapore. However, more economic assessments are needed before commercial units are recommended for Eurasian cities. In particular, the availability and cost of energy should be analyzed.

Many other opportunities exist to improve the nutrition and health effects of food systems. However, in spite of a large amount of conceptual work resulting in a multitude of suggested pathways through which changes in food systems can flow to improved nutrition, as well as policy recommendations, the impact on nutrition has been very limited. The main reason for the very limited impact is the failure to consider political economy factors. Food systems are driven by decision makers who focus on economic relationships and favor economic goals, not nutrition and health goals. Unless action can be identified that removes conflict between

nutrition and economic goals pursued by governments and other decision-making agents in food systems, the desired nutrition-improving changes will not take place. Policy research is urgently needed to identify such action. This requires a focus on decision-making processes among farmers, consumers, traders, agricultural researchers, the news media, government officials, government policy makers, and other decision makers with influence over food systems. Win-win solutions to food insecurity have to be found and implemented. Such research is particularly important to generate evidence about how household food security and nutrition would be affected by changing agricultural production patterns such as, for example, changing from the current widespread use of land and water for cotton and wheat production to production of a broader portfolio of food commodities. The key question is: What policy interventions would be needed to ensure compatibility between economic and nutrition outcomes?

Food security and good nutrition can be ensured only if the food consumed is safe. Existing food safety monitoring and institutions vary greatly across the region's countries. A cross-country synthesis of the experiences, efficiencies, costs, and political economic aspects related to each country's efforts is likely to produce lessons useful to moving toward improved regional standards, institutions, and monitoring for the benefit of consumers, traders, and farmers. Such regional standards would also facilitate intra-regional food trade as well as exports to other countries.

## **Meeting Future Food Demands; Enhancing Agricultural Incomes; and Improving National, Regional, and International Supply Chains**

Population and income growth, changes in income distribution and poverty, urbanization, and diet transitions will influence future food demand in Eurasia and, together with food supplies and prices, will influence household food security among consumers and farmers. Although the future rate of population growth in the region is expected to be low, incomes are projected to grow by at least 3 to 4 percent annually, urbanization will proceed at historic rates, and diets are likely to incorporate more vegetables and processed foods. According to the Asian Development Bank (2015), the agricultural growth rate during 2014 was very impressive in some countries, notably Armenia with 7.8 percent and Uzbekistan with 6.9 percent, although the Kyrgyz Republic suffered a small negative growth rate. The high rates of growth in Armenia and Uzbekistan were caused in part by the Russian embargo on imports from other countries, and it is unclear whether such high growth rates will continue.

Urbanization in Central Asia is different from urbanization in East Asia. In the latter, the urbanization has been driven by large productivity increases in agriculture caused by the Green Revolution. Multiplier effects and transfers of capital from rural to urban areas contributed to significant investments in East Asian cities, which created new jobs and attracted people from rural areas. Dietary transitions resulted. Central Asia did not experience the large agricultural productivity increases, the changes in cities have been very limited, and rural-urban migration resulted in large measure in the movement of poor people from one economic activity (agriculture) to another one (urban service jobs) without the reduction in poverty and without the dietary transition seen in East Asia.

One of the key policy questions confronting net food-importing Eurasian countries is whether food self-sufficiency should be an overriding goal of agricultural policies and, if so, self-sufficiency in which commodities.<sup>6</sup>

Should government regulations and incentives be guided toward reduced cotton production and increased production of wheat or toward a broader portfolio of food commodities, including pulses, fruits, and vegetables? Or should cotton and/or wheat production be expanded? Should farmers be incentivized to produce for regional trade? Should governments dictate to farmers what to grow, as they do in some Eurasian countries such as Uzbekistan and Turkmenistan? Or should government action focus on investment in public goods such as infrastructure, risk management tools, and input and output market institutions and supply chains, leaving decisions about what to grow to the farmers?

Answers to these and related questions will necessarily be based on both economic and political goals and calculations. These calculations are more likely to result in desired outcomes if they are based on solid evidence about the impact of various policy decisions, including the impact on various stakeholder groups. This paper is primarily interested in how policy decisions related to the above questions affect food security and nutrition. Unfortunately, there is very little empirical evidence on that question for Eurasia.<sup>7</sup> Evidence from other countries points to the conclusion that the pursuit of food self-sufficiency usually does not lead to better household food security than the dependence on trade that reflects comparative advantage. Furthermore, household food security is usually best served when governments invest in public goods, such as those mentioned above, leaving on-farm decisions to farmers and market transactions to the private sector. In general, the decision space available to each stakeholder group—including farmers, traders, and consumers—as compared to the decision space occupied by government is an important issue in determining the impact of policy interventions on food security and nutrition. Unfortunately, this issue is frequently overlooked by food policy analysts.

However, the evidence is context-specific and there is a pressing need for more policy research to better understand the economic and political consequences of self-sufficiency and the allocation of decision-making power for various stakeholder groups in each of the Eurasian countries. Ideally such research would identify empirically based pathways from various policy interventions to food security and nutrition. It would be based on data from the main stakeholder groups, including consumers, farmers, and various public and private sector agencies as well as policy makers.

A special effort should be made to either identify policy interventions that would satisfy economic as well as political and nutritional goals for the key stakeholder groups or to suggest trade-offs to be considered. These studies should also analyze the role of livestock in future production systems from the point of view of nutrition and natural resource management. Poleshkina and Peplozyan (2017) and Nefedjev and Bolotbekova (2017)

---

6 *National food self-sufficiency* is defined here as a situation in which all the food consumed in a country is produced in the same country. It differs from *food security*, which is defined as access to the food needed for a healthy and productive life. The term *food security* is usually used for households but not for nations. A third term found in the debate is *food sovereignty*, which refers to a country's ability to get access to the food needed to meet domestic demand, irrespective of whether the food is produced domestically or imported.

7 Following the breakup of the Soviet Union, a great deal was written about how to guide economic transformations in the Eurasian countries. However, nutrition effects were generally not considered.



provide interesting perspectives on how government policies should be designed for the livestock sectors in Armenia and the Kyrgyz Republic.

In addition to the above key policy questions, policy research is needed to generate evidence for a series of other challenges and opportunities related to food production for better food security and nutrition. Some of these are mentioned below.

Grain yields of 2–3 tons per hectare in most of the Eurasian countries (4–5 tons per hectare in Uzbekistan) are low compared to yields of other Asian countries. Considerable evidence shows very significant opportunities to increase yields through better access and use of improved seeds and other innovations that are applied widely elsewhere in Asia, as well as better soil and water management and more effective agricultural extension (Van Berkum 2015). Investments in rural infrastructure, including irrigation infrastructure, and improved output and input markets, including access to credit, pesticides, and fertilizers, have been shown to be effective in increasing agricultural production. Very high economic rates of return from such investments have been found in other Asian countries, and IFPRI studies for China and India have estimated relative returns to various kinds of public investments, thus guiding the allocation of public resources. Similar research would be useful to assist Eurasian governments in their allocation of public funds and possibly to identify opportunities for foreign direct investments.

Land and water tenure and property rights are important policy issues for Eurasian food security. They are linked to the ongoing debate about optimal farm sizes. In some of the region's countries consideration is given to the consolidation of large numbers of very small farms, while in others the policy question is whether to divide up large land holdings. Policy decisions on these matters and the role of the state in decisions about what to grow would benefit from additional policy research to estimate its impact on food production and the food security of high-risk population groups. As for much of the other policy research suggested in this paper, this research should include both economic and political issues and how these issues are affected by the decision-making processes followed by key stakeholder groups.

Another set of policy interventions for which more evidence is needed relates to the extent to which Eurasian food and agriculture systems should pay more attention to the impact on household food security and nutrition. As mentioned earlier, micronutrient deficiencies and obesity are very serious challenges for all the Eurasian countries, and Tajikistan is also fighting a high prevalence of calorie deficiency. Research in countries outside the region, such as China for example, has shown that policy interventions must be tailored to the specific food and nutrition problem to be solved and to the population groups suffering from the problem. In fact, individual interventions may reduce the prevalence of one problem such as calorie deficiencies while amplifying another, such as obesity. However, promoting the supply of nutrient-dense foods, whether from domestic production or imports, is likely to benefit a large share of the Eurasian population and harm no one. Furthermore, research from other countries shows that a more diverse production pattern is likely to result in a more diverse diet of both the farm household and net food-buying households residing in the community where the food is produced. This is caused in part by the consumption of own production and in part by a more diversified food supply in the local markets.

As mentioned in an earlier section of this paper, much research has been done to find ways to change food systems to benefit nutrition and health, but its impact on action has been very



limited. What is needed both in the Eurasian region and elsewhere is research that improves the understanding of the decision-making processes by key stakeholder groups, including but not limited to government agencies and policy makers. Such studies should include the above-mentioned production systems—for example, those of cotton, wheat, or a diversified portfolio of crops. Research should also look at the role of livestock, fish, pulses, vegetables, and other nutrient-dense food commodities for the food security and nutrition of both producers and consumers. Changes in incomes and prices as well as behavioral factors are important intermediaries between changes in food systems and food security and nutrition, and selective agricultural subsidies and taxes might be considered to alter the production patterns and increase farm incomes. It is proposed that the research should build on the large amount of conceptual work done elsewhere and the pathways identified. The research should be clear about both the economic and political effects of the recommendations made.

Eurasian food security and nutrition are affected by the structure and performance of the food supply chain. Processing may alter raw materials from agriculture for the benefit of nutrition—for example, fortification to reduce micronutrient deficiencies. Alternatively it may harm nutrition—for example, by removing nutrients or producing calorie-dense processed foods that contribute to obesity and chronic diseases. Deficient storage and transportation facilities may harm food safety and human health by, for example, providing an environment that encourages the growth of mycotoxins and causes large food losses and waste. Poorly functioning state-owned marketing monopolies may reduce prices to farmers and/or increase consumer prices, in both cases potentially resulting in food insecurity. Although food value chains are expected to increase the economic value of the food products along the chain from farmers to consumers, their nutritional value and health value may deteriorate. Economic and political analyses of food supply chains are urgently needed to assist policy makers with designing and implementing value chains that meet both economic and nutrition goals. Although value chain analyses are usually carried out for one commodity at a time, there is a need for analyses of multi-commodity value chains with nutrition value as the common denominator. The analyses should assess the most appropriate roles for the public and the private sectors and possible public-private partnerships. Farmer-instigated marketing co-operatives might be one of the arrangements assessed.

## Sustainably Managing Natural Resources

Water and land management is a key policy issue in Eurasia. Repairing past unsustainable use of soil and water is recognized by governments and other stakeholder groups in the region as extremely important and urgent. Crumbling irrigation infrastructure and continued unsustainable irrigation management add to widespread soil degradation, particularly waterlogging and salinization, drawdown of groundwater levels, and excessive extraction of surface water. A number of recent studies (Demidov and Akhmadov 2017; Golovleva 2016; Mavlyanova, Kulov, and Jooshov 2017; Safarova and Khasankhanova 2017; Trifonova 2017; World Bank 2015a; World Bank 2017) provide important policy-relevant evidence in support of government action. It is suggested that work similar to that undertaken by the World Bank for Tajikistan (2017) be undertaken for other Eurasian countries. Studies in other countries show that changes in property rights for land and water are vital to help ensure sustainability in natural resource management.

A “tragedy of the commons” is playing out on much of Eurasia’s pastures. Overgrazing appears to be a direct outcome of failed tenure arrangements, but more evidence about the economic and political consequences of alternative policy interventions to bring sustainability back to pasture management would be useful.

A recent study for Uzbekistan (World Bank 2015c) provided very important policy-relevant evidence about how to help ensure sufficient access to clean drinking water and good sanitation, factors essential to good nutrition and health. The study was based on primary data collected specifically for the study, and the recommendations for action reflect the challenges currently confronting households in the sample population. Before similar studies are undertaken in other Eurasian countries, it would be useful for analysts and policy advisors to assess whether the contexts in these countries are sufficiently similar to justify similar recommendations.

Kiselev et al. (2013) provide an overview of the links between climate change and food security in the Russian Federation. Eurasian agriculture and food security are very vulnerable to climate change and the associated temperature increase and extreme weather events. According to available projections, it appears that the agriculture sector in parts of the Eurasian region may benefit from the higher temperature and the higher concentration of CO<sub>2</sub> in the atmosphere while other parts may suffer. As further discussed in the next section, the increasing risk and uncertainty caused by extreme weather events may have very serious negative effects on food security and nutrition unless precautionary action is taken.

The impact of climate change on soil fertility and water availability may also affect food security and nutrition negatively. However, the uncertainty associated with the projected impact of climate change on agriculture makes decisions about policy interventions difficult and potentially erroneous. Nevertheless, certain adaptation and mitigation policies—such as supporting more agricultural research to develop crop varieties and animals tolerant of drought, floods, strong winds, higher temperatures, and changing cropping seasons—could be pursued. New crop pests and animal diseases should be identified to help set priorities for agricultural research. In this context, there is a need to assess existing institutional arrangements for agricultural research and consider institutional change where warranted.

As mentioned earlier, vertical, indoor food production provides a controlled environment free of the impact of weather volatility on production, farm incomes, and prices. It could provide a stable supply of nutrient-dense foods for urban areas, but indoor plant production requires a great deal of electricity and may be too costly unless energy prices are low. Recent innovations in renewable energy sources—such as solar energy and LED lighting as well as increasing efficiency of wind energy—may make indoor production of vegetables economically viable while reducing CO<sub>2</sub> emissions. Energy use and CO<sub>2</sub> emissions would also be reduced by placing the vertical food units in urban or peri-urban areas, thus reducing transportation distances. Considerable evidence and experience in this area is being generated outside the region, but feasibility studies should be undertaken within the Eurasian context prior to beginning commercial vertical indoor food production.

## Managing Risks and Uncertainty

Eurasia's food security is exposed to volatility in incomes, food production, and prices. The agriculture sector's dependence on fragile natural resources makes it vulnerable to climate change, resulting in production and price volatility. Furthermore, heavy dependence on world markets for wheat—either as a major exporter (Kazakhstan and the Russian Federation) or as a major importer (the other Eurasian countries and Armenia)—tends to transmit world market price volatility to the countries' domestic markets, while domestic price fluctuations caused by domestic factors such as droughts and imperfect competition may be dampened by a more stable world market.

Pursuing self-sufficiency in food is not a viable risk management strategy. Production decisions based on comparative advantage while spreading the risk of production shortfalls caused by extreme weather or pest attacks across countries through market integration and trade is more reliable. Regional futures markets for basic food staples might be a risk management tool worth pursuing, subject to a solid feasibility study.

Governments need evidence about how best to deal with these risks and uncertainties to protect food security and nutrition. Some such evidence is available. Agriculture sector risk assessments have been completed for Tajikistan, the Kyrgyz Republic, and Kazakhstan (Broka et al. 2016a, b, and c). Similar assessments would be useful for the other Eurasian countries and Armenia. These studies would provide the economic rationale for action. They should be complemented by a set of political economy studies that would identify political rationales, which should increase the probability that action would be taken.<sup>8</sup>

Evidence is needed about behavioral processes behind the responses to fluctuations in food availability and prices by government and other stakeholders. Knowledge about why governments and other stakeholder groups in each country responded to past uncertainty and shocks, irrespective of whether the shock was caused by droughts, floods, price fluctuations, energy price change, changes in remittance incomes, or other shocks to the food system would be useful to predict responses to future shocks and to attempt to make responses more appropriate for the protection of food security and nutrition. In particular, such political economy analyses of stakeholder responses to volatility and shocks in food production, prices, and incomes would be useful for adapting to market shocks and extreme weather events caused by climatic change.

In order to derive generalizable lessons for future policy interventions, it would be useful to undertake a study for each country and a cross-country synthesis. These lessons should help policy makers and other stakeholder groups improve management of risk and uncertainty and identify policy options, such as early warning programs, food storage, targeted transfers, or other interventions for future use.

Much is known about the action taken by governments in response to economic shocks. For example, the response to the global food and economic crises during the period 2007–12 varied from trade restrictions for grains introduced by Tajikistan, Turkmenistan, and Uzbekistan to reduced value added tax for wheat and price controls in Tajikistan and social

---

8 The methodology for such studies and the results from empirical studies in 14 countries may be found in Pinstrup-Andersen, ed. (2015).

assistance payments in the Kyrgyz Republic. Studies for Tajikistan (Akromov 2013; Akramov and Shreedhar 2012; and Ilyasov et al. 2016), for the Kyrgyz Republic (World Bank 2015b), and for Central Asia (Akramov 2012) provide considerable detail about government responses to international economic volatilities and their impact on food security. The knowledge gap that should be filled by the suggested policy research is concerned with the motivations, behavioral issues, and decision-making processes underlying these policy decisions.

## **Concluding Comments: Solid Evidence Is Key to Informed Policy Making**

The need for knowledge to make evidence available to government policy makers that would help them make the most appropriate policy choices to achieve their goals is urgent and important and changes over time. Similarly, evidence is needed for other stakeholder groups to take the action most effective in achieving their goals. Faulty action or lack of action may mean that opportunities for improving human and environmental health are foregone. This paper proposes what policy research should be undertaken to support policy action, not what action should be taken.

A political economy approach to generating evidence in which the decision processes, goals, and relative power of each stakeholder group are considered and understood is more likely to result in action generating the impact desired by the stakeholder groups. This paper addresses the societal goal of improving food security and nutrition while managing natural resources sustainably. However, policy-making entities and other stakeholder groups are confronted with many other goals, and trade-offs are usually required. This may well mean that the “first-best” solution to existing food insecurity, malnutrition, and unsustainable management of natural resources may be unacceptable to those in power. Compromises are likely to be needed. However, the overriding importance of a healthy population—now and in the future—for the achievement of other economic and political goals should always be remembered.

## References

- ADB (Asian Development Bank). 2015. Asian Development Outlook 2015: Financing Asia's Future Growth. Manila: Asian Development Bank.
- Akramov, Kamiljon T. 2012. "Agricultural Transformation and Food Security in Central Asia." In E. Ayşen Hiç Gencer and Cevat Gerni, eds. *Central Asian Economies in Transition*. Newcastle upon Tyne: Cambridge Scholars Publishing, pp. 72–89.
- — —. 2013. "Food Security Challenges and Agricultural Development in Tajikistan." In Stefan Mann, ed. *The Future of Mountain Agriculture*. Berlin and Heidelberg: Springer Geography, pp. 127–4.
- Akramov, Kamiljon T. and Mehrab Malek. 2014. "Agricultural Biodiversity, Dietary Diversity, and Nutritional Outcomes: Empirical Evidence from Tajikistan." Presentation at the Regional Research Conference Agricultural Transformation and Food Security in Central Asia, 2014 (IFPRI and UCA 2014).
- Akramov, Kamiljon T. and Ganga Shreedhar. 2012. "Economic Development, External Shocks, and Food Security in Tajikistan." IFPRI Discussion Paper 01163. Washington, DC: IFPRI.
- Broka, Sandra, Åsa Giertz, Garry Christensen, Debra Rasmussen, Alexei Morgounov, Turi Fileccia, and Rhoda Rubaiza. 2016a. "Kazakhstan: Agricultural Sector Risk Assessment." World Bank Group Report N. 103076-KZ, February. Washington, DC: World Bank.
- Broka, Sandra, Åsa Giertz, Garry Christensen, Charity Hanif, and Debra Rasmussen. 2016b. "Tajikistan: Agricultural Sector Risk Assessment." World Bank Group Report No. 103077-TJ, February. Washington, DC: World Bank.
- Broka, Sandra, Åsa Giertz, Garry Christensen, Charity Hanif, Debra Rasmussen, and Rhoda Rubaiza. 2016c. "The Kyrgyz Republic: Agricultural Sector Risk Assessment." World Bank Group Report No. 103078-KG, February. Washington, DC: World Bank.
- Brown, Kenneth H., Juan A. Rivera, Zulfiqar Bhutta, Rosalind S. Gibson, Janet C. King, B. Lönnerdal, Marie T. Ruel, Brittmarie Sandtröm, Emorn Wasantwisut, Christine Hotz, Daniel Lopez de Romaña, and Janet M. Pearson. 2004. "International Zinc Nutrition Consultative Group, technical document No. 1." *Food and Nutrition Bulletin* 25 (1): Suppl. 2).
- Demidov, Valery and Hukmatullo Akhmadov. 2017. "Rehabilitation of Saline Soils in Tajikistan: The Example of Saline Soils in Vakhsh Valley." In *Food Security in Eurasia: Case Studies*. Moscow: Lomonosov Moscow State University, pp. 29–44.
- ECFS (Eurasian Center for Food Security) (2017). *Food Security in Eurasia: Case Studies*. Moscow: Lomonosov Moscow State University.  
<http://ecfs.msu.ru/en/resources/case-study-publication-food-security-eurasia-778>
- FAO (Food and Agriculture Organization of the United Nations). 2017. *Europe and Central Asia: Regional Overview of Food Insecurity*. Budapest: FAO.  
<http://www.fao.org/3/a-i6877e.pdf>
- FAOSTAT. 2016. Food and Agriculture data. <http://www.fao.org/faostat/en/#home>
- Golovleva, Julia. 2016. *Soil Salinization in Central Asia*. Moscow: Eurasian Center for Food Security (ECFS).
- IFPRI (International Food Policy Research Institute). 2016. "Feed the Future Tajikistan 2015 Zone of Influence Interim Assessment Report." Washington, DC: IFPRI.
- IFPRI and UCA (International Food Policy Research Institute and University of Central Asia). 2014. "Policy Research Conference: Agricultural Transformation and Food Security in Central Asia, April 8–9, 2014, Bishkek, Kyrgyzstan. Unpublished Conference Proceedings.
- Ilyasov, Jarilkasin, Linde Götz, Kamiljon T. Akramov, Paul A. Dorosh, and Thomas Glauben. 2016.

- “Market Integration and Price Transmission in Tajikistan’s Wheat Markets: Rising like Rockets but Falling like Feathers?” IFPRI Discussion Paper 01547, August. Washington, DC: IFPRI.
- Kiselev, Sergey, Roman Romashkin, Gerald C. Nelson, Daniel Mason-D’Croz, and Amanda Palazzo. 2013. “Russia’s Food Security and Climate Change: Looking into the Future” Economics Discussion Papers No. 2013-16. Econstor and Kiel Institute for the World Economy. <http://hdl.handle.net/10419/69904>
- Krasilnikov, Pavel, Maria Konyushkova, and Ronald Vargas, eds. 2016. Land Resources and Food Security in Central Asia and the Caucasus. Moscow: Eurasian Center for Food Security (ECFS). <http://www.fao.org/3/a-i5914b.pdf>
- Mavlyanova, Nadia, Kubanichbek Kulov, and Payaziddin Jooshov. 2017. “Suggested Actions to Reduce Irrigation Erosion in the Kyrgyz Republic.” In Food Security in Eurasia: Case Studies. Moscow: Lomonosov Moscow State University, pp. 45–64.
- Mogilevskii, Roman and Kamiljon Akramov. 2014. “Trade in Agricultural and Food Products in Central Asia.” Working Paper No. 27. University of Central Asia, Institute of Public Policy and Administration.
- Nefedjev, Ivan and Aida Bolotbekova. 2017. “Development Issues in the Traditional Livestock Sector of the Kyrgyz Republic.” In Food Security in Eurasia: Case Studies. Moscow: Lomonosov Moscow State University, pp. 123–39.
- Pinstrup-Andersen, Per, ed. 2015. Food Price Policy in an Era of Market Instability. London: Oxford University Press.
- Poleshkina, I. and E. Peplozyan. 2017. “The Dairy Sector of Armenia: Relationships among Supply Chain Members.” In Food Security in Eurasia: Case Studies. Moscow: Lomonosov Moscow State University, pp. 101–22.
- Safarova, Ajsulu and Gulchekhra Khasankhanova. 2017. “Water and Land Management and Agricultural Policy in Support of Food Security: The Amu Darya Delta in Uzbekistan.” In Food Security in Eurasia: Case Studies. Moscow: Lomonosov Moscow State University, pp. 65–84.
- Trifonova, Tatiana. 2017. “Intensive Fish Farming as a Contributor to the Depletion of Underground and Surface Water Resources in the Ararat Valley.” In Food Security in Eurasia: Case Studies. Moscow: Lomonosov Moscow State University, pp. 11–28.
- Van Berkum, Siemen. 2015. “Agricultural Potential and Food Security in Central Asia in the Light of Climate Change.” Technical Report. LEI Wageningen UR, the Netherlands. doi: 10.13140/RG.2.1.3070.4481
- World Bank, 2015a. “Central Asia Water Management Study: Agriculture and Irrigation Note.” Sustainable Development Department, Europe and Central Asia Region, Final, June 10, 2015
- — —. 2015b. “Kyrgyz Republic: Food Prices and Household Welfare”. Poverty, Report No. 99773-KG. May 28, 2015
- — —. 2015c. “Social Impact Analysis of Water Supply and Sanitation Services in Central Asia: The Case of Uzbekistan.” Social, Urban, Rural and Resilience Global Practice, Water Global Practice, World Bank Group, Final Report, November. Washington, DC: World Bank.
- — —. 2017. “Central Asia: The Cost of Irrigation Inefficiency in Tajikistan”. Report No. ACS21200, CAEWDP.
- WHO (World Health Organization). 2009. Global Prevalence of Vitamin A Deficiency in Populations at Risk 1995–2005: WHO Global Database on Vitamin A Deficiency. Geneva: WHO
- — —. 2015. The Global Prevalence of Anaemia in 2011. Geneva: WHO.
- — —. 2017. Global Health Observatory (GHO) data: Overweight and Obesity. [http://www.who.int/gho/ncd/risk\\_factors/overweight/en/](http://www.who.int/gho/ncd/risk_factors/overweight/en/)