Food security indicators in India compared to similar countries

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Although in recent years the Indian economy is growing at more than 7% per annum, its performance in food security is dismal. India is known for having the largest number of undernourished children and women with anaemia. It is also home to the largest number of underweight children. In this scenario, it is important to focus on the Sustainable Development Goal 2 targeted to end all types of hunger by 2030. This article examines the progress of India's food security from 1990 to 2016, using four components, i.e. food availability, access, stability and utilization with the use of FAO food security indicators. India's progress is compared with eight countries (country groups) with similar per capita GDP. Even though India's performance is better for some food availability (dietary energy supply and value of food production) and stability (domestic food price indices) indicators, its record in some other (protein availability and prevalence of undernourishment indicators) is dismal. In case of food access and utilization indicators, its performance is miserable. India needs to improve its production of protein-rich foods and increase investments in irrigation to stabilize food supply. It needs to strengthen food entitlements for its vulnerable population through employment guarantee programmes and midday meals programmes.

Keywords: Food security indicators, sanitation, sustainable development, undernourishment.

THE concept of food security indicates four components, namely food availability, access, stability and utilization. Concepts of food security have evolved over the last 50 years. Up to 1970s, there was widespread shortage of food in the world, especially in developing countries like India. Hence the main focus was on country and global-level food supply adequacy to meet the growing population. Here the main variable considered was food supply (calories, proteins) at country and global level with more focus on food availability at country level. However, after Nobel laureate Amartya Sen's work on the famine, the focus shifted from availability to access (entitlements)[1]. Whether households have sufficient entitlements in terms of employment and income to purchase adequate food for a normal and healthy life. In recent years, measuring the third component, i.e. food stability is becoming important as there are more frequent food shocks (extreme weather events such as droughts, floods, hailstorms, displacement of people, war refugees) that have created local level food security risks to vulnerable households[2]. These shocks increase the variability of food supply and prices, resulting in unstable access to food to vulnerable sections of the society, including children, women, poorest of the poor, landless labourers and also urban casual labourers[3–5]. With increased food supply the world over, the years of food shortage are over, but there is widespread concern on food quality which affects the health of the population. The forth component, i.e. food utilization includes food safety and quality (including nutrition) and outcomes relating to health, including water quality and sanitary conditions. Food utilization is becoming far more important as the ultimate aim of humanity is proper utilization of the available food for a healthy life[6,7]. Food availability is important but not a sufficient condition for food utilization[8]. Even countries like Hong Kong and Singapore are not self-sufficient in food, but they are more food secure than India. India is food self-sufficient but has highest undernourished population in the world. India has highest number of malnourished children and pregnant women, and a large number of children are undernourished. However, there are few studies comparing India's progress with similar countries in these food security indicators. Reddy *et al.*[9] compared India's food security indicators with those of developed countries, and concluded that India's performance is below China and Brazil. Sometimes, China and other developed countries are not comparable with India, as China's per capita income is four times higher than that of India; per capita income of many developed countries are more than 10 times compared to India.

The present study examines the progress in food security in eight countries (country groups) based on data of

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Figure 1. Countries selected for analysis in the present study.

United Nations Food and Agriculture Organization (FAO), that are similar to India in terms of per capita gross domestic product (GDP) (Figure 1). The selected countries are Samoa, Vietnam, Uzbekistan, Nigeria and Congo, and country groups are Southern Africa, lower-middle-income economies and South Asia (excluding India). The specific objectives of the study are: (i) to examine the progress of food security indicators (food availability, access, risk and utilization) of India compared to its peers, and (ii) to provide policy options for increased food security and meet the Sustainable Development Goals (SDGs) by 2030.

Data and methodology

Keeping these four pillars of food security in mind, FAO credit a database on food security indicators, which is comparable across countries and over time. From each of the four components, namely food availability, access, stability and utilization, the study selected a minimum of three indicators to understand their trend across countries over time for the period 1990–2016. If data were not available for 2016, the latest available year's data were taken into account. To avoid year-to-year fluctuations in representing the data, we have taken moving averages of three years (i.e. 1990–92; 2000–02 and 2014–16) to compare the trends.

Selection of countries

To compare India's progress with similar countries, all countries (countries groups) are arranged in descending order of per capita gross domestic product (PPP–GDP) and seven countries (country groups) with the same (or with little difference) per capita-PPP-GDP. PPP-GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the US dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. Data are in constant 2011 international dollars (FAO Food Security Indicators). The aggregates are computed using a weighted population average. The lowest GDP-per capita country is Uzbekistan (5008$), followed by India (5144$), Nigeria (5466$), Samoa (5558$) and highest per capita GDP country Congo (5812$). We have also taken three country groupings: South Asia (excluding India) is with 5788$ per capita GDP; lower-middle-income countries with 5798$ per capita GDP, and Southern Africa with per capita GDP of 11942$ as it gives some perspective about a moderately high income country (Figure 2). Among all countries, India's income was far less in the 1990s, but due to rapid growth during the last 25 years its status has improved significantly.

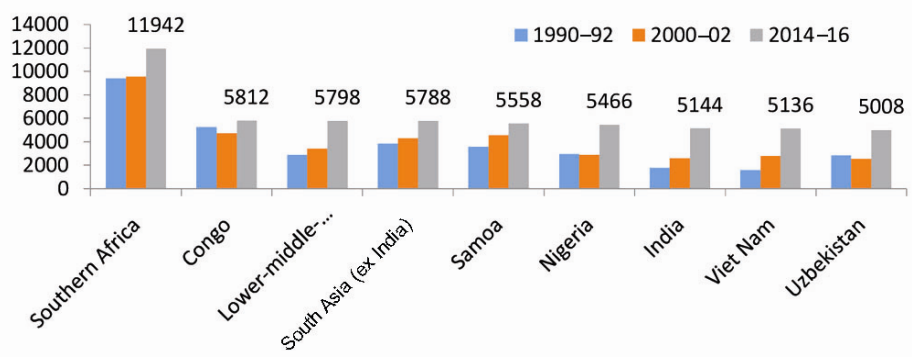

Figure 2. Gross domestic product per capita (in purchasing power equivalent) at constant prices of 2011 international dollars.

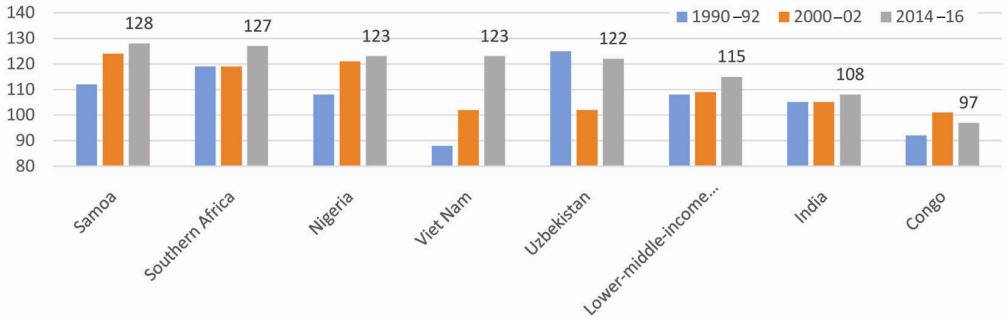

Figure 3. Average dietary energy supply adequacy (%).

Results and discussion

Food availability indicators

There are five indicators of food availability in FAO food indicators, out of which we have taken only three indicators to compare India with other countries. These are average dietary energy supply adequacy (ADESA), average value of food production (AVFP) and average protein supply (APS). All measures are on per capita basis.

Average dietary energy supply adequacy: ADESA (%) is an important indicator for food availability. It measures the dietary energy supply in a country as a percentage of the average dietary energy requirement (ADER) for the total population. Thus it measures the adequacy of food supply in terms of calories in the country. It allows discerning whether undernourishment is mainly due to inadequate food supply or unequal distribution of food among the population. As production in one year can also be consumed 2–3 years later, we have compared 3-year moving averages for the years 1990–92, 2000–02 and 2011–13. These indicators mainly reveal whether food is sufficiently available to meet calories requirement of countries population. If the indicator is 100 its supply is equal to its requirement. If it is less than 100, then food supply of country is inadequate to meet the population calorie requirements of its population. If it is higher than 100 then the country is adequately producing food. For this indicator, India's position of its population (108) is higher than that of Congo (97), but less than all other countries (Figure 3). For this food adequacy indicator all countries have a value higher than 100, except Congo, which shows calorie supply is adequate for all consumers if the food is distributed according to the requirements of individuals. In fact, in India availability of calories is 8% higher than what is required for the entire population. However, more than 66% of the population per capita consumption of calories is below 2100 per day in urban areas and 2400 per day in rural areas. The figure of 2100 for urban and 2400 for rural is the minimum consumption norm set by the Planning Commission in India[10]. This indicates that supply is a problem in food distribution and not food.

AVFP measures the net food production per capita in terms of constant 2004–06 international dollars. It compares the value of food production per capita across countries. The net production of food per capita in India (186$ per capita) is lower than most of the selected countries (Uzbekistan (358), Vietnam (294), Samoa (280), Southern Africa (228), lower-middle income countries (212) and Nigeria (200) (Figure 4). But India's per capita consumption is higher than Congo (98$) and South Asia (excluding India) (184). It is interesting to note that the

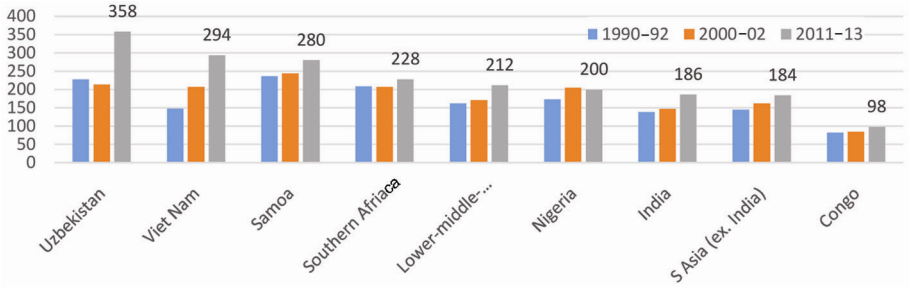

Figure 4. Average value of food production (at constant prices of 2004–06 $ per capita).

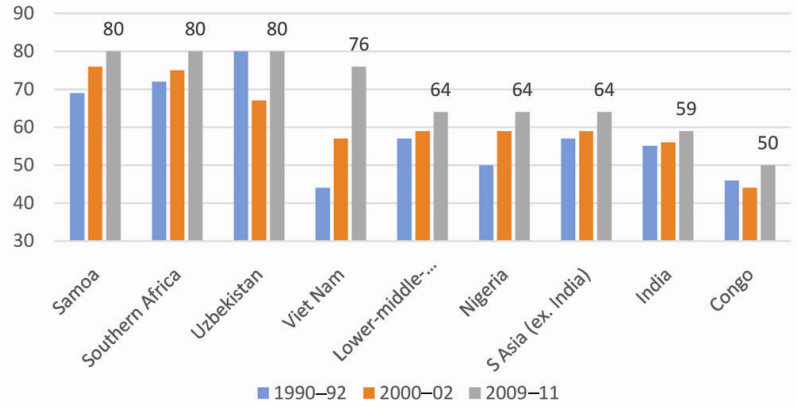

Figure 5. Average protein supply (g/capita/day).

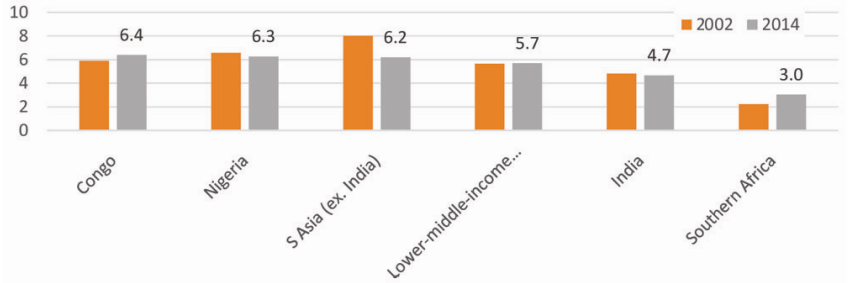

Figure 6. Domestic food price index.

average value of food production is highest in the country with lowest per capita GDP (Uzbekistan).

APS is an indicator of the quality of food supply available in a country. As in most of the developing and middle income countries, there is concern of protein malnutrition among the population, especially children and women. This indicator provides only supply but not the actual intake by children and women. Average protein supply per capita in India (59 g/capita/day) is lower than all countries, except Congo (Figure 5). Even South Asia (excluding India; 64 g/capita/day) has more protein supply than India. Protein supply is higher in Samoa, Southern Africa and Uzbekistan (80 g/capita/day) and also in Congo (76 g/capita/day). This shows the vulnerability of the Indian population to protein malnutrition. According to some studies, protein energy malnutrition is 54.8% among children in India[11].

Food access indicators

Among food access indicators, we have selected (i) gross domestic product per capita (in purchasing power equivalent), (ii) domestic food price index, (iii) prevalence of undernourishment and (iv) prevalence of food inadequacy. As we have selected countries that are similar in per capita GDP, except Southern Africa, we will discuss the remaining three indicators.

The domestic food price level index is an indicator of the relative price of food in a country. It is an important indicator for monitoring food security across countries, as it compares the relative food price over time. India's relative food price index (4.7) is lower than all other countries, except Southern Africa, and is stable from 2002 to 2014 (Figure 6). Even in South Asia (excluding India), the relative price of food is much higher at 6.2. It is

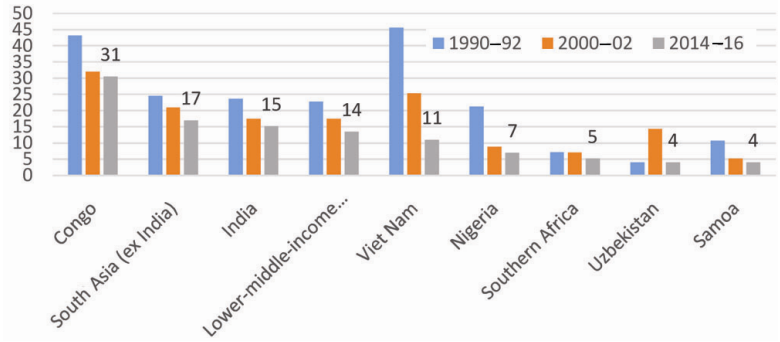

Figure 7. Prevelance of undernourishment (%).

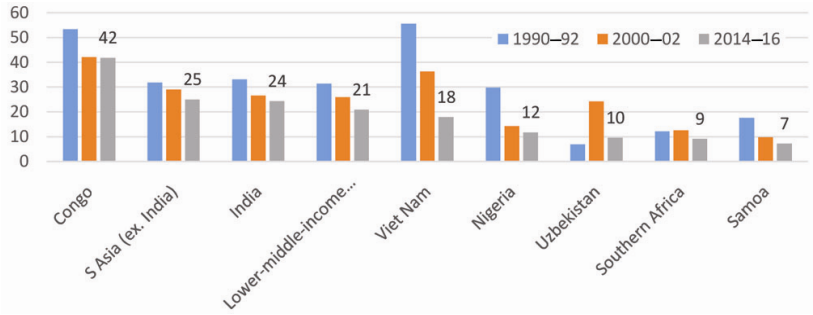

Figure 8. Prevelance of food inadequacy (%).

highest in Congo (6.4), followed by Nigeria (6.3) and lower-middle income countries (5.7). The lower and stable food price index in India may be due to the widespread public distribution system (PDS) to procure and distribute food (mainly rice and wheat) to below poverty line households and also the introduction of National Food Security Act under which all households are entitled to get subsidized rice and wheat through PDS. This helped reduce price volatility and food price inflation. The higher level of consumer sensitiveness to prices and vocal middle-income urban consumers help in keeping the prices low[12].

Prevalence of undernourishment is an indicator of chronic food deprivation. It is also an indicator of 'hunger'. It shows the percentage of population which does not consume adequate quantity of calories to maintain a healthy and normal life. For this indicator, India's performance is less than that of many of its peers. India (15% of population is undernourished) is better than Congo (31%) and South Asia (excluding India: 17%; Figure 7). Samoa and Uzbekistan (only 4% of the population is undernourished) fare better than India. Even Nigeria, Vietnam and average of all lower-middle income countries are better than India with regard to this indicator. Income inequalities and poverty might be the reasons for undernourishment.

Prevalence of food inadequacy is also an indicator of food access similar to prevalence of undernourishment, but calculated setting the caloric threshold to a higher level. In addition to the undernourished population (hunger), it also accounts for those at risk of not consuming food for normal physical activity.

The figures for prevalence of food adequacy show more or less similar pattern as that of undernourishment, but at a higher magnitude. Prevalence of undernourishment is 15% in India, while that of food inadequacy is 24% (Figure 8). This indicates that about 15% of the population in India suffers from chronic food deprivation and about 11% is at the risk of not consuming food for normal physical activity.

Overall, among food access indicators, India fares better in price indicators than the other two indicators, namely prevalence of undernourishment and prevalence of food adequacy.

Food stability

We have selected three indicators under food stability. They are: (i) value of food imports over total merchandise exports; (ii) domestic food price volatility, and (iii) per capita food supply variability.

The first indicator provides a measure of risk and shows the sufficiency of export earnings to pay for food imports, which is traditionally known as an indicator of self-reliance in food. India is better positioned with respect to this indicator. It shows that value of food imports is only 5% of the total merchandise exports (Table 1).

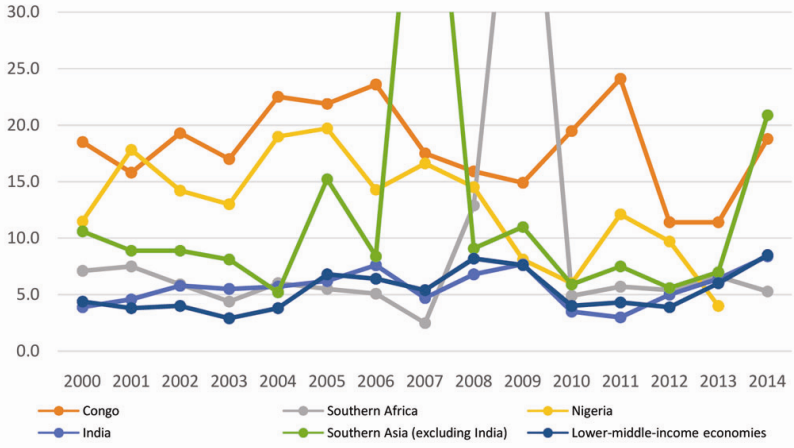

Figure 9. Domestic food price volatility Indices.

Table 1. Value of food imports in total merchandise exports (%)

Country	1990–92	2000–02 (average)	2011–13
Congo	9	6	4
India	4	5	5
Southern Africa	5	4	5
Nigeria	5	6	6
Vietnam	5	4	7
Lower-middle-income economies	12	9	9
Uzbekistan	73	9	9
Southern Asia (excluding India)	15	12	14
Samoa	230	167	112

Table 2. Per capita food supply variability (kcal/capita/day)

Country	1990–92	2000–02	2009–11
South Asia (excluding India)	35	24	11
Nigeria	64	23	21
Vietnam	43	51	24
Southern Africa	37	18	25
Lower-middle-income economies	45	13	30
Samoa	68	54	37
Congo	49	58	47
India	66	23	49
Uzbekistan	520	193	56

Whereas in countries like Samoa, the value of food imports is 12% higher than the total merchandise export earnings. Even though India is better able to finance food imports through export earnings, it is excessively dependent on pulses and edible oil imports, which needs to be curtailed in the long run through technological advancement (India is importing nearly 30% of its domestic consumption in case of pulses and about 50% in case of edible oils).

The domestic food price volatility index measures the variability in the relative food prices in a country. Monthly prices are used to calculate month-on-month growth rates and standard deviation of the growth rates is measured over the previous 8 months (8-months rolling standard deviation). The average of these standard deviations over 12 months for each year is presented as the annual volatility indicator. This is useful to compare price volatility across countries over time.

Domestic food price volatility is lower in India compared to the other countries, except Southern Africa. As indicated earlier, public outcry over higher prices, consumer activism in addition to the fairly efficient PDS in India help in reducing price volatility. Domestic food price volatility is higher in South Asia (excluding India; 21) followed by Congo (19), lower-middle-income countries (8.5), India (8) and Southern Africa (5.3) (Figure 9).

Per capita food supply variability for a specific year is measured as the standard deviation of the per capita food supply over the previous 5 years. It is interesting to note that the variability is much higher in India compared to all other countries except Uzbekistan (Table 2). The higher per capita food supply variability in India is because agricultural production is mainly monsoon dependent. However, supply variability has decreased from 66 in 1990–92 to 23 in 2000–02; but in recent years, it has again increased to 49 in 2009–11, as 2009–10 was a drought year. The decline between 1990–92 and 2000–02 is mainly due to improved technology which has reduced the impact of climate variability on crop production and also expansion of irrigated area since 1990s. However, recent increase in supply volatility might be due to the increased climate change, and drought year in 2009–10. High frequency of extreme weather events like floods and droughts during recent years may be the reason for increased volatility. In almost all the countries per capita food supply variability declined from 1990–92 to 2009–11.

Among all food stability indicators, India's relative position is better in both value of food imports over total merchandise exports and domestic food price volatility,

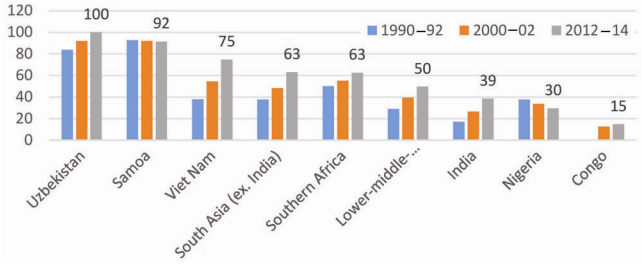

Figure 10. Percentage of population with access to sanitation facilities.

but its position with respect to per capita food supply variability is dismal.

Food utilization

Under food utilization indicator, we have selected three indicators, i.e. (i) access to improved sanitation facilities; (ii) percentage of children under 5 years of age who are underweight, and (iii) prevalence of anaemia among pregnant women.

Access to improved sanitation is an important utilization indicator. This refers to the percentage of the population with access to excreta disposal facilities that will eliminate human, animal and insect contact with excreta to reduce incidence of diseases and improve health. Improved facilities range from well-maintained pit latrines to flush toilets. Here India ranks above Congo and Nigeria, but is far behind other countries. Only 39% of the population has access to improved sanitation facilities, whereas it is 100% in Uzbekistan, 92% in Samoa, and 75% in Vietnam. Even in South Asia (excluding India), 63% of the population has access to improved sanitation (Figure 10).

The status and progress of India under percentage of children under 5 years of age who are underweight is dismal (Table 3). It ranks last among all the countries for which data are available. About 40% of the children are under weight, whereas it is only 1.7% in Samoa, 4.4% in Uzbekistan, 12.1% in Vietnam, 23.4% in Congo and 25.4% in Nigeria. India's position did not improve between 2000–02 and 2012–14.

Prevalence of anaemia among pregnant women shows the percentage of pregnant women whose haemoglobin level is less than 110 g/l (Table 4). Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs. In its severe form it is associated with fatigue, weakness and dizziness. Prevalence of anaemia among pregnant women in India is 54%; the same figure is very low in Vietnam (24%), Samoa (27%), Southern Africa (32%) and Uzbekistan (35%). Even for Southern Asia (excluding India), it is only 41%. Only Nigeria and Congo have higher values compared India. Overall, among all the three food utilization indicators India stands poorly, except Nigeria and Congo.

Table 3. Percentage of children under five years of age who are underweight

	1990–92	2000–02	2012–14
Samoa	1.7	1.7	1.7
Uzbekistan	15.3	7.1	4.4
Vietnam	36.9	25.1	12.1
Congo	30.0	33.6	23.4
Nigeria	35.1	27.2	25.4
India	50.7	40.3	40.0

Table 4. Prevalence of anaemia among pregnant women

Country	1990–02	2000–02	2009–11
Vietnam	48	35	24
Samoa	41	33	27
Southern Africa	38	35	32
Uzbekistan	51	43	35
Southern Asia (excluding India)	51	46	41
India	52	55	54
Nigeria	61	61	58
Congo	64	64	60

Policy conclusions

In the present study, we have ranked all the countries in all the indicators. Care has been taken that the best performing country is given the first rank and the worst performing country given the last rank. Then the averages for all the indicators have been taken for each country. Among all country and country groups, Southern Africa comes first with average rank of 3.0, followed by Samoa (3.6), Vietnam (3.9), Uzbekistan (4.6), then come lower-middle-income economies (4.8), Nigeria (5.0), South Asia (excluding India; 5.2), India (5.5) and Congo (6.0) (Table 5). The figures indicate that average rank of India is worse than all the countries, except Congo. India fares better than Vietnam and Uzbekistan in terms of per capita GDP. It is interesting to note that Congo ranks second in per capita GDP, but ranks last in food security indicators. Southern Africa ranks first in GDP per capita as well as food security indicators.

Overall, correlation between ranking of countries based on per capita GDP and overall food security is –0.02, which indicates that there is no relation between per

Table 5. Rank of countries in different food security parameters

Country	PPP-GDP per capita	Food availability			Food access			Food stability			Food utilization			Average rank	Overall rank
		Average dietary energy supply adequacy	Average value of food production	Average protein supply	Domestic food price index (i)	Prevalence of under nourishment (ii)	Prevalence of food inadequacy (iii)	Value of food imports in total merchandise exports (iv)	Domestic food price volatility (v)	Per capita food supply variability (vi)	Access to sanitation	Percentage of under-weight children (vii)	Anaemia women (viii)		
Southern Africa	1	2	4	2	1	7	3	3	1	4	5		3	3.0	1
Congo	2	8	9	9	6	1	9	1	5	7	9	4	8	6.0	9
Lower-middle-income economies	3	6	5	5	3	4	6	6	4	5	6			4.8	5
South Asia (ex. India)	4		8	7	4	2	8	8	6	1	4		5	5.2	7
Samoa	5	1	3	1		9	1	9		6	2	1	2	3.6	2
Nigeria	6	3	6	6	5	6	4	4	3	2	8	5	7	5.0	6
India	7	7	7	8	2	3	7	2	2	8	7	6	6	5.5	8
Vietnam	8	4	2	4		5	5	5		3	3	3	1	3.9	3
Uzbekistan	9	5	1	3		8	2	7		9	1	2	4	4.6	4

(i) Least price index country given first rank. (ii) Least prevalence of undernourishment given first rank. (iii) Least prevalence of food inadequacy country given first rank. (iv) Country with least value of food imports in total merchandise exports given first rank. (v) Country with least domestic food price volatility index given first rank. (vi) Country with least per capita food supply variability given first

capita GDP and overall food security indices of a country among lower-middle-income countries. It depends more on the level of development of a country, as Samoa (belonging to Oceania, which was under the influence of Australia and the United States), Vietnam (belonging to more developed Southeast Asian countries) and Uzbekistan (formerly belonging to the Soviet Republic with high human development index) have better food security ranking compared to Nigeria and Congo, which are more backward and belong to the African continent.

Although food supply in India is more than sufficient, it needs to increase production of pulses and oilseeds, and also meat and meat products as protein supply is less in the country. India needs to improve its agriculture and food production through technology (like drought-resistant varieties), and agronomic and management practices (like watershed development). The country needs to develop its overall human development indices, like literacy and education, to become more food secure. Some states like Kerala and Tamil Nadu have already reached a higher level of food security even with less per capita income. There is a need for increasing food entitlements through efforts like employment guarantee programmes (MGNREGA), midday meal programmes, anganwadi, health programmes like ASHA workers needs to be strengthened to increase food entitlements, food access, stability in food availability and food utilization. The 'Swachh Bharat' programme has to play a greater role to improve sanitation. A recent study on the midday meal programme suggests that spending of Rs 2 per child can reduce protein deficiency among children by 100%, calorie deficiency by almost 30% and iron deficiency by nearly 10% (ref. 13).

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