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Food Security in Brics – Current Status and Issues

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FOOD SECURITY IN BRICS – CURRENT STATUS AND ISSUES

Malini L Tantri[1] and Kumar Shaurav[2]

Abstract

Food security is a major area of concern for BRICS economies, as they are home to a combined population of almost three billion people and the largest share of undernourished people in the world. In this context, this paper, while making use of available secondary data, outlines the current state of food security among BRICS economies and the possible lessons they can learn from each other. The analysis helps us argue that though China and India boast of having the highest GDP (PPP), they have failed to provide food security to a large section of their population, whereas Russia and Brazil have performed outstandingly in most of the indicators pertaining to food security. This definitely calls for improved coordination among the member states and highlights the need to share the existing know-how for the progress and development of all the BRICS nations.

Introduction

The acronym BRIC (Brazil, Russia, India and China) was coined by Goldman Sachs in 2001 to represent the fastest growing economies in the world. Subsequently, in 2010, the acronym evolved into BRICS with the addition of South Africa. Currently, BRICS accounts for more than 42 per cent of the global population, 30 per cent of the land mass, and 30 per cent of world GDP in purchasing power parity. Though these countries have formed a bloc, they still don't work as a unit within or outside the international associations like G-20 (Van Agtmael, 2012). Despite this, the impact of globalization and internal policy changes of BRICS economies have given them the power to resist some of the international economic laws which were not in favour of emerging economies (Trubek, 2012). They are also increasingly attempting to reshape the balance of Bretton Woods (Rolland, 2013), counter the west and improve their bargaining power at various multilateral institutions (Mathur & Dasgupta, 2013 and Kornegay, 2014). Despite a number of advancements in BRICS economies on various fronts, several issues remain to be addressed or need special attention, both at the individual and the group level. For instance, Gokhberg et al (2012) identified the following issues that pose obstacles for the growth in BRICS economies: Inadequate infrastructure, poor healthcare systems, low spending on public health and health infrastructure, inequalities in access to education and income distribution, lack of institutionalization, the fragile nature of trade and investment linkages among the BRICS countries, lack of spending on R&D and lack of food security. Food security, for BRICS in particular, is a major area of concern as it constitutes the combined population of almost three billion people. Agricultural production being one of the highest in BRICS economies, their productivity growth has a huge impact on the global food security (Fan & Brzeska, 2010). Hence BRICS economies can play a key role in terms of food security in the fight against global hunger since they themselves have one of the largest shares of the world's undernourished population. Increasing food insecurity and global food crises led the BRICS

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nations to adopt the agenda of food security in their very first summit held in Yekaterinburg, Russia. Though there are a number of country-specific studies available to explore the state of food security (See for instance: Dev and Sharma, 2010; Sedik and Wiesmann, 2003; Rocha, 2009; Koch, 2011; Huang, J and Rozelle, S, 2010) no systematic attempt is done in the literature to explore where BRICS countries stand in comparision with each other in their fight against hunger, poverty and for food security and what kind of lessons they can possibly learn from each other. It is in this context that this paper looks at the status of food security among BRICS countries and discusses major issues, the kind of policy intervention adopted and how they can learn from each other.

In order to explain the issues raised above, we have explored the database of World Development Indicator, UNDP Human Development Report, FAOSTAT. The rest of the paper is organised as follows: The second section gives a brief socio-economic profile of BRICS countries vis-a-vis each other. The third section outlines empirical evidence on the state of food security among BRICS countries and various forms of policy intervention undertaken. The last section summarises the paper.

Brief Profile of BRICS

BRICS nations continue to have a dominant share in population, with nearly 42 per cent of the world population (2014). China and India together contribute more than 1/3rd of world population (Table 1). The population growth rates have gone down since the year 1990 for both China and India due to a number of measures adopted by both the countries to tackle their population issues. Russia, which has a very low population density, shows negative growth for the year 2000 and 2005. However, it was able to record 0.22% growth rate for the year 2014. The growth rate in South Africa and India was more than the world average throughout the study period. Population growth rate in Brazil, China and Russia were found to be below the world average. BRICS nations' per capita income was mostly less than that of the world average till 2005, but the situation changed in 2010 when Brazil and Russia performed better than other nations in the bloc. This was due to the low population growth in these countries vis-a-vis their rising GDP. In fact, per capita GDP in BRICS countries has increased at a compound annual growth rate (CAGR) of nearly 10.25% from 2000-2014, and within the BRICS bloc, the Chinese economy is the greatest contributor to world GDP while India, which is the third largest economy in PPP terms, contributed around 7% to world GDP as per the latest data.

Trade, one of the important macroeconomic indicators for measuring growth, reveals that South Africa's trade as a percentage of GDP is more than any other BRICS economies since 2010 (Table 2). With respect to the sectoral composition of trade (Table 3), India has shown significant growth in trade in services, while others are lagging behind. With respect to FDI (Table 1), the Chinese economy receives the maximum FDI inflow in terms of the world average while Brazil is the second best destination. Sectoral composition of employment reveals that the primary sector dominates in attracting a labour force up to 51 per cent while in South Africa, 70 per cent of working population is engaged in the service sector. In fact, China, which had around 42 per cent of the labour force working in the primary sector in the year 2000, showed an extreme decline in the subsequent years. The unemployment figures within the BRICS economies show that South Africa accounts for the highest share (25.1 per cent) while India accounts for just 3.59 per cent.

Poverty data reveals that South Africa, which has 0.70 per cent of the total world population, has 13 per cent of its population below the world poverty line in the year 2000, though a significant fall was recorded by the year 2012. India, which housed around 17 per cent of the world's population in the year 2004, had around 9.2 per cent of the people below the poverty line. With respect to infant mortality rate (IMR), India has the maximum infant deaths since 1990 among the BRICS economies which can be attributed to its lowest R&D expenditure in the health sector among the BRICS nations, while Russia has the least IMR since it has had a good healthcare system since the Soviet times. Post-2000, only Brazil and China could make life expectancy greater than that of the world average for their citizens while all the other BRICS economies performed badly (Table 1). Even Russia, which had good healthcare facilities, could not reach the world's average. India and South Africa were reported to be the worst in life expectancy at birth among the BRICS economies. BRICS, which is in the spotlight because of its high growth rate, is unable to perform at the same level when it comes to the HDI values. Specifically, South Africa and India are among the poorest performers in the bloc.

Table 1: A Comparison of Socio-Economic Characteristics among BRICS

Population to percentage of World Population						
Countries/Year	**1990**	**1995**	**2000**	**2005**	**2010**	**2014**
Brazil	2.84	2.85	2.87	2.89	2.87	2.83
China	21.48	21.12	20.64	20.01	19.32	18.79
India	16.48	16.84	17.23	17.57	17.78	17.84
Russia	2.81	2.61	2.39	2.21	2.06	1.98
South Africa	0.67	0.68	0.71	0.72	0.73	0.74
GDP in terms of world's GDP (%)						
Brazil	3.49	3.57	3.28	3.13	3.17	3.01
China	3.91	6.13	7.65	10.09	13.98	16.53
India	3.51	3.94	4.38	5.01	6.08	6.77
Russia	4.16	2.28	2.08	2.61	3.31	3.08
South Africa	0.83	0.76	0.72	0.72	0.68	0.65
Trade (per cent of GDP)						
Brazil	15.16	16.63	22.64	27.09	22.52	25.11
China	29.62	38.44	39.36	62.89	49.33	41.54
India	15.24	22.47	26.44	41.31	48.31	48.71
Russia	36.11	55.18	68.09	56.71	50.36	52.89
South Africa	42.99	43.61	51.44	53.15	55.99	64.36
FDI (per cent of world FDI Inflow)						
Brazil	0.50	1.52	2.48	1.02	3.05	6.21
China	1.78	11.21	2.91	6.89	13.95	18.52
India	0.12	0.67	0.27	0.48	1.57	2.17
Russia	***	0.65	0.21	1.03	2.47	1.47
South Africa	-0.04	0.39	0.07	0.43	0.21	0.37

Countries/ Year	1990	1995	2000	2005	2010	2014
Unemployment (per cent of total labour force)*						
Brazil	6.9	6	9.5	9.3	7.9	6.8
China	4.9	4.5	4.5	4.1	4.2	4.7
India	4.3	4	4.3	4.4	3.5	3.6
Russia	12.2	9.4	10.6	7.1	7.3	5.1
South Africa	24.5	16.9	26.7	23.8	24.7	25.1
Life expectancy at birth, total (years)						
Brazil	65.34	67.60	70.04	71.84	73.26	74.40
China	69.03	69.93	71.73	73.77	75.01	75.78
India	57.94	60.44	62.63	64.52	66.51	68.01
Russia	68.90	65.22	65.34	65.47	68.86	70.37
South Africa	62.12	61.37	55.84	51.56	54.39	57.18
World	65.39	66.28	67.61	69.01	70.49	71.45
Labour force participation rate, total (per cent of total population ages 15+)						
Brazil	64.6	69.2	68.2	70.2	70	69.7
China	78.9	78.6	77.1	73.2	70.7	71.4
India	60.9	60.5	59.1	60.8	55.4	54.2
Russia	67.2	60.5	60.7	61.9	63	63.8
South Africa	53.5	55.1	56.8	54.1	51.3	52.5
World	66.32	65.89	65.28	64.80	63.43	63.49

Source: World Development Indicator (WDI) * 1991 data used as 1990 data was not available.

Table 2: Trade (per cent of GDP)

	2005		2010		2014	
Countries	**Service**	**Merchandise**	**Service**	**Merchandise**	**Service**	**Merchandise**
Brazil	4.31	22.00	4.26	17.81	5.31	19.21
China	7.17	62.68	5.16	49.24	5.67**	41.54
India	11.91	29.07	13.57	33.75	14.85	38.30
Russia	9.07	48.33	8.16	42.58	10.04	43.31
South Africa	9.30	44.20	9.50	50.14	9.68	60.83

Source: WDI

** Data for 2013 was taken as 2014 value was unavailable

Table 3: Sectoral Division of Employment (per cent of total employment)

Countries/ Year	2000			2005			2010		
	Primary	Industrial	Service	Primary	Industrial	Service	Primary	Industrial	Service
Brazil	18.5	21.2	59.1	20.5	21.4	57.9	17*	22.1*	60.7*
China	46.3	17.3	12.7	3.9	43.4	49.5	2.9	44.3	48.8
India	59.9	16	24	55.8	19	25.2	51.1	22.4	26.6
Russia	14.5	28.4	57.1	10.2	29.8	60	7.9	27.7	64.4
South Africa	15	23.7	60.7	5.8	25.3	59.1	4.9	24.5	70.6

Source: WDI * Data of 2009 is represented as 2010 data was not available

Table 4: HDI Values

Countries/ Year	1990	2000	2010	2015
Brazil	0.611	0.685	0.724	0.754
China	0.499	0.592	0.700	0.738
India	0.428	0.494	0.580	0.624
Russia	0.733	0.720	0.785	0.804
South Africa	0.621	0.629	0.638	0.666

Source: UNDP Human Development Reports

The State of Food Security among BRICS Economies

Over the years, measuring and assessing food security has proved to be a challenging and complicated task as it demands combination of indicators to capture its multi-faceted nature. Food security is generally broken down into three different components – availability, accessibility and utilisation or absorption. Availability of food refers to the supply of food from production, imports or stock. Accessibility refers to the affordability and allocation of the food. The third and last critical dimension, utilisation refers to actual metabolisation of food by the body. Food that is available and accessible does not alleviate food insecurity if people do not utilize food properly because of inadequate nutrition education and food preparation, bad habits, eating disorders or poor health. In the pursuit of developing a standard measure of food insecurity for the BRICS nations, the survey module measures both the static and dynamic determinants of food security for each of the BRICS countries.

Table 5: Area, Production and Yield of Major Crops among BRICS

	AREA HARVESTED, PRODUCTION and YIELD of MAJOR CROPS AMONG BRICS NATIONS																			
	AREA HARVESTED(Ha)																			
Countries/Year	1990					2000					2010					2014				
	Rice	Wheat	Cereals	Oilseeds	Pulses	Rice	Wheat	Cereals	Oilseeds	Pulses	Rice	Wheat	Cereals	Oilseeds	Pulses	Rice	Wheat	Cereals	Oilseeds**	Pulses
Brazil	3946690	2680990	18512400	14093806	4783025	3655290	1065897	17244374	15160369	4374960	2722459	2181567	18600440	24931991	3453943	2340878	2834945	21850734	27017570	3209184
China	33518971	30754285	93583276	24465732	3804530	30301490	26653326	85639713	29204087	3359548	30117262	24257900	90172915	27938147	2763441	30871051	25002100	94996794	26187680	2912000
India	42686608	23501904	102536512	32291200	23415000	44712000	27486000	102402400	34620600	19471600	42862400	28457400	100075800	38911800	26533800	43400000	31188000	98618000	40156300	30532000
Russia*	265300	24259500	59541250	4224413	2256600	167600	21346000	41145200	5104630	800500	200900	21639800	32357000	7540200	1045200	195552	23907772	42221333	9240980	1599389
South Africa	1191	1563000	6156932	862266	122138	1018	934000	5272460	640440	93883	1123	558100	3548001	820901	66650	1150	486000	3998410	1110200	64540
	PRODUCTION(Tonnes)																			
	1990					2000					2010					2014				
Countries	Rice	Wheat	Cereals	Oilseeds	Pulses	Rice	Wheat	Cereals	Oilseeds	Pulses	Rice	Wheat	Cereals	Oilseeds	Pulses	Rice	Wheat	Cereals	Oilseeds**	Pulses
Brazil	7420931	3093791	32490390	4133134	2271707	11089800	1661526	45893360	6675394	3057688	11235986	6171250	75161327	13582335	3172163	12175602	6261895	101398284	13305368	3305958
China	191614680	98231940	404719096	9742475	6136720	189814060	99636127	407336509	15142456	4696498	197212011	115181303	498463455	16699784	3890693	208239610	126212750	559312863	17439626	4514000
India	111517408	49849504	193919312	7117588	12856900	127464896	76368896	234931192	7761324	13712800	143963000	80803600	267838300	11878941	17236300	157200000	94483000	293993000	10759890	19980000
Russia*	753630	46166700	103793750	1476967	3080620	585750	34455488	64326238	1759421	1177510	1060660	41507580	59624036	2744568	1400635	1048566	59711382	103154436	4157164	2315613
South Africa	2260	1709000	11558395	346877	154971	3000	2428100	14527340	312710	108160	2876	1430000	14699306	351530	73655	3010	1759000	17274820	474160	74180
	YIELD(Hg/Ha)																			
	1990					2000					2010					2014				
Countries	Rice	Wheat	Cereals	Oilseeds	Pulses	Rice	Wheat	Cereals	Oilseeds	Pulses	Rice	Wheat	Cereals	Oilseeds	Pulses	Rice	Wheat	Cereals	Oilseeds**	Pulses
Brazil	18803	11540	17551	2933	4750	30339	15588	26614	4403	6989	41271	28288	40408	5448	9184	52013	22088	46405	4925	10302
China	57166	31941	43247	3982	16130	62642	37382	47564	5185	13980	65481	47486	55280	5977	14079	67455	50481	58877	6659	15501
India	26125	21211	18912	2204	5491	28508	27785	22942	2242	7042	33587	28395	26764	3053	6496	36221	30295	29811	2680	6544
Russia*	31220	20457	17432	3496	13652	34949	16141	15634	3447	14710	52795	19181	18442	3640	14018	53621	24976	24432	4499	14478
South Africa	18976	10934	18773	4023	12688	29470	25997	27553	4883	11521	25610	25623	41430	4282	11051	26174	36193	43204	4271	11494

Source: FAOSTAT

*- Data for Russia is available only since 1992

** - Oilseeds Data for 2012 is taken for yera 2014 due to unavailability

Table 6: Other Indicators of Food Availability

Average Dietary Energy Supply Adequacy (per cent)				
Countries/Year#	**1991**	**2000**	**2010**	**2015***
Brazil	118	122	133	135
China	106	116	124	129
India	105	107	108	108
Russia	120	116	133	136
South Africa	121	121	125	131
World	**113**	**116**	**120**	**123**
Dietary Energy Supply from Cereals, Roots & Tubers (per cent)				
Countries/Year#	**1991**	**2000**	**2010**	
Brazil	39	35	34	
China	69	61	52	
India	66	63	59	
Russia	49	47	41	
South Africa	55	57	53	
World	**58**	**55**	**52**	
Average Protein Supply(grams/caput/day)				
Countries/Year#	**1991**	**2000**	**2010**	
Brazil	67	79	92	
China	65	83	94	
India	55	57	59	
Russia	92	86	101	
South Africa	74	75	82	
World	**69**	**74**	**79**	
Average Supply Of Protein Of Animal Origin (gr/caput/day)				
Countries/Year#	**1991**	**2000**	**2010**	
Brazil	30	41	49	
China	15	27	37	
India	9	10	12	
Russia	46	42	54	
South Africa	26	25	34	
World	**24**	**28**	**31**	
Cereal Import Dependency Ratio (Per cent)				
Countries/Year#	**1991**	**2000**	**2010**	
Brazil	14.2	15.3	-3.0	
China	3.3	0.1	2.1	
India	-0.2	-1.4	-3.1	
Russia	23.6	5.0	-27.5	
South Africa	12.5	4.8	2.8	
World	**-0.1**	**-0.2**	**-0.2**	

Per cent of Arable Land Equipped For Irrigation[3]			
Countries/Year#	**1991**	**2000**	**2010**
Brazil	5.2	5.7	7.5
China	40.4	46.2	61.7
India	30.5	37.6	42.4
Russia	4.2	3.7	3.6
South Africa	9.4	10.9	12.6
World	**18.5**	**20.6**	**23.1**
Value of Food Imports In Total Merchandise Exports (per cent)			
Countries/Year#	**1991**	**2000**	**2010**
Brazil	6	6	3
China	4	3	3
India	4	6	5
Russia	28	6	6
South Africa	3	3	4
World	**7**	**5**	**5**

Source: FAOSTAT

Represent mid value with continuous series of three intervals

* Provisional

When a country has enough stock of food available to meet its food requirement at the macro level either through production or through imports, then the country considered to have achieved the first dimension, i.e. availability aspect of food security. With respect to APY in crops like rice, though India has more crop area than China, it still produces less than China, with the Chinese yield greater than that of India throughout our study period. Russia, with a CAGR of 1.51 per cent for the year 1991-2014 in rice production and CAGR of 2.28 per cent in rice yield, stood just below Brazil with a CAGR of 2.08 and 4.33 per cent in production and yield of rice for the same period. China and India even stood first and second respectively for the production of wheat, cereals and to an extent, oilseed, but later Brazil overtook India's oilseeds production in 2014. Meanwhile, Russia had really performed very well in the production of oilseeds with a CAGR of more than 11% in 2001-2014. India outweighs all the BRICS nations in the production of pulses. China, Brazil and South Africa recorded better yield for most of their crops whereas India has the lowest yield from its harvested area. India, which has the more harvested area, comparatively produces less than other countries which sheds light on India's subsistence farming techniques and the immediate need to alter the farming practice to a more modernized one.

Mere increase in foodstock in India, however, cannot be considered as an achievement as many caveats are associated with it. Like, the storage of excess foodgrain has been responsible for high carrying and maintenance costs, besides wastage and deterioration of food quality. In fact, the increase in food production and also good buffer stock could not increase much the availability of per capita foodgrain, cereals and pulses (Dev & Sharma, 2010). The well-being of the people of any country depends not only on aggregate production of food but also its distribution. In this context, the Average

[3] Per cent of Arable Land Equipped For Irrigation is the value of arable land equipped for irrigation to total arable land.

Dietary Energy Supply Adequacy[4] (Table 6) indicates that, among the BRICS economies, India is the only country which was found below the world average while other BRICS countries have a better state of Average Dietary Energy Supply Adequacy. Russia and Brazil are among the best countries in the BRICS bloc, but China's compound annual growth Rate (CAGR) is comparatively more than that of any other BRICS economy with 0.82 per cent for the years 1991-2015. The share of cereals, roots and tubers in providing the energy supply has revealed a downward trend for all the BRICS economies. Protein is a macronutrient needed in relatively large amounts to stay healthy unlike vitamins and minerals, which are micronutrients and only needed in small quantities. Hence, the study of average protein supply is essential to study the availability of food security to check whether adequate amount of protein is available in our diet. The average protein supply was found to be the least for the Indian citizens among all the BRICS economies and even below the world average. China and Brazil are among the countries with a CAGR of 1.96 per cent and 1.68 per cent for the years 1991- 2010 while India's CAGR was the least at 0.39 per cent. Russia's average supply of protein was the least with a CAGR of 0.85 in the last two decades of our study period 1991 to 2010 while China's share of CAGR was the highest at 4.48 per cent in the same period. Cereal Import Dependency Ratio shows the dependency of a country on imports for satisfying its cereals requirement and hence can be used as a proxy to measure the cereal self-sufficiency of a country. Countries like Russia and Brazil have performed very well since 1991 in reducing their dependency on foreign markets for cereals while China's imports have increased since 2000. South Africa's dependency was found to be the greatest with 2.8 per cent, which can be attributed to the very small percentage of irrigated land (12.8%). Meanwhile, Russia's area under irrigation has reduced, and import dependency has gone down. China and India have the maximum amount of arable land under irrigation with approximately 62 and 42 per cent of land respectively. The value of food imports in total merchandise exports shows the ability of a country to finance food imports through exports of goods and services and data so obtained indicate that all the BRICS economies could sustain food availability through revenue coming from merchandise exports.

[4] Is the ratio of dietary energy supply to a percentage of the Average Dietary Energy Requirement (ADER) of the country. It measures the adequacy of the national food supply in terms of calories and helps to understand whether undernourishment is mainly due to the insufficient food supply or due to bad distribution.

Table 7: Accessibility Aspect of Food Security

Domestic Food Price Index				
Countries/Year	**2000**	**2005**	**2010**	**2014**
Brazil	2.28	2.27	2.38	2.61
China	2.26	2.46	2.94	3.25
India	4.91	4.80	4.83	4.68
Russia	4.29	4.07	4.19	4.30
South Africa	2.13	2.29	2.92	3.04
Domestic Food Price Volatility Index				
Countries/Year	**2000**	**2005**	**2010**	**2014**
Brazil	6.0	4.8	6.7	4.4
China	10.8	13.7	9.4	8.1
India	3.9	6.2	3.5	8.4
Russia	6.3	7.5	3.9	5.2
South Africa	7.1	5.8	5.5	6.2
World	**3.6**	**6.3**	**6.5**	**6.4**
Per capita food production variability				
Countries/Year	**1990**	**2000**	**2010**	**2013**
Brazil	14.1	12.4	11.2	16.2
China	3.3	1.7	3.4	1.8
India	4.4	2.3	5.7	4.1
Russia	18.1*	11.2	5.4	22.7
South Africa	9.6	12.8	12.7	10.3
World	**1.7**	**2.0**	**2.3**	**2.8**
Per capita food supply variability (kcal/caput/day)				
Countries/Year	**1990**	**2000**	**2010**	
Brazil	27	20	18	
China	43	16	17	
India	58	25	54	
Russia	588	200	30	
South Africa	46	13	25	
World	**27**	**8**	**11**	
Prevalence of Undernourishment (per cent)				
Countries/Year	**1991**	**2000**	**2010**	**2015***
Brazil	14.8	12.3	<5.0	<5.0
China	23.9	16.2	12.5	9.3
India	23.7	17.0	15.7	15.2
Russia	**<5.0**	**<5.0**	**<5.0**	**<5.0**
South Africa	<5.0	<5.0	<5.0	<5.0

Depth of Food deficit (kcal/caput/day)[5]				
Countries/Year	**1991**	**2000**	**2010**	**2015***
Brazil	110	92	15	10
China	188	130	101	74
India	165	118	112	109
Russia	12	13	9	8
South Africa	30	33	24	13
Prevalence of Food Inadequacy (per cent)[6]				
Countries/Year	**1991**	**2000**	**2010**	**2015***
Brazil	21.7	19.0	5.4	<5.0
China	33.5	24.5	20.2	15.9
India	33.1	25.7	24.9	24.3
Russia	<5.0	<5.0	<5.0	<5.0
South Africa	9.3	10.0	7.9	<5.0

Source: FAOSTAT

* Data from 1992 is considered

The second dimension of food security is accessibility, i.e. when members of the society have access to the food required to lead a healthy life either from their own production or through government distribution programmes. Poverty and unemployment are the two most important hurdles in achieving food security. Income plays a dominant role in deciding food accessibility in a market economy. Hence, increasing employment and proper distribution of income can contribute to proper access to food. BRICS economies have seen a declining trend in poverty and unemployment rate[7]. With increasing purchasing power through various employment opportunities, the poor would be able to increase their food consumption, thereby ensuring food accessibility. Access to food doesn't depend only on the level of poverty and unemployment (a proxy for the purchasing power of households) but prices and the other indicators like food inadequacy. It's important to consider the prevalence of undernourishment too while studying the accessibility dimension of food security. The Domestic Food Price Index was used to compare the relative price of food across countries and time. India and Russia had a price index greater than that of other countries in the BRICS bloc in 2014, while Brazil had the least share of the food price in the consumption basket as compared to other BRICS economies. The Domestic Food Price volatility Index shows domestic price variation in food among the BRICS economies. India's volatility of food price was found to be the greatest among the BRICS economies and that of the world average, while all the BRICS economies saw declining trends except India. Variability of the net food production value which is given by per capita food production variability was found to be the highest for Russia while it is the lowest in China and India. India has the maximum variation when it comes to per capita food supply among the BRICS economies, followed by Russia in 2010. However, none of the countries was able to reduce the variability in food supply to below the world average. The prevalence of undernourishment among various BRICS economies demonstrates

[5] The depth of the food deficit indicates how many calories would be needed to lift the undernourished from their status, everything else being constant.

[6] It measures the percentage of the population that is at risk of not covering the food requirements associated with normal physical

[7] Please refer Table 1 for details

Brazil being the best performer while India takes the lowest spot. Considering the extent of food deficiency in BRICS nations, India and China have to work really hard to provide more nutritious food to their people. Brazil has performed outstandingly by reducing the depth of the food deficit at a CAGR from 1.2 per cent in the period 1990-2000 to 17 per cent in 2001-2010.

Table 8: Absorption/Utilization Aspect of Food Security Indicators

Access of Improved Water				
Countries/Year	**1990**	**2000**	**2010**	**2015**
Brazil	88.50	93.50	96.90	98.10
China	66.90	80.30	91.40	95.50
India	70.50	80.60	90.30	94.10
Russia	93.40	94.90	96.30	96.90
South Africa	82.80	86.50	91.10	93.20
World	76.08	82.50	88.39	90.97
Access To Improved Sanitation				
Countries/Year	**1990**	**2000**	**2010**	**2015**
Brazil	66.6	74.7	80.5	82.8
China	47.5	58.8	70.8	76.5
India	16.8	25.6	35.5	39.6
Russia	72.7	72.5	72.3	72.2
South Africa	51.4	57.2	63.5	66.4
World	52.90	58.79	64.85	67.52
Prevalence Of Anaemia among Children under Five Years**				
Countries/Year	**1990**	**2000**	**2010**	
Brazil	37.2	22.8	22.7	
China	30.4	13.2	17.1	
India	75	68.1	60	
Russia	35	25.9	25.6	
South Africa	29.6	32.5	40.3	
Prevalence Of Anaemia among Pregnant Women				
Countries/Year	**1990**	**2000**	**2010**	
Brazil	41.8	35.5	32.4	
China	NA			
India	51.8	55.0	53.9	
Russia	31.2	26.3	23.4	
South Africa	35.1	32.6	30.0	
Infant Mortality Rate (per 1,000 live births)**				
Countries/Year	**1990**	**2000**	**2010**	**2015**
Brazil	50.9	28.1	14.8	14.6
China	42.1	30.2	13.5	9.2
India	88.3	66.4	46.3	37.9
Russia	21.9	19.7	10.3	8.2
South Africa	47.4	54	38.2	33.6

NA- Not Available

Source: FAOSTAT

** Data source is WDI

Food accessibility depends on factors like employment, income, government transfer mechanisms etc., while absorption is a vast concept that includes various factors like mother's health at the time of delivery, child's weight at the time of birth, proper food intake, improved drinking and sanitation facilities. The proportion of people with access to improved drinking water in Russia, Brazil and South Africa is higher than in China and India for the year 1990. China's efforts to provide improved drinking water facilities to its citizens has led to an incredible improvement from 47.5% to 76.5% in 2015, while Brazil has been successful in providing its 82.8 per cent people with improved drinking water facilities. But when it comes to sanitation facilities, India and China were below the world average until 2000. Anaemia among the children below the age of 5 years has reduced among all the BRICS economies except for South Africa. India has the maximum number of anaemic children below the world average throughout the study period while China has the least. Brazil and Russia have shown moderate behaviour. Infant mortality rate (IMR) and prevalence of anaemia among pregnant women are low in Russia while India, which has come out with various programmes like ICDS for providing pregnant women with nutrititive diet, still accounts for the highest number of anaemic women and the existence of the highest IMR index.

A comparative perspective of various parameters of food security among BRICS economies shows that Brazil and Russia are among the best performing states in most of the indicators pertaining to food security while India's performance has been unsatisfactory. China, India and Brazil are among the highest producers of foodgrains while South Africa and Russia are among the least food-producing countries. On the accessibility and absorption aspect of Food security, China's performance remains moderate. BRICS economies should improve coordination and should share the know-how for the progressive development of all the BRICS economies. The nations can learn from one another from the policy decision adopted by other countries and ensure better implementation of the policies. In this context, it is very interesting to look at the kind of intervention policies that have taken place in these countries and the lessons that can be learnt from each other. The next subsection outlines major policy interventions in BRICS with regard to food security.

Table 9: Comparative Perspective of Food Security Indicators among BRICS Countries

			Best Performer	Average Performer	Poor Performer
Availablity	Rice#	Production	Brazil	India/Russia	China
		Yield	Brazil	India/Russia	China
	Wheat#	Production	Brazil/India	China/Russia	South Africa
		Yield	Brazil/China	India	Russia
	Cereals#	Production	Brazil	India/China	Russia
		Yield	Brazil	South Africa	China
	Oilseeds#	Production	Brazil/Russia	China	South Africa
		Yield	Brazil/China	Russia	South Africa/India
	Pulses#	Production	India	Brazil	South Africa
		Yield	Brazil	India	South Africa
	Average Dietary Energy Supply Adequacy*		Russia/Brazil	South Africa	India
	Average Protein Supply***		Russia	Brazil/China	India
	Average Supply Of Protein Of Animal Origin***		Russia	Brazil/China	India
	Cereal Import Dependency Ratio***		Russia	India/Brazil	South Africa/China
	Per cent of Arable Land Equipped For Irrigation***		China	India	Russia
Accessibility	Domestic Food Price Index##		Brazil	South Africa	India/Russia (costly food)
	Per capita Food Supply Variability***		China/Brazil	South Africa	India
	Depth Of Food Deficit*		Russia	Brazil/South Africa	India
	Prevalence of Food Inadequecy*		Brazil/Russia/ South Africa	China	India
	Undernorishment(%)*		Brazil/Russia/ South Africa	China	India
Absorption	Anemic Children Under 5**		Brazil/Russia	China	India
	Anemic Pregnant Women**		Russia	South Africa	India
	Undernorished (in million)*		Russia	China	India
	Access to Drinking Water*		Brazil	Russia	South Africa
	Access to Sanitation*		Brazil	china/Russia	India
	Human Development Index (HDI)*		Russia	Brazil/China	India

CAGR Values are used for rating; * 2015 Values are used for rating; ** 2011 values used for rating

*** 2010 values used for rating; ## 2014 values used for rating

Major Policy Interventions to Address Food Security in BRICS Economies

In India, one-third of the population is living below the poverty line and one-half of the population of children are malnourished, (Dev & Sharma, 2010) while Brazil, which is the fourth largest food exporter, still has a massive population of around 66 million people, i.e. 30 per cent of its total population, facing some degree of daily food insecurity (Government Of Brazil 2010). Of this, more than 6 per cent, i.e.

around 12 million people, are exposed to severe food insecurity or hunger problems (FAO, 2011). South Africa, which gained independence from Britain in 1994, was so focused on food security that it granted it as a constitutional right to its citizens (Government of South Africa, 2011). Thirty years ago in China, every third person was found to be undernourished, while today, China grows enough to meet the needs of the world's most populous country and even become a net exporter of the cereals (Huang & Rozelle, 2010). Russia's concerns about food security arose with its transition period which saw a massive increase in poverty, making food accessibility a major issue (Liefert & Swinnen, 2002).The problem of food security is likely to get even worse, given that its food demand is likely to grow faster than its supply (Kannan et al, 2000) among the BRICS economies. Achieving food security needs policy and investment reforms on multiple fronts (Rosegrant & Cline, 2003). Hence India adopted the Green Revolution, a policy transformation in the late 1960s to combat the growing food insecurity, which led to a tripling of foodgrain production, making India a food self-sufficient nation at the macro level (Ittyerah, 2013). Institutional reforms, which account for Chinese agricultural growth, started with the adoption of the Household Responsibility System (HRS) from the collective farming system (Lin, 1992), leading to an increase in per capita food production as farmers were incentivised to work on land (Carter & Rozelle, 2001). Brazil's Fome Zero Programme (Zero Hunger) was launched in January 2003 by President Luiz Inácio Lula da Silva to provide food access to roughly 50 million people, thereby reducing poverty and hunger in Brazil (Meade & Rosen, 2003 and Rocha, 2009). The huge problem of food insecurity in South Africa can be attributed to the high income inequality and the poor distribution of food and other resources in the country (Dube, 2013). South Africa adopted the Reconstruction and Development Programme (RDP) in 1994, making food security a priority policy objective. A huge amount of public spending was focussed on improving the food security situation of historically disadvantaged people (Government of South Africa, 2002). The Russian government implemented a Food Security Doctrine to make Russia self-sufficient in food production (Lunze et al, 2015), making it a food secure nation in terms of food availability at a macro level. However, even if countries have enough food stock available at the macro level, huge income inequality makes it inaccessible to a large section of the population living in poverty (Mittal & Sethi, 2009). Hence, availability and accessibility doesn't ensure absorption or utilization of nutrition as it involves a number of factors like hygiene, drinking water, sanitation, the health of pregnant women, child's dietary intake during infancy etc. (Dev & Sharma, 2010). The policymakers of BRICS economies should focus on making their countries food secure, considering all facets of food security. Many government initiatives exist in individual BRICS nations to ensure food security. In India, programmes like the Targeted Public Distribution Scheme (TPDS) and employment schemes like MGNREGA and other poverty alleviation schemes to help a vast majority of the poor. (Mittal & Sethi, 2009). The Brazilian government's Conditional Cash Transfers (CCT) programme (Bolsa Familia) is part of a broader package of social security to help ensure basic right to food (Sharma & Gulati, 2012). South Africa launched the Integrated Food Security Strategy (IFSS) in 2002 to increase the production and distribution of food, improve nutrition, food safety and also to increase income and employment opportunities while attaining food security (Koch, 2011). The Chinese Government's National Minimum Subsistence Guarantee System for urban residents was a step to reach urban poor (Government of China, 2004). A 'unified grain procurement and sale system' was

established in 1953 to provide enough foodgrains through a ration system to the poor in urban areas. Though the system gradually disappeared around the mid-1990s, assistance to the poor continued in the form of a more reformed social security system through a cash transfer (Zhou & Wan, 2006). Russia's Family Beneficiary System, through government cash transfer schemes like pensions, ensured food security to the country's poor. (Sedik & Wiesmann, 2003). In India, centrally-sponsored schemes like Mid-day Meals and Integrated Child Development Services (ICDS) were launched to cater to the nutritional requirement of poor children (Hazra, 2012 and Dev & Sharma, 2010). Similarly, the Brazilian government's National School Meals Programme (PNAE) which is now integrated in the Zero Hunger Programme, South Africa's National Schools Nutrition Programme and China's National Soybean Action Plan, 1996 and Nutrition Improvement Action Plan, all aim to provide poor children with at least one meal a day by offering healthy nutritious meals at schools (Rocha, 2009; Government of South Africa, 2011 & Holdaway, 2015). Increasing population makes it imperative for BRICS economies to take necessary measures like investments in agricultural research, extension and outreach programmes to disseminate technological know-how, effective communication that improves farmers' access to market information and improvement in the irrigation infrastructure (Mittal & Sethi, 2009).

Table 10: Major Policy Intervention to Address Food Security among BRICS Countries

Countries	Year	Schemes	Nature
Brazil	1995	School Feeding Programme	Providing nutritional diet to children
	1996	National Programme for Strengthening Family Agriculture (PRONAF)	Support for family agriculture for increasing production
	2003	Zero Hunger (Fome Zero)	Agricultural credit, crop insurance and technical assistance to help Brazil's food availability drive
		CCT(Bolsa Familia)	Financial aid to poor families
		Food Purchase Programme(PAA)	Promote access to food and support family farming
China	1953	Unified Grain Procurement and Sale System	Providing Minimum foodgrains through ration system in urban areas
	1979	Household Responsibility System (HRS)	It privatized farming to some extent. Allowed farmers to sell surplus production after fulfilling government procurement quotas
	1996	National Soybean Action Plan	To increase the supply of soy milk and soy products to primary and middle school students
	1997	Nutrition Improvement Action Plan	Policy to address hunger and micronutrient deficiencies among vulnerable like pregnant women and small children
	2004	National Grain Subsidy System	Designed to increase grain production
	2005	National Minimum Subsistence Guarantee System	Receive basic subsistence assistance from the local government

South Africa	1994	The Reconstruction and Development Programme (RDP)	Centred around increasing production, land reforms and rural development
		National Schools Nutrition Programme	Providing one meal to school children
	1995	Integrated Nutrition Programme	Vitamin A supplements; food fortification
		Integrated Food Security Strategy (IFSS)	To ensure sufficiency, save and provide nutritious food to the poor
	2004	Social Grants Act	Department of social development carries out various schemes of social security
	2013	Fetsa Tlala	To promote food production and nutrition security to its citizens
Russia	1990	Pension Fund	To continue access to food for old people through pension (transfer) distribution mechanism
	1991	Land Reforms	Privatization of state owned and collective farms
	2010	Food Security Doctrine	Aims at the independence of domestic production and a guarantee for food safety
India	Early 1960s	Green Revolution	Drive to increase production and yield of foodgrains to overcome the acute shortage of foodgrains using HYV seeds and advanced technology
	1975	Integrated Child Development Services (ICDS)	Provides nutritional diet to pregnant women, lactating mothers and children below 6 years
	1995	National Social Assistance Programme (NSAP)	The main objective behind the scheme was to provide old age, widow pensions and family benefits support schemes
	1997	Public Distribution Schemes (PDS)	To provide minimum foodgrains through fair price shops to targeted citizens
	2000	Antyodaya Anna Yojana (AAY)	To provide the poorest of the poor with food supplies
	2001	Foodgrain Banks	To provide foodgrains to the BPL poor families at gram panchayat levels
		Annapurna Yojana	To provide poor destitute people with 10 kg of foodgrains for free
	2004	Midday Meal Scheme	School meal programme to improve the nutritional status of school-age children nationwide by providing them with cooked food
	2005	Mahatma Gandhi National Rural Employment Guarantee (MNREGA)	Provides 100 days employment, making them food secure
		National Horticulture Mission	To promote holistic growth of the horticulture sector through area-based regionally differentiated strategies
	2007	National Food Security Mission (NFSM)	To increase production of crops like wheat and pulses on a sustainable basis
		Rashtriya Krishi Vikas Yojana (National Agriculture Development Scheme)	4 per cent agro growth annually through development of agriculture and allied sectors
	2013	National Food Security Act	Aims to provide subsidized foodgrains to targeted two-thirds of India's 1.2 billion people

Source: Author's Compilation

On the whole, Brazil and Russia are among the best performing states in most of food security indicators. Russia's performance can be attributed to its pre-Soviet era socialist system. Brazil's Zero Hunger programme, which is an integrated policy, undertakes many programmes covering the availability, accessibility and absorption aspect of food security. The programme seems to be very promising and can be adopted by other BRICS nations too. Schemes like mid-day meals or school meals programme are also very popular among many BRICS countries.

Summary

Brazil, China, India, Russia and South Africa accounted for more than 42 per cent of the global population, nearly 30 per cent of the total land mass and generated 30 per cent of the total world GDP (in PPP terms) in 2014, which is set to rise significantly. With the increasing influence of emerging economies in reshaping the global order, BRICS nations have been very vocal in the area pertaining to economics, security, politics and culture, which concerns all developing countries. Despite this, BRICS economies work more as a competitor in foreign markets than working as a bloc. Their inability to identify common interests and develop consensus on various issues has only hampered their position in international institutions and hence a more co-ordinated, co-operative and strong institutional base is what is expected from BRICS economies to move forward. With a large section of their population suffering from hunger and malnutrition and global food prices rising steadily, BRICS nations are forced to focus on various aspects of food security. Though China and India are proud of their high GDP numbers (PPP), both of them are lagging behind when it comes to providing food security for their people. Meanwhile, Russia and Brazil have performed really well in most of the indicators pertaining to food security. While Russia's performance can be attributed to its pre-Soviet era socialist policies, Brazil's integrated zero hunger programme undertook many schemes, covering availability, accessibility and absorption aspect of the food security.

Despite implementing many policies to provide nutritious food at a subsidized rate to children and pregnant and lactating mothers, India's performance has been unsatisfactory, due to its inability to reach the targeted group, corruption and illiteracy. The irony is China and India, along with Brazil are among the biggest producers of foodgrains in the world, while South Africa and Russia have the least amount of agro-production among the BRICS countries. India, which is the worst performer in accessibility and absorption aspect of food security in the study, needs progressive policy action to boost incomes and reduce poverty. Beside this, there is also need to educate its vast illiterate population and make sure that schemes reach the targeted people.. BRICS economies should improve coordination among themselves and share the existing know-how for the progressive development of all the nations in the bloc.

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