RESEARCH FRONT

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NEED OF 2ND GREEN REVOLUTION FOR WORLD EMPOWERMENT

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Introduction

The world's worst recorded food disaster happened in 1943 in British-ruled India. Known as the Bengal Famine, an estimated four million people died of hunger that year alone in eastern India. The initial theory put forward to 'explain' that catastrophe was that there as an acute shortfall in food production in the area. However, Indian economist Amartya Sen has established that while food shortage was a contributor to the problem, a more potent factor was the result of hysteria related to World War II which made food supply a low priority for the British rules. The hysteria was further exploited by Indian traders who hoarded food in order to sell at higher prices.

Nevertheless, when the British left India four years later in 1847, India continued to be haunted by memories of the Bengal Famine. It was therefore natural that food security was a paramount item on free India's agenda. This awareness led, on one hand, to the Green Revolution in India and, on the other, legislative measures to ensure that businessmen would never again be able to hoard food for reasons of profit.

However, the term "Green Revolution" is applied to the period from 1967 to 1978. Between 1947 and 1967, efforts at achieving food self-sufficiency were not entirely successful. Efforts until 1967 largely concentrated on expanding the farming areas. But starvation deaths were still being reported in the newspapers. In a perfect case of Malthusian economics, population was growing at a much faster rate than food production. This called for drastic action to increase yield. The action came in the form of the Green Revolution.

The 'Green Revolution-II is extremely relevant in the present national context in view of the importance of agriculture as a major component of Indian economy and also as a single largest private enterprise. We successfully ushered in Green Revolution following a concerted effort that began during the decade of 1960s. However, in the past about 40 years many changes have taken place on several fronts such as food demand, production environment, consumption, trade, policy, socio-economic etc. that have necessitated need for a second Green Revolution. In this endeavor our approach has to be radically different from the commodity centric approach in the past.

The term "Green Revolution" is a general one that is applied to successful agricultural experiments in many Third World Countries. It is NOT specific to India. But it was most successful in India.

Green Revolution in India

There were three basic elements in the method of the Green Revolution: -

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Continued expansion of farming areas

As mentioned above, the area of land under cultivation was being increased right from 1947. But this was no enough in meeting with rising demand. Other methods were required. Yet, the expansion of cultivable land also had to continue. So, the Green Revolution continued with this quantitative expansion of farmlands. However, this is NOT the most striking feature of the Revolution.

Double-cropping existing farmland

Double-cropping was a primary feature of the Green Revolution. Instead of one crop season per year, the decision was made to have two crop seasons per year. The one-season-per-year practice was based on the fact that there is only natural monsoon per year. This was correct. So, there had to be two "monsoons" per year. One would be the natural monsoon and the other an artificial "monsoon".

The artificial monsoon came in the form of huge irrigation facilities. Dams were built to arrest large volumes of natural monsoon water which were earlier being wasted. Simple irrigation techniques were also adopted.

Using seeds with superior genetics

This was the scientific aspect of the Green Revolution. The Indian Council for Agricultural Research (which was established by the British in 1929 but was not known to have done any significant research) was re-organized in 1965 and then again in 1973. It developed new strains of high yield value (HYV) seeds, mainly wheat and rice but also millet and corn. The most noteworthy HYV seed was the K68 variety for wheat. The credit for developing this strain goes to Dr. M P. Singh who is also regarded as the hero of India's Green Revolution.

Growth in Agricultures
Annual Average growth rate

Table No. 1 - (at constant prices) (per cent)		
Five Year Plan	**Overall GDP growth rate**	**Agriculture & Allied Sectors**
Seventh Plan (1985-1990)	6.0	3.2
Annual Plan (1990-92)	3.4	1.3
Eighth Plan (1992-97)	6.7	4.7
Ninth Plan (1997-2002)	5.5	2.1
Tenth Plan (2002-07)		
2002-03	3.8	-.9
2003-04(P)	8.5	10.0
2004-05(Q)	7.5	0.7
2005-06(A)	8.1	2.3
P: Provisional, Q: Quick estimates, A: Advance estimates Note: - Growth rates prior to 2001 based on 1993-94 prices and from 2000-01 onwards based on new series Source : SCO		

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Low and volatile growth rates in Indian agriculture and allied sectors was reflected in the average annual growth rate of value added in the sector declining from 4.7 per cent during the Eighth Plan (1992-1997) to 2.1 percent during the Ninth Plan (1997-2002) (Table No. 1). As against the target of annual growth rate of 4 percent during the Tenth Plan (2002-07), agricultural growth rate in the first year (2002-03) was negative (-6.9 percent) due to a severe drought of 2002. With a favourable monsoon, growth was an impressive 10.0 percent in 2003-04. But deficient rainfall in 2004-05 again caused a decline of food grains production as well as rate of growth of Agriculture and allied sectors to 0.7 percent. The advance estimates of National Income for 2005-06 released by the CSO on February 7, 2006 has estimated a growth rate of 2.3 percent for the agriculture and allied sectors based on New Series (at 1999-2000 prices).

International Comparisons of yield

Table No. 2 -Selected commodities – 2002 (Kg/hectare)

Rice/paddy		**Wheat**		**Maize**	
Bangladesh	3448	Bangladesh	2164	China	5022
Egypt	9135	China	3885	Egypt	7789
India	2915	France	7449	France	8813
Japan	6582	India	2770	India	1705
Myanmar	3532	Iran	1905	Italy	9560
Pakistan	2882	Pakistan	2262	Pakistan	1769
Thailand	2597	U.K.	8043	Philippines	1803
U.S.A.	7372				
World	**3916**	**World**	**2720**	**World**	**4343**
Sugarcane		**Tobacco Leaves**		**Groundnut (in shell)**	
Bangladesh	39890	Bangladesh	1233	Argentina	2329
China	66353	Canada	2600	Brazil	2043
Colombia	94789	France	2778	China	2986
Egypt	119893	India	1353	India	794
Guatemala	94032	Indonesia	829	Sudan	630
India	68049	Italy	3333	U.S.A.	2669
Pakistan	48042	Pakistan	1848	Uganda	701
World	**65802**	**World**	**1589**	**World**	**1381**

Source: - Ministry of Agriculture and Cooperation.

Low productivity has afflicted growth of Indian agriculture (Table No. 2). For example, though India accounted for 21.8 per cent of global paddy production, the yield per hectare in 2002 was less than that in neighboring Bangladesh and Myanmar, and only about a third of that in Egypt, which had the highest yield level in the reference year. India, while accounting for 12 percent of global production in wheat, had average yield levels higher than the global average, but only a third of the highest level achieved in the UK in 2002. However, in maize and groundnut, while accounting for 2 per cent and 18 percent of global output, yield levels were only 39 percent and 57 percent of the global levels. In sugarcane, yield was in excess of average global levels.

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Foodgrains production (Million tones)

Table No. 3						
Crop/Year	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05***	**2005-06 $**
Rice	85.0	93.3	71.8	88.3	85.3	73.8
Wheat	69.7	72.8	65.8	72.1	72.0	-
Coarse Cereals	31.1	33.4	26.1	38.1	33.9	26.4
Pulses	11.1	13.4	11.1	14.9	13.4	5.0
Foodgrains						
(i) Kharif	102.1	112.1	87.2	116.9	103.3	105.3
(ii) Rabi	94.7	100.8	87.6	96.6	101.3	-
Total (i) + (ii)	196.8	212.9	174.8	213.5	204.6	-

***- 4th advance estimates. $- 1st advance estimates (Kharif only)**
Source: - Ministry of Agriculture.

Crop production in 2004-05 and prospects for 2005-06

The first advance estimates of foodgrains production for 2005-06 released by the Ministry of Agriculture on September 19, 2005 put kharif production at 105.3 MT, up by 2 MT from the previous year's level (Table No. 3). Production of rabi foodgrains would be around last year's level of 101.3 MT provided the weather remains favourable.

Commercial crops production

Table No. 4 (Million tones)						
Crop/Year	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05@**	**2005-06 $**
Groundnut	6.4	7.0	4.1	8.2	7.0	5.9
Repessed & Mustard	4.2	5.1	3.9	6.2	8.4	-
Soyabean	5.3	6.0	4.7	7.9	7.5	6.6
Other Oilseeds	2.5	2.6	2.1	3.0	3.2	2.1
Total nine oilseeds	18.4	20.7	14.8	25.3	26.1	14.6
Cotton*	9.5	10.0	8.6	13.9	17.0	15.9
Jute & Mesta**	10.6	11.7	11.3	11.2	10.5	10.1
Sugarcane	296.0	297.2	287.4	237.3	232.3	257.7

***- Million bales of 170 kgs, each. ** Million bales of 180 kgs, each.**
@ - 4th advance estimates . $ - 1st advance estimates (kharif only).
Source: - Ministry of Agriculture.

Kharif oilseeds production for 2005-06 is estimated at 14.6 MT as per the first advance estimates. The rabi oilseeds production may reach the target level of 10.4 MT with favourable weather. The first advance estimates for 2005-06 put sugarcane output at 257.7 MT against 232.3 MT in 2004-05. However, prospects of cotton production in 2005-06 are not considered better than in 2004-05 (Table No. 4)

Area and production of major horticultural crops

Table No. 5								
Crops	**2002-03**		**2003-04**		**2004-05***		**2005-06***	
	Area	**Production**	**Area**	**Production**	**Area**	**Production**	**Area**	**Production**
Fruits	3.8	45.2	4.8	49.2	5.0	53.1	5.2	57.6
Vegetables	6.1	84.8	5.9	84.8	6.1	91.6	6.3	99.4

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Spices	2.4	2.9	2.4	3.8	2.5	4.1	2.6	4.4
Plantation Crops	3.0	9.7	3.1	13.1	3.2	14.1	3.3	15.3
Flowers	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2
Others	1.0	1.6	0.9	0.9	0.9	1.0	1.0	1.1
Total	16.3	144.4	17.2	152.0	17.8	164.1	18.6	178.1

Source: - National Horticulture Board, * Estimated

Horticulture

Acreage under horticulture- which includes fruits, vegetables, spices, floriculture and coconut – increased to 17.8 million hectares or about 10 percent of gross cropped area of the country in 2004-05 from 16.3 million hectares in 2002 – 03 (Table No. 5). With a production of 164 million tones in 2004-05, the sector contributed 28 percent of GDP from agriculture. The targeted growth rate during the Xth Plan for the sector is 8-9 percent.

Gross Capital Formation in Indian Agriculture

Table No. 6

Year	Investment in Agriculture (Rs. Crore)			Share in agricultural gross investment (percent)		Investment in Agriculture as a percent of GDP at constant prices
	Total	Public	Private	Public	Private	
1990-91	14836	4395	10441	29.60	70.40	1.92
1995-96	15690	4849	10841	30.90	69.10	1.57
1996-97	16176	4668	11508	28.90	71.10	1.51
1997-98	15942	39793870	11963	25.00	75.00	1.43
1998-99	14895	4221	11025	26.00	74.00	1.26
1999-00	17304		13083	24.40	75.60	1.37
New Series (at 1999-00 prices)						
1999-00	43473	7754	35719	17.8	82.2	2.2
2000-01	38176	7018	31158	18.4	81.6	1.9
2001-02	46744	8529	38215	18.2	81.8	2.2
2002-03	45876	7849	38018	17.1	82.9	2.1
2003-04	47833	12809	35024	26.8	73.2	2.0
2004-05*	43123	12591	30532	29.2	70.8	1.7

*** Quick Estimates.**
Source: - CSO

Capital Formation in Indian Agriculture

The decline in the share of the agricultural sector's capital formation in GDP from 2.2 percent in the late 1990s to 1.7 percent in 2004-05 is a matter of concern (Table No. 6). This declining share was mainly due to the stagnation or fall in public investment in irrigation, particularly since the mid-1990s. However, there is indication of a reversal of this trend with public sector investment in agriculture reaching its highest level of Rs.12,591/- crore in 2004-05 since the early nineties. The share of public investment in gross investment increased by over 11 percentage points to reach 29.2 percent in 2004-05 relative to 1999-2000.

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Capital formation include the following

- A roadmap for agricultural diversification has been prepared with focus on horticulture, floriculture, animal husbandry and fisheries.
- Strengthening of agriculture marketing infrastructure.
- National scheme for the repair, renovation and restoration of water bodies.
- Focus on micro irrigation, micro finance, micro-insurance and rural credits.
- Setting up a Knowledge Centre in every village.
- Setting up a National Fund for strategic agricultural research.
- Provision of urban amenities in rural areas through creation of new growth poles.

Reduction in share of agricultural exports to total exports

The agricultural export has recorded an impressive growth of 7% during the period 2000-2001. Despite trade liberalization the share of agricultural exports to total national exports have declined from 18.49% in 1990-91 to 11.2% in 2004-2005. Over the years, the share of agricultural exports in total exports has been decline on account of diversification of the country's export basket and falling international prices of agricultural products. India's agricultural exports have shown extreme volatility.

Agricultural Exports and Their Share in Total National Exports since 1990-91

Year	Agriculture Imports	Total Imports	% Agriculture Imports to Total Imports	Agriculture Exports	Total Exports	% Agriculture Exports to Total Exports
1	2	3	4	5	6	7
1990-91	1205.86	43170.82	2.79	6012.76	32527.28	18.49
1991-92	1478.27	47850.84	3.09	7838.04	44041.81	17.80
1992-93	2876.25	63374.52	4.54	9040.30	53688.26	16.84
1993-94	2327.33	73101.01	3.18	12586.55	69748.85	18.05
1994-95	5937.21	89970.70	6.60	13222.76	82673.40	15.99
1995-96	5890.10	122678.14	4.80	20397.74	106353.35	19.18
1996-97	6612.60	138919.88	4.76	24161.29	118817.32	20.33
1997-98	8784.19	154176.29	5.70	24832.45	130100.64	19.09
1998-99	14566.48	178331.69	8.17	25510.64	139751.77	18.25
1999-00	16066.73	215528.53	7.45	25313.66	159095.20	15.91
2000-01	12086.23	228306.64	5.29	28657.37	201356.45	14.23
2001-02	16256.61	245199.72	6.63	29728.61	209017.97	14.22
2002-03	17608.83	297205.87	5.92	34653.94	255137.28	13.58
2003-04	21972.68	359107.66	6.12	37266.52	293366.75	12.70
2004-05	22057.49	481064.11	4.59	39863.31	356068.88	11.20
2005-06	21025.54	630526.77	3.33	49802.92	454799.97	10.95

Source: - DGCI & S, Ministry of Commerce, Kolkata.

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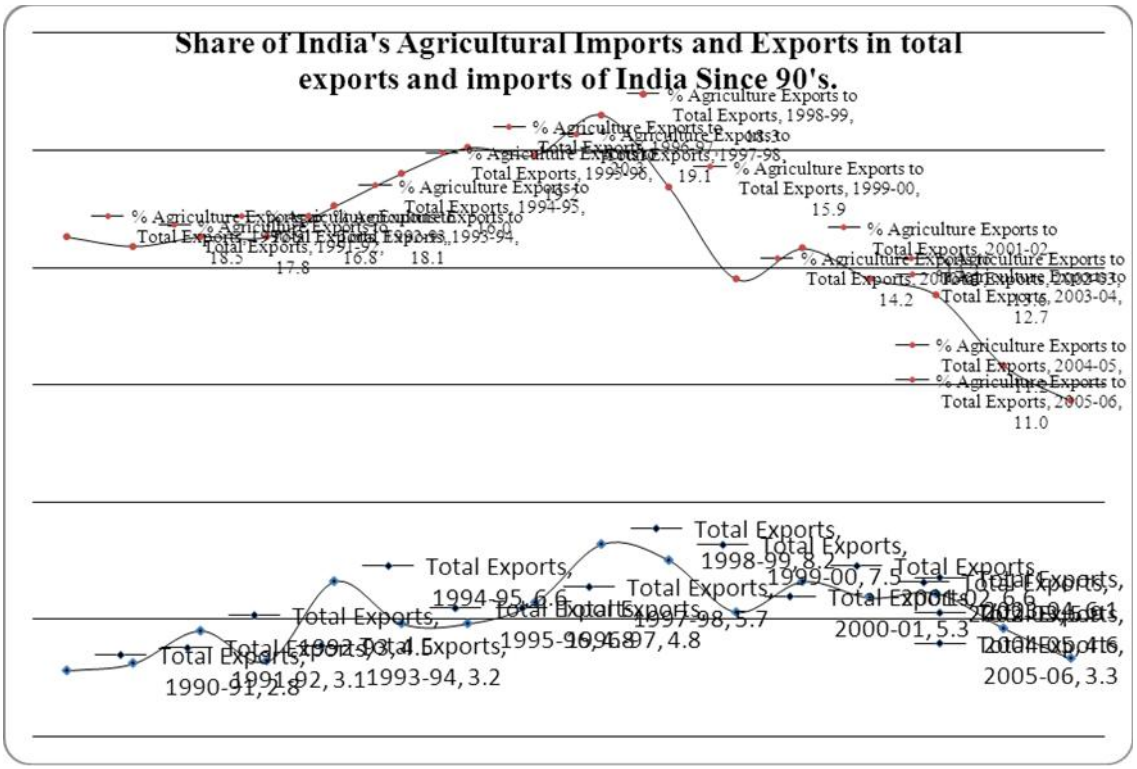

% Agriculture Imports to Total Imports % Agriculture Exports to Total Exports

Socioeconomic impacts

The transaction from traditional agriculture in which inputs were generated on-farm to Green Revolution agriculture, which required the purchase of inputs, lead to the widespread establishment of rural credit institutions. Smaller farmers often went into debt, which in many cases result in a loss of their farmland.

The increased level of mechanization on larger farms made possible by the Green Revolution removed a large source of employment from the rural economy. Because wealthier farmers had better access to credit and land, the Green Revolution increased class disparities. Because some regions were able to adopt Green Revolution agriculture more readily than others (for political or geographical reasons), interregional economic disparities increased as well. Many small farmers are hurt by the dropping prices resulting from increased production overall.

The new economic difficulties of small holder farmers and landless farm workers led to increased rural-urban migration. The increase in food production led to a cheaper food for urban dwellers, and the increase in urban population increased the potential for industrialization.

Globalization

In the most basic sense, the Green Revolution was a product of globalization as evidenced in the creation of international agricultural research centers that shared information, and with transnational funding from groups like the Rockefeller Foundation, Ford Foundation, and United States Agency for International Development USAID.

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Additionally, the inputs required in Green Revolution agriculture created new markets for seed and chemical corporations, many of which were based in the United States. For example, Standard Oil of New Jersey established hundreds of distributors in the Philippines to sell agricultural packages composed of HYV seed, fertilizer, and pesticides.

Economic results of the Green Revolution

1) Crop areas under high-yield varieties needed more water, more fertilizer, more pesticides, fungicides and certain other chemicals. This spurred the growth of the local manufacturing sector. Such industrial growth created new jobs and contributed to the country's GDP.
2) The increase in irrigation created need for new dams to harness monsoon water. The water stored was used to create hydro-electric power. This in turn boosted industrial growth, created jobs and improved the quality of life of the people in villages.
3) India paid back all loans it had taken from the World Bank and its affiliates for the purpose of the Green Revolution. This improved India's creditworthiness in the eyes of the lending agencies.
4) Some developed countries, especially Canada, which were facing a shortage in agricultural labour, were so impressed by the results of India's Green Revolution that they asked the Indian government to supply them with farmers experienced in the methods of the Green Revolution. Many farmers from Punjab and Haryana states in northen India were thus sent to Canada where they settled (That's why Canada today has many Punjabi-speaking citizens of Indian origin). These people remitted part of their incomes to their relatives in India. This not only helped the relatives but also added, albeit modestly, to India's foreign exchange earnings.

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