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**RE-VISITING AGRICULTURAL POLICIES IN THE LIGHT OF
GLOBALISATION EXPERIENCE: THE INDIAN CONTEXT**

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Revisiting the Growth Patterns in Indian Agriculture using
Internationally Compatible Methodology¹

I

INTRODUCTION

Agriculture plays a dominant role in the growth of Indian economy. This large sector will continue to be important for the Indian economy and for the integrated world. Increasingly, the structural changes, taking place within the sector, are influencing the earning potentials of the people engaged in farming. It has been observed that food habits undergo changes with economic growth and the inflow of knowledge on nutritional needs. The dynamics in the Indian agricultural sector which is facing crop specific food inflation, farm technology and demand coming from processing industries now make accounting globally important.

The agricultural sector supplies food to the country's large population, provides raw materials to industries including the emerging food processing industries and the surplus is exported to the deficit countries to enable attainment of food security across the world. Agriculture is also a market for industrial products that include farm inputs and consumer goods. The share of agriculture in India's GDP started declining in recent times because GDP of agricultural sector has grown at a slower rate than the entire economy. This is also not surprising in a growing economy. However, not only the growth rate but the pattern of this growth also occupies an important place in sustaining high GDP growth in India along with greater equity.

Literature has many studies on development of agriculture and growth related issues in India (Kannan and Sundaram, 2011, Balakrishnan, *et al.*, 2008, BIRTHAL *et al.*, 2007) largely dependent on the government databases and methods, National Accounts Statistics (NAS) by Central Statistics Organization (CSO) and Ministry of Agriculture. This study attempts to create an alternative product account in line with the state production accounts constructed for the US farm sector by U.S. Department of Agriculture's (USDA) Economic Research Service (ERS) (Ball *et al.*, 1999, Wang *et al.*, 2015). Broadly in line with international standards but utilising data from the same government sources, the methodology will be useful for international comparisons. The product accounts thus created are used to estimate the growth rates and analyse the pattern of these growth rates of agricultural output in India for the period 1976-2008. The use of compatible methodology can also be potentially

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¹The authors are affiliated to Institute of Economic Growth, Delhi. This study is part of a larger work on building up world agricultural output and input datasets (KLEMS) and estimating the total factor productivity. The authors acknowledge the team leader Dr. Eldon Ball of USDA for his advice in this study.

important for estimating accurately the growth of output of agriculture in different countries of the world in a coherent way towards attaining food and income security across the world. The rest of the paper is organised with methodology and sources of data in section 2, and review of agricultural growth in section 3 followed by conclusions in section 4.

II

METHODOLOGY AND SOURCES OF DATA

For international compatibility, we follow a method used by ERS (Economic Research Service) of USDA (United States Department of Agriculture (Ball et al. 1999, Wang *et al.*, 2015). ERS uses Tornquist approach (Theil-Tornquist index) to construct aggregated output as implicit quantities based on detailed output information on agriculture consisting of field crops, horticulture and animal based products with revenue shares as weights. Thus, nominal output series valued at current prices and producer prices needs to be created for all products and sub-sectors broadly consistent with those of other countries of the world with calendar year as the unit of time. Then, the Theil-Tornquist method is applied on these modified categories of product groups to estimate price indices. The Theil-Tornquist Price index (TTI) for N products (or sub-sectors) is computed as follows:

$$TTI_{kt} = \prod_{i=1}^N \left(\frac{p_{it}}{p_{ik}} \right)^{\frac{w_{ij} + w_{ik}}{2}} \quad \dots(1)$$

where $w_{it} = \frac{(p_{it}q_{it})}{(\sum_i p_{it}q_{it})}$ represents the weights, p_{it} and q_{it} represent price and quantity, respectively of the i^{th} product, and k is the base year. TTI_{kt} is the composite price index of t^{th} year with k^{th} base year weighted by average of value shares of current and base years. This approach of creating price indices has a merit of comparing two years separated by several years when the production basket may have changed (Prasad *et al.*, 1995). Finally, we compute value of the real output as the ratio of nominal value of output to the estimated TTI price index with 2005 as the base year as in US Product Accounts.

Agriculture in our specification shall comprise of 62 products including field crops, horticulture and animal based products. To be broadly similar to the product accounts for other countries and also with India's national accounting protocols, these products are regrouped in eleven sub-sectors. These are Cereals (CER), Millets (MLT), Pulses (PLS), Oilseeds (OLS), Fibres and Materials (FM), Condiments and Spices (CS), Sugarcane (SCN), Beverages and Narcotics (BN), Fruits (F), Vegetables

(V) and Livestocks and Fisheries (LF). The data are mostly obtained from India's official sources, Ministry of Agriculture, Government of India, supplemented by FAOSTAT only if unavoidable. The sample period considered is 1976 to 2008 covering a span of 33 years. For the entire sector, price index is based on all the products whereas sub-sector level price indices are based exhaustively on products within the sub-sectors except in a few exceptional cases where price indices are based only on specific crops within the sub-sectors due to constraints on data availability. Details of crops in each sub-sector will be discussed later in the sub-sector level analysis. Production is attributed to the calendar year and valuation is based on prices in the marketing period, i.e., only when the producer income is realized from this production. Crop calendars in various regions in the country are used for the purpose. This is in line with the international standards.

For prices, first state level monthly prices are estimated by averaging corresponding prices reported across the major wholesale markets (*mandis*). Then, producer prices, used for valuation, are proxied by average prices only of months in the peak marketing season, i.e., three months immediately following the harvest as bulk of the produce is sold by farmers during this period. All India level estimates are then obtained as the weighted average of state level producer prices with production in the states as weights. For rice and wheat, public procurement at pre-announced prices called minimum support prices (MSP) by the Food Corporation of India play a major role in a few dominantly producing states. Producer prices of these crops are the averages of state level prices and the MSPs with the shares of sales in the two channels used as weights. For sugarcane, which has multiple organized sector uses including production of energy and biofuel, the MSP of cane is used to avoid the confusion created by prices reported by different agencies for various by-products. For minor crops and crops where price data is not reported regularly by the Ministry, current values of crops reported in the National Accounts Statistics deflated by quantities reported by the Ministry of Agriculture have been used as approximations with due adjustments for calendar year. The resultant series of real output of agriculture and its sub-sectors are used for computing growth rates.

III

REVIEW OF AGRICULTURAL GROWTH

All Products

For illustrating agricultural growth, compound annual growth rates (CAGR) of real output of agriculture i.e., output implicitly valued at 2005 prices have been computed. The entire period of 1976 to 2008 has been divided into sub-periods comprising of 5 years each to understand the growth patterns vis-a-vis various policies pertaining to a particular sector.

Table 1 shows the comparisons of growth rates estimated as per methodology in this study with those based on NAS (CSO's methodology) for the entire period, 1976-2008. Our estimates are almost same (3.25 per cent per annum) as those based on NAS. However, for the recent period 2001-08, our estimate at 2.90 per cent per annum is a little higher than 2.60 percent based on NAS. At the sub-sector level, for the entire period, our estimates exceed those based on NAS for MLT, BN, SCN and LF but are lower in magnitude for other sub-sectors. For 2001-08, our estimates, however, exceed the NAS estimates also in CER, PLS and CS. For the crops sector as a whole however our estimates are lower than those based on NAS in 1976-2008 as well as in 2001-08.

TABLE 1. AVERAGE COMPOUND ANNUAL GROWTH RATES (PER CENT) OF REAL VALUE OF OUTPUT IN AGRICULTURE

(1)	CER (2)	MLT (3)	PLS (4)	OLS (5)	FM (6)	CS (7)	F (8)	V (9)	BN (10)	SCN (11)	CROPS (12)	LF (13)	All products (14)
Estimates#													
1976-80	4.27	-0.77	-6.47	-2.64	1.10	-4.21	7.28	3.69	2.25	-2.16	2.08	4.09	2.54
1981-85	3.96	-7.74	1.29	0.54	3.94	6.21	7.83	7.45	-0.30	2.50	3.92	6.01	4.43
1986-90	4.76	5.26	-0.22	9.35	9.92	3.15	2.12	5.76	2.52	7.23	4.84	4.60	4.77
1991-95	2.01	2.08	0.68	4.46	6.38	5.06	7.90	4.97	2.42	3.40	3.69	4.67	3.96
1996-00	2.48	-1.68	-0.63	-4.07	-5.51	0.87	-0.51	9.84	4.73	1.57	1.51	3.41	2.06
2001-08	1.33	0.06	1.54	3.92	6.91	3.62	4.40	-1.93	3.45	2.02	2.08	4.66	2.90
1976-08	2.58	0.52	0.24	3.00	3.41	2.55	3.73	3.13	3.45	2.80	2.73	4.60	3.25
National Accounts Data@													
2001-08	1.24	-1.12	0.85	3.92	7.07	3.58	3.11*		0.47	-1.72	2.16	3.65	2.60
1976-08	2.61	0.42	0.83	3.81	3.68	4.65	3.73*		2.60	1.68	2.89	4.22	3.25

- Notes: 1. # Estimates are authors computations as per the methodology in this study with TTI as the deflator (base=2005) and calendar year as the unit of analysis.
 2. @ Estimates based on NAS are at constant prices 2004-05 and are for financial years 1976-77 TO 2008-09 and 2001-02 to 2008-09.
 3. * includes vegetables.

Thus at the sub-sector level, the methodological variations may have yielded the differences in the estimates of growth rates. Differences may have emerged partly because of the calendar year used as the unit of analysis. In the following subsections we discuss in detail, the patterns in the growth rates of real output of agriculture computed by our methodology in this study.

Sub-Sector Level Performance and Policy Influences

Among the sub-sectors in the entire period 1976-08 (Figure 1), LF has registered the highest growth rate of 4.6 per cent followed by F, BN, FM, V and OLS with growth rate between 3 to 4 per cent. SCN with a growth rate of 2.8 per cent has been followed by CER and CS each with a growth rate of 2.6 per cent. MLT and PLS recorded the least growth rate of 0.5 per cent and 0.2 per cent only.

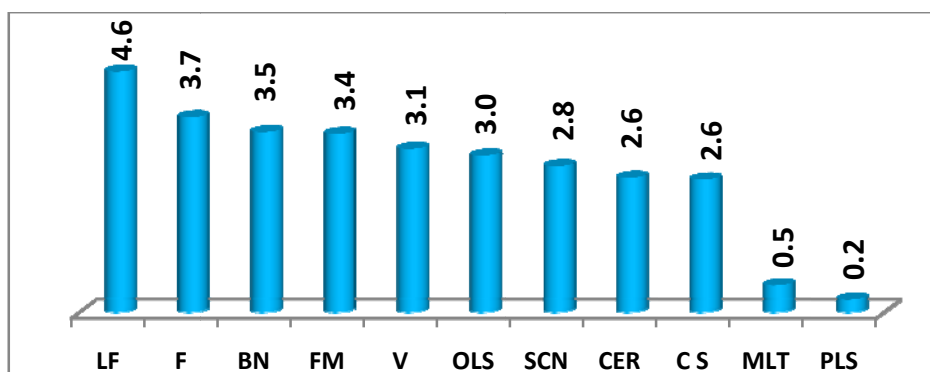


Figure 1. CAGR (per cent) of Real Output for Sub-Sectors in Agriculture in India (1976-2008)

Figure 2 suggests that behind the period averages there are considerable sub-period level variations in growth rates. The growth rate increased from 2.5 per cent in 1976-80 to an impressive growth rate of 4.8 per cent in 1986-90. But thereafter i.e., since 1991, the year of initiation of economic reforms, growth rate started declining and reached 2.1 per cent only in 1996-00 from where again growth rate started picking up and increased to 2.9 percent in the latest period of 2001-08. The sub-period 1996-00 can appear as a turning point indicative of an initial set back after launch of reforms and a reversal thereafter.

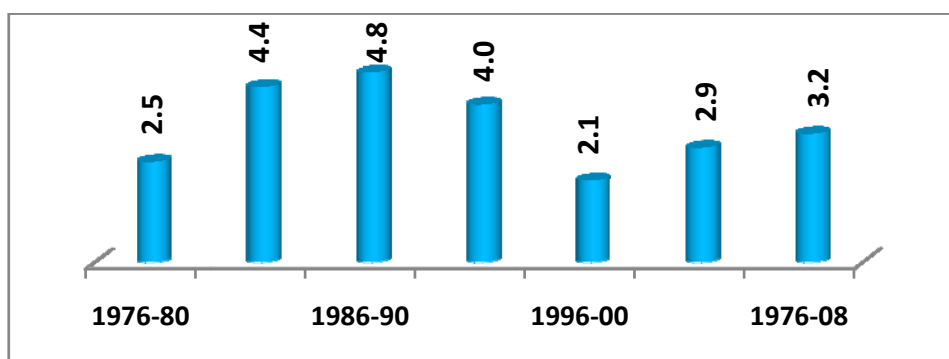


Figure 2. CAGR (per cent) of Real Output of all Products across Sub-Periods.

The large variations in the growth rates across various sub-periods for different sub-sectors may have been related to policy measures, changing food habits and sudden globalisation when India began losing her insulation from the world economy. The usual vagaries of weather, explaining around 60 per cent of the variation in the growth of agricultural output, are also accountable. Below we shall review in detail the patterns in output growth for the various sub-sectors over different sub-periods in view of the major policy programmes and other policy

interventions. Figure 3 depicts the annual variations in the growth rates of various sub-sectors.

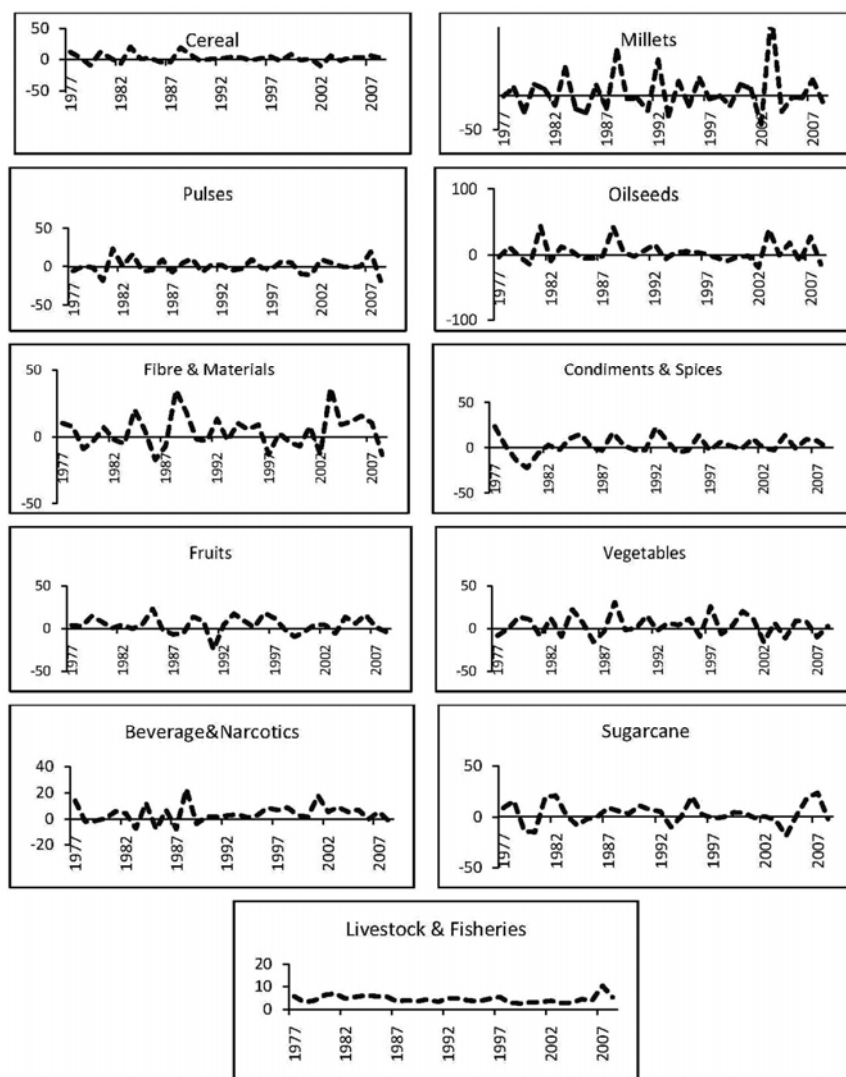


Figure 3. Annual Variations in Growth Rates (Per cent) across Sub-Sectors of Indian Agriculture.

Cereals

Growth of CER (Rice, Wheat, Jowar, Maize and Barley) output has been higher in the 1980s as compared to other years. The growth rates however stabilized over

time except for a pronounced negative shock observed only in 2002 (Figure 3). The probable reason for increase in the production of this group has been generally attributed to the green revolution and domestic agricultural price policy consisting of price support through open ended procurement that discourages production of coarse cereals and pulses (Karwasra, *et al.*, 2003). The stagnation of growth in the later years is also a sign of saturation of green revolution.

Millets

In the MLT sector (Bajra, Ragi, and Small millets), though ‘All India Co-ordinated Small Millets Improvement Project’ launched in 1986 played a significant role in 1986-90 but decline in the area followed because of decreasing demand, low price, rising incomes and changing food habits despite being cheap sources of proteins and vitamins to the poor and deemed nutritionally superior to rice and wheat. Millets being sensitive to weather, the growth rate is highly volatile.

Given the fact that they can grow without irrigation and with very little external inputs, millets play an important role in reviving the agriculture sector while providing food and nutritional security. Various initiatives have been taken to promote millets. In 2007 and 2008, Millet Net Work of India (MINI) was initiated by Deccan Development Society and the workshop, National Consultation on Millets was also organized by MINI in Hyderabad where participants were given the option of millet based drinks, breakfast and lunch (National Institute of Rural Development, 2008). MLT may have also been facing competition in dry regions from other major cereals and cash crops that benefitted from government price support mechanisms (Pray and Nagarajan, 2009).

Pulses

Output of PLS (Arhar, Gram, Moong, Urad, Masoor, and Other Pulses) has grown at the rate of 0.24 per cent only over 1976-2008 which is even less than that for millets. Over the sub-periods also, the growth rate has been either negative or negligible positive. Fluctuating productivity of this rainfed crop is responsible along with stagnant area with farmer’s preference to rice, wheat or other cash crops in irrigated areas. Thus various initiatives taken by the government to increase the pulses output have hardly been effective. Pulses imports are likely to increase further, even while sources of import of pulses are limited, if adequate measures are not taken.

Oilseeds

OLS (Groundnut, Rapeseed & Mustard, Soybean, Linseed, Sesamum, Castor, Nigerseed, Safflower and Sunflower) output moved from a growth rate of -2.6 per

cent in 1976-80 to 0.5 percent only in 1981-85. However, Technology Mission on Oilseeds in 1986 resulted in an impressive growth rate of oilseeds output after mid eighties except during 1996-00. This phenomenal increase in the production of oilseeds has even been called the 'yellow revolution' (Shenoi, 2003).

Fibres and Materials

Output of FM (Cotton, Jute, Mesta, Sunhemp, Rubber, Coconut and Gaurseed and Others) grew at an impressive rate throughout except in the initial period and negative rate in the period 1996-00. This trend can be explained by the area under the main crop cotton. The departure in 1996-00 seems to be because of attack of disease and pests on the cotton crop in 1997-98 and 1998-99 and severe drought of 1999-2000 in almost all cotton growing states in the country. The approval of commercial cultivation of BT cotton seed in India during 2002 is possibly a factor behind the success in 2001-08. BT cotton is said to control worms and reduces the use of insecticides without compromising on yield (Manickam, *et al.*, 2007).

Condiments and Spices

CS sector (Cardamom, Chillies, Black Pepper, Dry Ginger, Turmeric, Garlic and Coriander and Others) consisting of major commercial crops having dietary, medicinal and other uses earns a major part of foreign exchange annually. The sector has grown by 2.55 percent during 1976-08 but in the sub-periods, growth has been fluctuating though at positive levels except in 1976-80. The growth rate was high in 1977 but remained positive except the lowest level reached in 1980 and in 1996-2000 following India's signing the WTO treaty.

Fruits and Vegetables

India is the world's second largest producer of Fruits (Banana, Cashewnut Apple, Mango, Orange, Grape, Papaya and Others (Guava, Sapota, Citrous, Pineapple, Litchi, Mosambi, Lemon, etc.)) and Vegetables (Potato, Sweet Potato, Tapioca, Onion, Cabbage, Cauliflower, Tomato and Others (Brinjal, Ladyfinger, Peas and Mushroom etc.)) which had a growth rate of 3.73 per cent and 3.13 per cent respectively over 1976-2008. Increase in area is a major factor behind the performance. Vegetables like fruits also have the erratic pattern in the growth rates being largely dependent on seasonality.

Impressive growth of fruits and vegetables despite seasonality is the result of several initiatives taken by Government of India like flagship National Horticulture Mission (NHM) in 2005-06 and other area based regionally differentiated strategies. The agriculture ministry is also implementing market intervention scheme for procurement of various horticultural commodities to protect the growers from making

distress sales in the event of a bumper crop when there is glut in the market, causing prices to fall below economic levels.

Beverages and Narcotics

BN (Tea, Coffee, Tobacco and Arecanut and Others) shows an impressive growth rate over the 1976-08, though its share in the total output of agriculture is very low, being around 2 per cent only that has declined even further over the years. It may be noted that the growth rates in the initial period are marked by year to year volatility till 1989 since when growth rates scarcely fell to negative levels. Among the crops of this group, Tea production has been insignificant because of the negligible increase in area along with aging of tea bushes and consequent re-plantation/rejuvenation activities, labour shortages, pest attacks and vagaries of weather. Growth of coffee production has been more than the growth of tea production for the entire period as the demand for coffee increased driven by the expansion of coffee culture among the youth during recent times.

Growth of Arecanut has been the highest and that of tobacco has been the smallest as a result of policy measures. Arecanut has been habitual item with demand increasing further with the emergence of scented supari and ghutka. The decline in the tobacco production moved in tandem with public propaganda over health issues and the taxation policies on the manufacturing sector (Goyal *et al.*, 2004).

Sugarcane

SCN is a long season (perennial) crop with the durations, seasons and cultivation practices varying across regions. The crop is sensitive to weather conditions at different points in the long growing season often exceeding a year. The erratic behaviour of India's sugarcane output is also driven by policy interventions such as government price support policies which remains in an unresolved state, trade policies and release of free sale sugar and buffer stocks. Thus, given the globalization, changing diet consciousness, new emerging uses such as ethanol for energy and the political sensitiveness of the sector, the government policy is yet nascent in meeting the challenges.

Livestocks and Fisheries

Growth of output of LF (Milk, Meat, Egg and Fish) of 4.6 per cent has been the highest among all sub-sectors in the entire period. Over the sub-periods also, growth has been in general stable relative to the other sub-sectors. The growth of this sector can be explained by the growth of output of milk which has the largest share. Shifts in demand towards dairy products as well as technological improvements on the supply side especially in genetic upgradation of animals and massive intervention by government of India through institutional and policy initiatives have contributed in

the growth of this sector. The cooperative movement known as Operation Flood started by Dr. Varghese Kurien, called Father of Milk Revolution in India, Technology Mission on Dairy Development (TMDD), an Integrated Dairy Development Programme (IDDP) in Non-Operation Flood, hilly, and backward areas have played a significant role. Further trade regulation policies to promote domestic production were responsible for the robust growth of this sector.

Production of fish, egg and poultry in India has also increased over the years especially since the 1990s due to a combination of several factors, easier access to modern technology facilitated by policy and liberalization. Rising incomes and a rapidly growing middle class encouraged consumption. The progress of poultry industry is also attributable to the efforts of Dr. B.V. Rao called Father of Indian Poultry Industry for providing world class facilities in the country along with promotional schemes like Poultry Venture Capital Fund and Poultry Performance Testing Centers, Marine Fisheries Development Scheme, Inland Fisheries Development Scheme and Fisherman Welfare Scheme.

IV

CONCLUSION

The growth rates of real output of agriculture in India estimated using internationally compatible methodology have been found to differ from those estimated using NAS based on CSO methodology at the sub-sectoral levels though consistent at an aggregate level. Thus, while making any comparison across countries, it is desirable to use a modified methodology.

Over the years, growth rate of agricultural output increased till 90s, started declining thereafter but recovered in 2000s. Among the sub-sectors, LF have had the highest growth rate and pulses the lowest growth rate. Over the sub-periods, growth rate of output has been fluctuating in most cases, it appears, on account of policy interventions besides usual vagaries of weather that affect short term fluctuations. The growth rates are subject to year to year variations often negative and sharp, livestock and horticulture being exceptions. The country is challenged by the impatience over poverty, aspirations of people, changing food preferences, clamour of privatization in the face of welfare commitments, WTO compliance demands and weather vagaries. There is urgency for restructuring of the policy regime with a holistic perspective covering agriculture, industry, trade and welfare. In a globalised scenario, policy formulation will be facilitated by revisiting the product accounts and the methodology behind them in line with international conventions to achieve greater uniformity and easy comparisons.

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