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## **Fruits and Vegetables: Production Trends and Role of Linkages**

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### **INTRODUCTION**

Fruits and vegetables constitute a crucial nutrient source in human diet. The economic importance of fruits and vegetables has been increasing on account of increase in domestic as well as international demand for them. Domestic demand was increasing due to increase in incomes, population growth, changing consumption patterns and higher nutrition consciousness among the masses. The result was a shift in the cropping pattern in favour of fruits and vegetables and consequent increase in their production and availability. It is estimated that the share of fruits and vegetables in gross calorific value of food items produced increased from 3.1 per cent in 1950-51 to 4.8 per cent in 1993-94 (Satyasai and Viswanathan, 1996). The aggregate domestic demand for fruits and vegetables is estimated to grow at over 3.54 per cent per annum upto 2010 (Radhakrishna, 1996). Further, the export of fruits and vegetables, both fresh and processed, has become a potential source of foreign exchange for the country being the second largest producer in the world. The value of exports of fresh fruits and vegetables in 1994-95 was of the order of Rs. 489 crores which registered a growth rate of 22.52 per cent per annum between 1990-91 and 1994-95. The exports of processed fruits and vegetables in 1994-95 amounted to Rs. 273 crores registering a growth of 44.86 per cent per annum during the same period (CMIE, 1996). The export potential of fresh fruits and vegetables alone is estimated to be Rs. 1,245 crores by 2001 A.D. which is about three times higher than the present level of exports of fruits and vegetables (Singhal, 1995).

The annual production of fruits and vegetables in the country is estimated at about 104 million tonnes. Nonetheless, 30 per cent of the produce is damaged due to inadequate or improper post-harvest handling and lack of adequate processing facilities. Further, mere 1.6 per cent of the produce is processed annually leading to colossal waste of the produce. Because of the perishable nature of the commodities, processing becomes essential for exploiting their economic potential by creating time, form and space utilities. The economic potential of the fruits and vegetables can be best harnessed by stepping up the production of fruits and vegetables which is possible in view of the country's diverse climate, by better utilisation of the current production through efficient post-harvest handling, and by forging effective linkages among producers, processors, marketers (including exporters), facilitators, infrastructure facilities and consumers.

Against this background, the paper seeks to examine the trends in production and consumption of fruits and vegetables in the country, to discuss the importance of different credit and non-credit linkages for promotion of fruit and vegetable sector and to examine the adequacy of the available linkages at present.

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The views expressed in the paper are of the authors alone.

## DATA AND METHODOLOGY

The data on area, production and productivity of fruits and vegetables and estimates of consumption expenditure on food items and fruits and vegetables compiled by Centre for Monitoring Indian Economy (CMIE), Mumbai are used for this study. Trend growth rates are measured using semi-log function. The elasticity of consumption of food items and fruits and vegetables with respect to price and income of consumers was estimated using double-log functional form as given below:

$$\ln C = \beta_0 + \beta_1 \ln Y + \beta_2 \ln P + u$$

where C = per capita final consumption expenditure (Rs.),

Y = per capita income (Rs.),

P = implicit price deflator,

$\beta_0$  = intercept,

$\beta_1$  = income elasticity,

$\beta_2$  = price elasticity, and

u = error term.

## RESULTS AND DISCUSSION

*Trends in Production*

The area and production of fruits and vegetables in the country have been growing on account of diversification in agriculture. Fruits and vegetables occupied a share of only 0.58 per cent of the gross cropped area in triennium ending (TE) 1952-53 which has grown to a level of 2.29 per cent in TE 1992-93 (Satyasai and Viswanathan, 1996). The growth in the production of fruits and vegetables over the last three and a half decades is appreciable. The value of output from fruits and vegetables showed a growth rate of 5.76 per cent per annum between 1960-61 and 1992-93. Among the individual crops, potato showed the highest rate of growth at 7.28 per annum, followed by banana at 5.7 per cent per annum. The growth rates of different fruits and vegetables during the last three decades are given in Table 1.

TABLE 1. GROWTH RATE OF VALUE OF OUTPUT FROM FRUIT AND VEGETABLE (REAL TERMS)

Crop (1)	Compound growth rates (per cent)			
	1960-61 to 1970-71 (2)	1970-71 to 1980-81 (3)	1980-81 to 1990-91 (4)	1960-61 to 1992-93 (5)
Banana	2.32	4.41	4.68	5.76
Cashewnut	5.59	-3.37	3.55	3.22
Potato	5.87	5.68	4.92	7.28
Tapioca	9.84	0.89	-0.77	3.96
Onion	-	-	1.99	-
Others	7.73	1.65	2.46	5.35
All fruits and vegetables	7.01	2.74	2.91	5.76

As could be expected from the impressive growth in value of output, the share of fruits and vegetables in the gross value of output also demonstrated substantial shift. The share of fruits and vegetables in the gross value of output from agriculture increased from 7.36 per cent in 1960-61 to 12.23 per cent in 1992-93. The shares of banana, potato and tapioca got more than doubled. The share of fruits and vegetables in the gross value of output from agriculture during the past decades is given in Table 2.

TABLE 2. TREND IN SHARE OF FRUITS AND VEGETABLES IN GROSS VALUE OF OUTPUT

Crop (1)	Share in the value of output from agriculture				
	1960-61 (2)	1970-71 (3)	1980-81 (4)	1990-91 (5)	1992-93 (6)
Banana	0.70	0.80	0.92	1.24	1.48
Cashewnut	0.13	0.18	0.25	0.26	0.36
Potato	0.84	1.40	1.70	1.94	1.47
Sweet potato	0.00	0.00	0.22	0.16	0.18
Tapioca	0.23	0.64	0.43	0.50	0.51
Onion	0.00	0.00	0.35	0.60	0.33
Others	5.46	7.33	7.36	7.55	7.90
Overall	7.36	10.35	11.24	12.26	12.23

### *Trends in Consumption*

The per capita consumption of fruits and vegetables had been increasing in the country on account of increasing incomes of the consumers and change in consumption pattern. The per capita final consumption expenditure (PCFCE) on food vis-a-vis fruits and vegetables and their growth rates in comparison with per capita income and prices are given in Table 3.

TABLE 3. PER CAPITA FINAL CONSUMPTION EXPENDITURE, INCOME AND PRICES OF FOOD, FRUITS AND VEGETABLES

Year (1)	PCFCE (Rs.) on		Per capita income (Rs.) (4)	Price deflator	
	Fruits and vegetables (2)	Food (3)		Fruits and vegetables (5)	Food (6)
1970-71	98.32	746.28	1,671.46	0.47	0.46
1980-81	82.89	780.87	1,803.05	1.00	1.00
1990-91	96.95	896.01	2,529.83	2.49	2.14
1994-95	104.14	945.90	2,776.66	3.70	3.31
Growth rates (per cent per annum)					
1970-81	-0.27	0.68	1.12	7.79	6.81
1980-91	1.01	1.39	3.26	8.84	7.30
1990-95	2.37	1.47	2.48	8.88	10.50
1970-95	0.66	0.90	2.31	8.92	7.72

It could be seen from the table that the PCFCE on fruits and vegetables had been declining at a rate of 0.27 per cent per annum in the seventies, and started growing continuously at 1.01 per cent per annum in the 1980s and at 2.37 per cent per annum in the 1990s. Although the corresponding growth rates in PCFCE on food were higher during 1970s and 1980s, the relatively higher growth in consumption expenditure on fruits and vegetables during the 1990s is an indicator of the recent changes in the economy favouring the horticultural products and their consumption.

The per capita income of the consumers increased from Rs. 1,671 in 1970 to Rs. 2,777 in 1994, registering an annual growth of 2.31 per cent per annum. The growth in consumer expenditure on food, and fruits and vegetables during the same period was 0.9 per cent and 0.66 per cent respectively. However, during the 1990s the per capita income showed comparable growth as in the past at a rate of 2.48 per cent per annum, while the growth in expenditure on food was only 1.47 per cent per annum whereas the expenditure on fruits and vegetables recorded a growth of 2.37 per cent per annum. The differential growth in the prices of fruits and vegetables vis-a-vis food during the 1990s in favour of the former partly explains the higher growth in consumption expenditure on fruits and vegetables during the 1990s.

The estimated functions to measure the demand for fruits and vegetables and food in general with respect to income and price are given below.

$$\ln FV = -4.67 + 1.22 \ln Y - 0.32 \ln P \quad \dots (1)$$

(0.28)      (0.08)  
R<sup>2</sup> = 0.46    N = 25

$$\ln FD = 20.4 + 0.61 \ln Y - 0.02 \ln P \quad \dots (2)$$

(0.11)      (0.03)  
R<sup>2</sup> = 0.94    N = 25

where FV and FD = per capita final consumption expenditure (Rs.) on fruits and vegetables, and food respectively,

Y = per capita income (Rs.) and

P = implicit price deflator.

(Figures in parentheses are standard errors.)

The income showed positive influence on the demand for fruits and vegetables and the income elasticity of demand worked out to 1.22.<sup>1</sup> This is almost double compared to income elasticity in the case of food in general and is indicative of faster growth in demand for fruits and vegetables with rising incomes in future. The price elasticity of fruits and vegetables was (-) 0.32 and statistically significant. Consumption of food as a whole, on the other hand, seems to be insensitive to price changes as shown by very low elasticity. Besides income and price, structural changes taking place in the economy with the New Economic Policy and Globalisation, is expected to bring major shifts in the consumption of fruits and vegetables among others.

### *Role of Linkages*

In view of the considerable potential of fruits and vegetable sector from the production (supply) side as well as from the consumption (demand) side, it is imperative to examine the various linkages that facilitate/constrain the performance of this sector. The role of infrastructural facilities including credit facilities in promoting horticultural ventures is widely acknowledged (IIFT, 1997; Chand, 1996; Jairath, 1996). The perishability of the produce coupled with seasonality in production and the distance between production and consumption centres warrants an effective linking of producers and consumers through strong market support. This necessitates infrastructural facilities such as motorable roads, regulated markets, cold storage, refrigerated transport, grading, packing, processing facilities, credit support, market information, research and development, etc. The availability and adequacy of crucial linkage factors for the fruit and vegetable sector are discussed in what follows.

### *Credit Linkages for Production*

The institutional credit agencies including commercial banks, Regional Rural Banks and co-operatives have been extending short-term as well as long-term credit facilities for various activities in the plantation and horticulture sector ranging from establishment of nursery, layout of plantations, orchards, vegetable cultivation, etc. The refinance extended to plantation/horticulture sector by National Bank for Agriculture and Rural Development (NABARD), which is proxy for total ground level credit flow, in the past is given in Table 4.

TABLE 4. REFINANCE DISBURSED TO PLANTATION AND HORTICULTURE  
SECTOR BY NABARD

Year (1)	(Rs. crores)	
	Refinance to planta- tions and horticulture (2)	Total refinance (3)
1982-83	27	703
1990-91	94	1,902
1991-92	99	2,054
1992-93	105	2,359
1993-94	122	2,745
1994-95	129	3,011
1995-96	137	3,064
Growth rate between 1982-83 to 1995-96 (per cent per annum)	10.92 (2.00)	10.81 (1.90)

Figures in parentheses are growth rates in real terms.

The flow of refinance to plantation and horticulture sector has grown at 10.92 per cent per annum during 1982-83 to 1995-96. This growth is on par with the growth in overall refinance to agriculture. In real terms, the growth was at 2 per cent per annum. The ground level credit flow on account of refinance alone would work out to Rs. 222 crores during 1995-96.

*Credit Linkages for Processing*

Besides extending credit support directly to the production of fruits and vegetables, the commercial banks have been financing fruits and vegetable processing industries. The credit support extended by commercial banks to fruit processing industries is given in Table 5.

TABLE 5. COMMERCIAL BANK CREDIT TO FRUITS AND VEGETABLE PROCESSING INDUSTRIES

Year	Number of accounts	Outstanding amount (Rs. crores)	Outstanding amount/account (Rs. lakhs)	Per cent of total credit to fruits and vegetable processing
(1)	(2)	(3)	(4)	(5)
1990	683	41.39	6.06	0.97
1991	810	71.27	8.80	1.45
1992	989	66.44	6.72	1.25
1993	1,152	77.47	6.72	1.29
1994	1,414	102.44	7.24	1.56

The credit support extended for fruits and vegetable processing units by commercial banks has more than doubled between 1990 and 1994. The amount outstanding has increased from Rs. 41.39 crores in 1990 to Rs. 102.44 crores in 1994. The share of fruits and vegetable processing was 0.97 per cent of the total outstanding amount in food processing industries in 1990 which went upto 1.56 per cent in 1994. Commercial banks have even established special branches for promotion of such hi-tech ventures.

*Non-Credit Linkages*

Non-credit linkages, essential for the growth of fruits and vegetables sector, are infrastructural facilities for transport, storage and processing of the produce. Motorable roads, facilities for cold storage, processing facilities and market infrastructure are crucial for the success of horticultural ventures in a state. The liberalised policies of the Government and the incentives provided for fruits and vegetable processing industries coupled with changing socio-economic conditions have given a boost to such industries recently. The growth of fruits and vegetable processing industries during the 1990s is given in Table 6.

TABLE 6. NUMBER, CAPACITY AND CAPACITY UTILISATION OF FRUITS AND VEGETABLE PROCESSING INDUSTRIES

Year	Number of licensed units	Installed capacity (lakh tonnes)	Production (lakh tonnes)	Capacity utilisation (per cent)	Exports (Rs. crores)
(1)	(2)	(3)	(4)	(5)	(6)
1990	3,629	7.08	2.45	34.6	92.29
1995	4,270	14.02	6.76	48.2	348.00
1996	4,368	17.50	8.50	48.6	470.00

Source: Government of India (1996).

It can be noticed that the installed capacity of fruits and vegetable industries has grown by about 2.5 times from 7.08 lakh tonnes at the beginning of 1990 to 17.5 lakh tonnes at the beginning of 1996. This corresponds to the growth in number of licensed units from 3,629 to 4,368 during the same period. The capacity utilisation has also improved from 34.6 per cent in 1990 to 48.6 per cent in 1996. The exports of fruits and vegetable products have grown remarkably by more than five times during the same period from Rs. 92.29 crores in 1990 to Rs. 470 crores in 1996. However, the percentage of fruits and vegetables used by the processing industry for commercial purposes and to make value added fruit products was only 1.6 per cent of total production.

We can exploit the potential of the fruit and vegetable sector if the infrastructural facilities are properly matched with the available production potential. To examine whether such a matching exists, we compare the CMIE index of relative development of infrastructure which indicates general level of infrastructure development in the states, number of processing units and value of materials used for processing that indicate the development of processing facilities and the number of regulated markets representing the development of market infrastructure with the volume of production of fruits and vegetables in different states. A statewise comparison of the production of fruits and vegetables vis-a-vis indicators of these non-credit linkages is made in Table 7.

TABLE 7. STATEWISE PRODUCTION VIS-A-VIS INDICATORS OF NON-CREDIT LINKAGES

State	Production (000 tonnes)	Numer of pro- cessing units (1992-93) per million tonnes of production (Nos.)	Value of material used per thou- sand tonnes of production (Rs. 000)	CMIE index of infrastructure	Regulated markets/000 tonne production (Nos.)
(1)	(2)	(3)	(4)	(5)	(6)
Andhra Pradesh	6,135	62.43	142.10	103.00	9.26
Bihar	19,559	0.46	17.45	96.00	4.08
Gujarat	3,472	9.22	140.63	125.00	9.82
Haryana	1,151	5.21	29.72	152.00	22.33
Himachal Pradesh	801	6.24	19.85	84.00	6.49
Karnataka	8,100	11.11	153.89	97.00	4.90
Kerala	4,834	56.68	830.59	140.00	0.14
Madhya Pradesh	3,329	2.70	5.17	75.00	16.28
Maharashtra	7,885	11.16	59.15	111.00	9.30
Orissa	8,781	1.25	1.34	89.00	1.48
Punjab	2,149	2.33	20.01	205.00	30.72
Rajasthan	397	0.00	0.00	80.00	95.44
Tamil Nadu	3,328	81.73	103.03	138.00	8.29
Uttar Pradesh	12,952	0.93	9.99	109.00	4.90
West Bengal	14,126	0.85	6.17	113.00	2.60
Average	96,998	12.45	83.62	100.00	6.33

As is evident from the table, the infrastructural facilities available in the states are not matching with the production of fruits and vegetables. The number of processing units and materials used for processing were higher in commercially advanced states like Maharashtra and Gujarat. The development of general infrastructure as well as development of market infrastructure was higher in agriculturally developed states like Punjab and Haryana. The



development of the processing facilities was far below the average in the production pockets of Bihar, West Bengal and Uttar Pradesh. This has to be reversed and processing facilities should be stepped up in production centres. This would save cost of transport and reduce losses of produce due to damage (Malliswari, 1996). In addition, the price of processed food to be paid by the consumers can be brought down and would also improve the local employment opportunities.

The co-operative sector can play a model role in building up the infrastructural linkages for collection, processing and marketing of perishable commodities like fruits and vegetables, going by the example of "Anand Model" which worked wonders in the field of even highly perishable commodity like milk. The co-operative sector has a network of fruit and vegetable marketing societies throughout the country offering various services like establishment of market yards (mandies), godowns, cold storage units, etc. The statewide position of fruit and vegetable marketing societies under co-operatives as at the end of 1993-94 is given in Table 8.

TABLE 8. STATEWISE STATUS OF FRUIT AND VEGETABLE MARKETING SOCIETIES AS ON MARCH 31, 1994

State	Number of societies	Number of mandies	Godowns		Cold storage	
			Number	Capacity (tonnes)	Number	Capacity (tonnes)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh	19	-	1	-	-	-
Gujarat	150	47	4	1,085	1	1,000
Haryana	8	17	1	1	-	-
Himachal Pradesh	25	9	22	145	-	-
Karnataka	62	70	14	570	1	100
Kerala	35	31	5	2,205	-	-
Madhya Pradesh	12	6	4	10	3	8,000
Maharashtra	432	289	105	17,819	12	2,760
Orissa	33	7	4	80	-	-
Tamil Nadu	84	34	75	8,115	-	-

The fruit and vegetable co-operative marketing societies do not have adequate infrastructural support to match the production. Moreover, such facilities are concentrated in developed states and not in the states with higher share in production nor in those which lack even the minimum infrastructural facilities. This calls for strengthening of fruit and vegetable marketing co-operatives in the interest of the growers as co-operatives are the best channels to maximise the producer's share in the consumer's rupee compared to other marketing channels and to minimise certain other malpractices faced by the growers in marketing (Singh, 1996).

It follows from the above that the indicators of different linkages, both credit and non-credit, necessary for the development of the fruit and vegetable sector do not have a one to one correspondence with the level of production of fruits and vegetables in different states. The relationship between different linkage factors and production as emerging from the cross-sectional data of different states is depicted in the form of a correlation matrix in Table 9.

TABLE 9. CORRELATION MATRIX BETWEEN PRODUCTION AND LINKAGES

Variable	(2)	(3)	(4)	(5)	(6)	(7)
(1) Volume of production	-0.11	-0.01	0.17	-0.13	0.11	-0.23
(2) Number of processing units	1.00	0.58	0.28	0.13	-0.03	0.12
(3) Value of material processed		1.00	0.08	-0.02	0.01	0.16
(4) Refinance			1.00	0.002	0.79	-0.07
(5) Number of regulated markets				1.00	0.26	-0.08
(6) Commercial bank credit for processing					1.00	0.01
(7) CMIE index						1.00

The correlation coefficients suggests that none of the existing linkage factors has a strong correlation with the volume of production of fruits and vegetables in different states. The number of processing units, value of materials used for processing, number of regulated markets and CMIE index of infrastructure showed negative correlations with the volume of production, indicating the low levels of these indicators in the states with more production. Similarly, the volume of production showed a weak correlation with refinance to plantation and horticulture and commercial bank credit to processing. That is, credit is flowing both for production and processing segments but not commensurately with the production. The number of processing units showed high correlation with the value of materials used for processing and weak but positive correlation with general infrastructure development index. This has a serious implication because processing industries can be viable and cost effective if they are located in the ambience of adequate infrastructure. However, commercial bank credit was negatively correlated with the number of processing units, again indicating the divergence of the two at the state level. The value of materials used for processing at the state level was positively correlated with commercial bank credit. Refinance to plantation and horticulture had stronger correlation with commercial bank credit for processing. Refinance was not correlated with development of infrastructure, while commercial bank credit for processing showed positive correlation with the same.

#### CONCLUSIONS

The area and production of fruits and vegetables in the country have been increasing. The consumption pattern also has shifted in favour of fruits and vegetables in recent years. This trend is expected to increase the demand for fruits and vegetables in future as evidenced by the high income elasticity of demand. In addition, the exports of fresh as well as processed fruits and vegetables offer a solid source of foreign exchange for the exchequer. Given the diverse agro-climatic conditions available in the country, there exists high potential for production of fruits and vegetables. However, the infrastructural facilities such as processing facilities, market facilities, credit, etc., are not matching with the production potential available in different states. Exploiting the available production potential through concerted

efforts and maximising the use of available production through efficient post-harvest handling of the produce to avoid spoilage and bringing in value addition through promotion of infrastructure are the necessary tasks for the promotion of the fruit and vegetable sector in the country.

## NOTE

1. The elasticity could be higher for lower income strata (Birthal, 1996). The implication is that the income redistribution would bring compounded increase in the demand for fruits and vegetables thereby improving the nutritional standards of the lower income groups.

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