THE POLITICAL ECONOMY OF VEGETABLE TRADE IN INDIA

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1 INTRODUCTION

Presently, India is the second largest producer of vegetables in the world (next to China). The production of vegetables in India has touched 101.434 million tonnes (Mt) in 2004, from about 33 Mt in 1972-73. The per capita consumption of vegetables in the country has also increased from 47 kg in 1983-84 to 76 kg in 1999-00, with annual growth rate of 2.9 percent (Economic Survey, 2006-07). Consumer preferences have also shifted away from cereals and moved towards high-value agricultural produce like vegetables. With increase in economic standards, urbanization of growing Indian villages, international market integration and trade liberalization the demand for horticultural products are expected to increase even further. On the production side, if cereal pricing is left to market forces, land will be released from traditional cultivation to meet the growing demand for non-cereal crops such as oilseeds, fruits and vegetables in accordance with the diversification in consumption pattern (Mittal, 2006). Thus, in a holistic way, horticulture can be promoted as a means of agro-diversification for the second Green Revolution, providing the much needed impetus to the growth of agricultural sector, through increase in trade, income and employment. Presently, Indian agriculture is diversifying into the production of high value commodities, also providing an increasing role to small holding farmers. Indian rural economy had been facing the challenge of inability to manage the problems involved with transition of agriculture from a supply-driven value chain to a demand-led market-oriented supply chain (Viswanadham, 2006). The present study presents a glimpse and overview of vegetable scenario of Indian market with special reference to production, consumption, trade and export potential. An attempt has also been made to cover the entire vegetable scenario of Indian market during past two decades.

2 MATERIAL AND METHODS

In the present study data on area, production and yield of vegetables is taken from various

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report of the Indian Horticulture Database, published by the National Horticulture Board (NHB); Area, Production and Yield of Principal Crops in India from the Directorate of Economics and Statistics and Ministry of Agriculture for the national level data. FAO (Food and Agricultural Organization) statistics website by the Food and Agricultural Organization is used for the international data on area, production and yield. Agricultural Statistics at a Glance' of the years 2002, 2003, 2004 is used to fill in the gaps and for cross-checking the data. Most of the data of India for years 1991 to 2004 is taken from NHB and matched with 1989 and 1999 data from FAO stats. Cost of cultivation data for cereals is taken from the Reports of the Commission for Agricultural Costs and Prices (CACP), for crops sown during 2002-03, 2003-04 and 2004-05 seasons. The Wholesale Prices and Arrivals information is referred from report of the Indian Horticulture Database (2005), published by NHB, and publication of the Directorate of Economics and Statistics on prices.

3 RESULTS AND DISCUSSION

The results of the above investigation and their further discussion are presented under the following heads:

3.1 India's cropping scenario

India has experienced a considerable degree of crop diversification in term of changes in the area under various crops since the Green Revolution which was largely in favour of foodgrains to meet the objective of self- sufficiency and country's food security. In past one decade, the changes in cropping pattern are more towards the horticulture sector and commercial crops like cotton thus diverting green revolution towards golden revolution. Agricultural diversification is an important instrument for economic growth. Changes in cropping patterns are responsive to these factors. The aggregate cropping patterns of the country are represented by the gross cropped area allocation among different crops and commodity groups.

Table 1 presents the change in cropping pattern between 1990 and 2004. The changes are presented between the sub-periods 1990-95, 1995-2000 and 2000-04. The shift in area away from foodgrains, rice, coarse cereals and pulses is evident from the figure 1. Area under pulses has also seen a decline till 2000 which later revised due to shortfall of pulses and also implementation of special mission to revise the pulse sector. But overall the foodgrain sector

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had experienced a decline in area of about 7,680 thousand hectares in last one-and-a-half decades. This shift in area from foodgrains is towards the oilseeds, cotton, fruits and vegetables. The overall magnitude of decline in area under foodgrain (-7,680 thousand hectares) is very close to the magnitude of increase in area under horticulture (7,270 thousand 2 hectares) in the period 1990-2004.

Vegetables have also seen a small decline in area under it in 1990-95, which later recovered. A significant change for area under vegetables is seen in 1995-2000 with an additional increase in area in 2000-04 (Fig. 1). The gain in area in last 4-5 years is equivalent to the change in area in the 1990s. This gain in area under horticulture and mainly under fruits and vegetables is a collective impact of the diversification of production pattern of the producer and the increased demand of consumers due to shift in their consumption pattern (Mittal, 2007). Diversification largely depends upon the opportunities and responsiveness of farmers to technological breakthrough, consumer demand, government policy, trade arrangements and development of irrigation, roads and other infrastructure (Kumar and Mittal, 2003).

3.2 Production trends in India

There has been a significant growth in area and production of important vegetables in India during 1973-2003 (Fig. 2). The additional increase in vegetable area of 3.3 million ha during 1972-73 to 2002-03 was mainly contributed by potato (23.3%), followed by other vegetables (22.1%), tomato (13.3%), and onion (10.3%). Table 2 presents the change in the area among major vegetables under the broad groups. Among vegetables, the area under potato has increased by 35 percent in the last 15 years. Brinjal and onion are the next important ones with an area increase of 28.9 percent and 22.5 percent respectively. The area under cauliflower and green peas has seen a decline in the last few years. The other major vegetables which have seen an increase in area are cabbage, okra, peas and tomato.

The pattern of growth in production of important vegetables in India presented in Table 3 shows that growth in onion and potato production was mainly driven by area growth during 1973-1984. Production growth in okra and cabbage was again driven by growth in area during 1973-93 and it transformed in productivity led growth during 1994-2003. While production growth in vegetables like eggplants, cauliflower, tomato and green peas was area driven during 1973-83., it was driven through productivity led growth during 1984-1993 and again shifted on area led growth during 1994-2003. The detailed growth analysis of important vegetables production is mainly area driven and need proper breakthrough to convert to productivity driven.

During 1990-2004, in the horticulture sector, the production of vegetables is the highest followed by fruits. Figure 3 presents the growth rate in area and production of vegetables over period and sub-periods. The area under vegetables increased at the rate of 3.15 percent in 1995-2000 which later declined and the same period also observed high production growth. Overall area growth had been 2.10 percent for vegetables respectively during 1990-2004. In the same period the production growth had been 3.95 percent for vegetables respectively. The area covered by dominant vegetables namely potato, brinjal, tomato and onion is 19%, 8%, 7% and 7% respectively (Table 4). In terms of production, potato contributes 24% whereas brinjal and onion contribute 8% each.

3.3 Global scenario and India's exports

The world production data obtained from the FAO statistics database reveals that India and China are the world leaders in the major vegetable production. For brinjal, cabbage, cauliflower, onion and pumpkins China is the biggest producer followed by India. India ranks first for green peas. In spite of potato being the number one among the vegetable production in the country, India ranks third in the world production. For tomato India ranks sixth in world production. Onion and potato are the most important ones among the fresh vegetables, both in terms of quantity exported and value (Table 5). Tomato and pumpkin are also among the major fresh vegetables exported to the world but their volume is very low.

Brinjal had recently been added to the export list. The volume of exports of both fruits and vegetables has seen a rise since 1990. The commodity-wise analysis shows that it is the neighbouring countries where maximum share of India's vegetables are exported. In vegetables the maximum shares of onion and tomato exports go to Bangladesh. Brinjal has found the market in UK, Saudi Arabia, the Netherlands and France, with 63.4 percent share of total brinjal exports going to UK. Among our neighbouring countries, Nepal receives bulk of India's exports of cauliflower, potatoes, UAE imports more than 60 percent of India's exports of pumpkins (Fig. 4). Other major exporting countries for India for fresh vegetables are Malaysia, Singapore and Saudi Arabia.

The analysis of data on processed vegetables during 1993-2001 indicates that exports of processed vegetables have been growing at the rate of more than 20 percent per annum, both in quantity and value terms (Table 6). Among the processed vegetables exported, gherkin registered a growth of 43 to 45 percent, and onion grew at 26 to 29 percent. The export of mushroom though has registered a negative growth quantity; in value terms the export has grown at a rate of around 13 percent. All these suggested a considerable scope in export of

processed vegetables. In the case of exports of fresh vegetables, there had been stagnation and only in case of vegetables other than onion, there was some growth. This means that instead of depending on onion alone, it is necessary to diversify India's exports to other vegetables and vegetable products.

It is heartening to note that to improve the level of processing and to reduce the wastage, APEDA (Agriculture Produce Export Development Agency) had developed the concept of Agri-Export Zones (AEZs). It takes a comprehensive look at a particular produce/product located in a contiguous area for the purposed of developing and sourcing raw materials, their processing/packaging, leading finally to exports. The cluster approach is followed to address marketing problems of certain produce/products in a specified area. There area 45 SEZs (Special Economic Zones) for horticultural produce/products. AEZs have been set up in different states of India namely Jharkhand, Uttar Pradesh, Andhra Pradesh, West Bengal and Gujarat. AEZs have been established for rose onion (type of a onion group mainly used for export purposes) and gherkins in Karnataka; for onion, garlic and potatoes in Madhya Pradesh and Maharashtra and for potatoes, cabbages, broccoli, baby corn, carrot, green beans, chillies and tomatoes in Punjab.

These AEZs are expected to enhance the exports of vegetables in the years to come. Further, in the context of changing global policy environment due to WTO (World Trade Organization) and to make the vegetable products competitive in the international markets, it is necessary to adhere to the international quality standards either by followed the HACCP (Hazard Analysis Critical Control Points) guidelines, Codex standards, or modifying the India standards under Prevention of Food Adulteration Act (PFA), AGMARK (Agricultural Marketing) grades and Bureau of India Standards to comply with the international standards.

3.4 Feasibility of shift towards horticulture

Cost-benefit analysis helps in determining the profitability of farmers to diversify their land to horticultural production from the conventional practices of cultivation. The cost-benefit ratio (CBR) helps in judging the feasibility of investing in the proposal. The cost-benefit ratio is defined as:

Cost-benefit ratio (CBR) = Gross Returns / Cost of Cultivation

Where,

Gross Returns = Yields * Price

Among the cost definitions of A1, A2, B1, B2, C1 and C2, which were given by the

Commission for Agricultural Costs and Prices (CACP), the ideal one is C2 which is used to compute the CBR for cereals. The C2 definition of cost includes the cost value on all the inputs, depreciation, and rent and the implicit value of land and family labour. For the horticultural produce, the estimate of cost is made available in the computations done by researchers and officials working with the National Horticulture Mission. This implies that in most states, farmers who cultivate wheat are not able to meet the cost of production. For paddy also the ratio is less than one, except for farmers in Punjab and Haryana. Rice, the staple food in southern India, has huge areas under paddy cultivation. The reason why farmers continue to cultivate the staple foodgrains is that part of the produce is for self-consumption, also these farmers take farming activity on part time. Their incomes are supplemented from other sources too. If the implicit cost of family labour and land is not included in these calculations then there are some positive incomes also to meet household expense. For other coarse cereals, the CBR is less than one and in some cases it is even less than 0.5. This also explains the shift in area away from cereals as explained in the earlier section.

In Table 7 the CBR is computed for some of the vegetables from major vegetable producing states of India for which information was available. These can be indicative and be generalized for vegetable sectors as a whole. Irrigated onion, tomato and brinjal in Karnataka have a CBR of more than 2. This indicates that the gross returns are double the cost of cultivation of the produce. None of the horticultural crops presented in the table shows CBR less than 1 or even on its margin. This is indicative of the economic benefit of crop diversification towards fruits and vegetables. The marketing costs are also included in the calculations. If the markets are brought close to the farm gate or in the supply chain the produce is directly procured from the farm gate then it will be more beneficial for farmers, as they will be getting a better price for the fresh produce. The BC ratio indicates that vegetables production is highly labour intensive, quick and regular incomes generating and profitable than cereals, apart from higher yield and income generation, vegetables generate high employment opportunities, since their production requires more labour (Table 8). It was postulated that increase in vegetable acreage on small and marginal farms would not only provide gainful employment, but would also reduce income disparity among different farm categories.

3.5 Domestic demand and supply

Diversification in both the production and consumption pattern is observed in India. The economy is moving from being a supply-driven economy to a demand-driven economy thus

with the change in consumption pattern of the population the production diversification is also evident. According to Engel's law with the economic growth and increase in per capita income, the consumption would shift from the staple food to high value commodities like fruits and vegetables, milk and milk products, fish and eggs. The National Sample Survey (NSS) consumer expenditure data shows that the share of fruits and vegetables in the household budget has increased from 9.7 percent in 1983 to 13.7 percent in the budget for 1999-2000 (Mittal, 2006). The annual consumption of vegetables has increased from 47 kg per capita in 1983-84 to 76 kg in 199-00 with 2.9% annual growth rate (Fig. 5). A widespread increase in consumption of vegetables was observed across income groups, regions an in both rural and urban areas (Table 9). Among the poorest of the poor households, per capita annual consumption has reached to a level of 48 kg in the year 1999-00 and was just hall of the per capita consumption of non-poor higher group. The vegetables consumption had accelerated at a higher rate among the poor. The annual growth rate of consumption was higher in the rural area (3.0%) that in urban area (2.6%). In 1999, the consumption of vegetables in rural pockets was found higher in all the income groups over the respective income groups in urban pockets, except in the non-poor higher income group. This widespread increase in consumption may be a reflection of higher production/ supply. The increase in consumption levels of vegetables has been quite similar in both the rural and urban areas. Demand projections are made on the assumptions about population, urbanization, poverty and economic growth. The estimates of the past population growth are available from the population census conducted every 10 years. These estimates assume that the urban population proportion in total population will follow the past trends.

The National Sample Survey Organisation (NSSO) collects data on household consumption expenditure5 at the national level in the form of various rounds by adopting sample survey techniques. The present study uses data from the consumer expenditure survey of the National Sample Survey (NSS) rounds number 38, 43, 50 and 55 pertaining to the periods 1983, 1987-88, 1993-4 and 1999-2000, respectively.

Total domestic demand for vegetables, this demand is expected to be 103.16 million tonnes by 2010 and 137.25 million tonnes by 2020 (Fig. 6). Demand for vegetables is expected to rise at the rate of 4-5 percent per annum in the next 15 years (Kumar et al., 2004b). The per capita demand is also expected to rise at the same rate. This huge increase in the demand of fruits and vegetables for domestic consumption is a challenge to be met by the country (Fig. 7). Along with this is the goal to produce horticultural products for exports, which can act as an engine of growth to the agricultural sector. Due to food security concerns, lack of credit with

farmers to diversify, and lack of the risk- taking attitude of farmers, it is difficult to allocate large areas of land for horticulture. Diversifying land away from cereals to horticulture remains a constraint in spite of it being more profitable for farmers to produce horticulture products than cereals. The way out is to increase yield and reduce post harvest losses (Subrahamanyam and Gajanana, 2000).

3.6 Nominal Protection Coefficient (NPC)

Many studies have analyzed that Indian horticulture is competitive in terms of prices. Price competitiveness is measured by the concept of nominal protection coefficient (NPC) (Mattoo et al., 2007, Gulati and Kelley 1999). NPC is the ratio of the price of domestic produce to the price of imported/exported products, after accounting for transportation cost and other marketing costs. In other word it is the ratio of domestic price and border price or the export reference price net of other costs. NPC basically helps in measuring the divergence of domestic price from the international price thus determines the degree of export competitiveness of the commodity (Gulati et al., 1994). The competitiveness of the commodities under consideration are treated under export hypothesis that implies that these commodities are treated as exportable and competes with the domestically produced commodities at a foreign port.

$NPC_i = P^d_i / P^w_i$

Where, NPC_i : Nominal Protection coefficient of commodity i

P^d_i : domestic (India) price of commodity

P^w_i : World reference price (border price equivalent) of commodity i, adjusted for transportation, handling and marketing expenses.

If NPC is less than 1 then the produce is supposed to be competitive, thus implies that domestic prices are less than the international prices and thus India's produce is internationally competitive. Between the commodities lower the NPC more export competitive is the commodity for India. The domestic prices are computed at the four major centres in India Delhi, Mumbai, Kolkata and Chennai. These are taken as the representative of markets in the respective regions. The all-India NPC is calculated as the weighted average of NPC estimates at these regional markets, weighted by total arrivals in each market. The domestic regional price is the average monthly (month end) wholesale price prevailing in the local market in these four cities. The data is used for year 2005 which is obtained from the Indian Horticultural Database (2005) published by the National Horticulture Board. The

annual price is the weighted average of monthly prices and the monthly arrivals are used as weights. Border price can be computed either by using the international price adjusted for freight and insurance. Since the information on these components is not readily available or just approximations, the study uses the other way of computing border price. The unit export price, that is the Free On Board (FOB) price, is being used which is derived by dividing value of imports or exports by their respective quantities, In the case of fresh vegetables the FOB prices are used due to lack of information on international prices.

The relevant border price or reference price used for calculations are obtained after deducting the transportation costs, that is deducting both the domestic and international costs, port clearing charges, marketing costs, trader's margin and the processing cost if any. The extent to which a product has to be transported, marketed and processed, the cost encored on these impact the incentive a farmer gets from its export. Higher is the cost, lower is the incentive for the farmer to export the commodities. The profit margin and competitiveness reduces with increase in the cost component above the production cost. A high international cost in case of long distance export makes the commodity less competitive if the domestic prices are relatively high. Thus under the exportable hypothesis in order to compete with the foreign markets the domestic price has to be low enough to make room for the transportation costs (Gulati et al., 1994). The average difference in the FOB price and reference price is about 25 percent of the domestic price. This assumption is used for computing the results and under this scenario the prices are presented in the column of reference price 1 (Fig. 8). Further, if in future we need to make our commodities more competitive then these transportation costs need to be reduced. Keeping this into consideration the results for the scenario if the transportation cost, processing and margins cost are reduced to 20 percent of domestic price and 15 percent of domestic price are also presented as different scenarios. Based on these prices the nominal protection coefficient is computed and presented in figure 9. In the vegetable category India is competitive in the export of brinjal, cabbage, cauliflower and peas. The NPC ratio is on margin for tomato (Fig. 10). As the total cost of transportation, handling and margins get reduced, more fresh vegetables get added to the competitive category.

Transportation cost in India is about 20- 30 percent higher than that in other countries, which works as an hindrance and a disadvantage to India's exports. Due to expensive transportation the Indian produce becomes expensive and lose its competitiveness. Within the country also the transportation infrastructure is very expensive. According to the latest World Bank report (Mattoo et al., 2007) the biggest obstacles to the competitiveness of India's horticultural exports lie outside the sector rather than inside it. The average price at the farm gate for a

typical horticulture product is just 12-15 percent of the price at which it is retailed. So, a 20 percent improvement in yields can translate into only 2.4-3 percentage points reduction in the final price, whereas a 20 percent reduction in international transport costs can reduce final prices by 8-10 percentage points (Mattoo et al., 2007).

3.7 Revealed Comparative Advantage (RCA)

Revealed comparative advantage ratio rules the export comparative advantage of the products. The ratio is defined as:

$R_{ih} = (X_{ih} / X_{it})/ (X_{wh} /X_{wt})$

Where,

R_{ih} = Revealed comparative advantage ratio for India in product h

X_{ih} = India's exports of product h

X_{it} = Total exports of India

X_{wh} = World exports of product h

X_{wt} = Total world exports

The RCA ratio is the share of a given product in a country's exports to its share in world exports. A country is said to have the revealed comparative advantage in the product if the ratio is greater than one. The RCA ratio less than one implies a disadvantage. The ratio is influenced by the individual countries' internal and external trade policies like government interventions, import restrictions, subsidies and high tariffs, etc. Thus, a disadvantage may not be a true picture of the comparative status, but it may also indicate that the trade policies are not in favour of the exports of the produce. The results of the RCA ratio for major vegetables are presented in Table 10. The results are presented for the years 1999 to 2005. Among all the vegetables that produce and export the ratio is above one onion in the vegetables group for all the years. The ratio for this produce has been increasing since 1999 and the magnitude of the ratio is huge. This implies that the comparative advantage of this produce has increased over time, India has very high comparative advantage. For peas RCA ratio has been above one for years 2002 and 2003 but in 2004 and 2005 again the RCA is less than one.

If a commodity has a comparative advantage then it means that the share of this country exports is increasing in the world total share, but this commodity might not be export competitive in price terms. Thus it means that the high delivery cost impacts the competitive of fresh vegetables, due to this commodity in which India have comparative advantage lose in

the world market due to high costs of delivery. The best example for this is onion. Mattoo et al., 2007 confirms that apart from quality problems and policy barriers Indian exporters have to face an important impediment which significantly erodes the production cost advantage enjoyed by Indian farmers. Domestic and international transportation cost is the single largest contributor to the retail price, accounting for nearly 25-40 percent of the price.

3.8 Constraints

In spite of India's wide range of soil and climatic conditions the horticulture sector is facing several constraints. The most important factor impacting the horticulture sector's growth is the low and declining productivity. As presented in Table 11 for fresh vegetables, the decline in productivity as well as the low productivity rates as compared to the world's high-yields is quite visible. For fresh vegetables the decline in yield has only been seen for peas in last decade, although the gains in the yield are almost negligible for sweet potato, pumpkin, lettuce and beans. On the other hand, in cassava production, India has the highest yield in the world. For all vegetables, the potential yield possible is higher than the existing yields.

Other major constraints (Kumar et al. 2004) are non-availability of quality seeds, inadequate irrigation facilities, lack of soil testing facility and extension staff, inefficiency in pest management, credit availability constraint, high cost of production, lack of information, huge post-harvest losses, lack of roads, cold storage, inadequate space, poor market network and high transportation cost. A lot needs to be done especially in the field of research and investment to improve the infrastructure conditions and reduce the post- harvest losses in the sector so that the per-unit productivity and per capita availability of vegetables is increased. The general constraints faced by this sector are the timely delivery , grading, packaging, good quality, poor market infrastructure, agro- processing plants, marketing credit, proper pricing, uniform grading and standardization of weights and measures; inadequate and poor dissemination of market information, poor post-harvest handling, low and declining productivity.

Mismanagement in supply chain

One of the weaknesses of the supply chain is that it is a multi-layered marketing channel lacking in infrastructure. Efficient supply chain requires strengthening all the levels of infrastructure such as the inputs delivery, credit, irrigation, improved procurement, minimizing post-harvest loses, cold storage chains, better and efficient processing and marketing techniques, efficient storage, warehouse and also efficient and competitive retailing

(Adhiguru and Ramaswamy, 2003). The infrastructure to improve efficiency and the linkages of the supply chain is very poor, which is affecting the growth potential of the horticulture sector. Timely availability of inputs, development of organized input market and infrastructure for its storage and distribution will add to the productivity of the sector. According to Cold Chain Summit (2007), Development of cold chain network will help in reducing the post-harvest losses of fruits and vegetables. Improving the post-harvest management means an overall improvement in the per unit productivity. Investment is required to build the cold storage chain from the refrigerated trucks which procure the produce from the farm gate, then pre-cooling chambers, cooled area for sorting and grading the produce, refrigerated trucks for transferring the produce to the market of distribution or part of delivery. The development of this chain requires huge investment in technology, infrastructure and maintenance. A study by Raghunath et al., 2005 has estimated that with strengthening the supply chain the benefits to consumers and producers can increase by 20-25 percent in the most perishable commodity like tomato. Due to inefficiency in the supply chain the price received by the farmers is only about 24 to 58 percent of the retail price the consumer pays.

4 CONCLUSION: POLICY AND STRATEGIES

The creation of sound infrastructure of vegetable research in India has helped to increased production of vegetables. The achievements made in the development of several varieties, techniques, spread of some vegetables (for example, mushroom), round the year availability are some of striking features of vegetable research in India. There has been considerable growth in production of vegetables, and potato, tomato, brinjal and onion have emerged as major vegetables in terms of both area and production. Studies have shown that growth in vegetable production, facilitated through productivity growth in 1980s has again reverted back to area expansion in recent years which is unsustainable. This indicates increasing role of research for enhancing productivity, quality and value addition. Besides advances in technology and its higher uptake, innovation in institutional support is required. For instance, production under contract arrangements ensures higher income to farmers along with no or less risk in product marketing. It also helped by providing improved technology and technical know-how. Export of both fresh and processed vegetables during 1991-2003, has increased at a high growth rate per year (20 percent) of both quantity and value. Evidence exists that there is a considerable scope in export of processed vegetables. Study further suggests that instead of depending on the export of onion alone, it was necessity to diversify vegetable export considering other vegetables. It is expected that identification of agri-export zones (AEZs)

would help in addressing problems of marketing of produce in the wake of changing global policy global policy environment. India can be competitive in export of vegetables by complying with strict sanitary and phytosanitary standards.

Development of agriculture in India needs some critical management inputs particularly that of supply chain management collaboration among various stakeholders along with efficient vertical and horizontal integration. The horticulture sector in particular has to prioritize development of research in the issues of genetics, biotechnology, integrated and sustainable production systems, post-harvest handling, storage, marketing and consumer education. Diversification offers an attractive option and a major source of pushing up growth of agricultural sector. While technological up-gradation and associated institutional changes are identified as thrust areas for future development of the horticulture sector, exports are considered to be most important for the growth of the sector. India can look forward to emerge as a major producer of horticultural products and thus secure reasonable market access for its agro exports, which are largely dependent on the competitive technologies that will help in enhancing export potential. This development will also help in overall growth of the economy through generation of extra foreign exchange, creating employment opportunities and also upliftment of the small and marginal farmers, with definite positive implications on income and employment. The government should create a positive environment that will ensure a mutually beneficial relationship between farmers and organized sector. Along with investment in infrastructure, development of extension activities and linkages with farmers is also an important area where the government can play an influential role. Vegetables are usually sold through commission agents and very little of pre-harvest contracting is done. Due to this the net returns are generally low. If the farmer does the marketing of his produce himself then the net returns to him would double. The marketing cost of fruits and vegetables is almost 50 percent of the total cost of production, thus, there is a need to set up institutional agencies that can advance credit to farmer and motivate them to market the produce themselves. Post-harvest losses in horticultural crops range from 15-50 percent. In spite of our broad production base, due to inefficient post-harvest handling and huge domestic demand, the availability for exports is limited. Poor infrastructure in terms of storage, transport, cargo space, facilities at air/sea ports, vapour heat treatment, etc, insufficient institutional support credit arrangement, promotion of Indian fruits and vegetables overseas and low research and development efforts in terms of quality and productivity comparable to those in other producing and exporting countries are the major constraints to the export of fresh vegetables. There is a need to remove the distortions in the present supply chain and create better integration between the different

links of the supply chain and reduce the losses. This will result in a net gain to producers, consumers and to the nation.

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Appendix

Table 1: Change in cropping pattern in India, 1990-2004

(Unit: 000' hectares)

Commodities	1990-95	1995-2000	2000-04	1990-2004
Rice	150.1	1873.3	-2590.0	-566.6
Wheat	843.9	719.0	760.0	2322.9
Coarse Cereals	-5365.4	11.1	-300.0	-5654.3
Cereals	-4500.0	2000.0	-3000.0	-5500.0
Pulses	-2380.0	-1930.0	2120.0	-2190.0
Foodgrains	-6830.0	40.0	-890.0	-7680.0
Oilseeds	1810.0	-3190.0	4230.0	2850.0
Cotton	1595.3	-505.3	390.0	1480.0
Jute and Mesta	-90.0	90.0	-120.0	-120.0
Sugarcane	461.4	172.6	-680.0	-46.0
Fruits	483.0	512.0	1095.0	2090.0
Vegetables	-258.0	915.0	506.0	1163.0
Fruits and Vegetables	225.0	1427.0	1601.0	3253.0
Horticulture	900.0	1856.0	4514.0	7270.0

Source: Mittal, 2007.

Table 2: Change in area under major vegetables in India, 1990-2004

(Unit: 000' hectares)

Vegetables	1990-95	1995-2000	2000-04	1990-2004	% change in area
Brinjal	134.2	38.5	57.6	336.3	28.9
Cabbage	40.1	27.0	44.9	113.0	9.7
Cauliflower	17.2	36.3	-18.1	35.4	3.0
Okra	208.5	-80.1	7.9	136.3	11.7
Onion	72.2	53.4	145.0	262.1	22.5
Peas	77.0	95.3	-42.6	99.0	8.5
Tomato	66.6	104.4	37.5	208.5	17.9
Potato	173.5	102.3	331.0	407.2	35.0
Sweet Potato	-11.9	-26.7	22.5	0.0	0.0
Tapioca	-22.7	25.3	27.8	30.4	2.6
Lettuce	4.2	4.0	0	8.2	0.7
Pumpkins and gourds	27	25	0	52	4.5
Beans	5	2	0	7	0.6
Cassava	-19.2	25.3	-13.5	-7.4	-0.6
Total Vegetables	-258.0	915.0	506.0	1163.0	100.0

Source: Mittal, 2007

Table 3: Pattern of growth in production of vegetables during 1973-2003

Pattern of growth	Vegetables
ALG (P1, P2, and P3)	Onion and potatoes
ALG (P1 and P3) and PLG (P2)	Egg plant, peas (green), cauliflower, tomato, all vegetables
ALG (P1 and P2) and PLG (P3)	Okra and cabbage
ALG = Area led growth, and PLG = Productivity led growth	

P1 = during 1973-83; P2 = 1984-1993; and P3 = 1994-2003

Table 4: Area and production share in total vegetables, 1990-2004

(Unit: percent)

Commodity	Area				Production			
	1991	1995	2000	2004	1991	1995	2000	2004
Brinjal	3.47	8.14	8.14	7.56	4.70	9.00	9.00	8.15
Cabbage	3.17	4.09	4.09	3.93	4.73	5.39	5.39	5.87
Cauliflower	3.63	4.12	4.12	4.10	5.12	3.46	3.46	5.00
Okra	3.97	8.07	8.07	5.61	3.22	5.63	5.63	3.57
Onion	5.93	7.41	7.41	7.18	8.04	5.70	5.70	5.03
Peas	3.18	4.20	4.20	5.11	1.45	3.27	3.27	3.20
Tomato	5.17	6.67	6.67	7.36	7.25	7.60	7.60	7.72
Potato	20.30	20.79	20.79	19.38	31.09	26.32	26.32	23.70
Sweet Potato	2.44	2.64	2.64	1.82	1.93	1.59	1.59	1.07
Tapioca	4.49	4.28	4.28	4.06	9.96	7.60	7.60	7.21
Lettuce	2.00	2.17	2.17	1.92	1.25	1.07	1.07	0.84
Pumpkins and Gourds	5.54	6.28	6.28	5.76	5.04	4.47	4.47	3.73
Beans	2.56	2.77	2.77	2.40	0.65	0.56	0.56	0.45
Cassava	4.49	4.28	4.28	4.06	9.96	7.60	7.60	7.21
Other Vegetables	29.68	14.09	14.09	19.75	5.59	10.74	10.74	17.24

Table 5: Exports of fresh vegetables from India to the world

(Unit: Quantity in tonne; value in Rs. lakh)

Commodity	Quantity				Value			
	1991	1995	2000	2005	1991	1995	2000	2005
Onion	240042.	2401281.5	260475.3	870216.9	9084.3	20461.9	20270.1	64411.9
Peas	317.1	1128.1	2132.7	68.2	205.9	443.1		
Tomato	117.1	1072.5	1232.7	7446.1	7.1	62.9	121.6	589.4
Potato	1530.4	15755.4	28200.2	65996.1	48.9	669.3	1395.3	3175.5
Other Vegetables	4074.2	6127.0	24834.1	18566.5	231.9	476.0	3644.7	1873.0
Total Vegetables	297968.8	525784.1	613013.9	1410369.8	14662.6	39576.8	94195.0	172458.0

Note: *Blank spaces indicate no exports in this period*

Source *: India Trades Database*

Table 6: Growth of vegetables export (1993-2001)

S. No.	Vegetable	Compound growth rate (%)	
		Quantity	Value
A	All processed vegetables	20.47*	20.26*
	1. Tomato	7.13^{NS}	5.78^{NS}
	2. Mushroom	-4.61^{NS}	12.85*
	3. Garlic	2.32^{NS}	10.25^{NS}
	4. Onion	29.19*	26.42*
	5. Gherkin	43.01*	45.03*
	6. Peas	17.41^{NS}	15.00^{NS}
	7. Chilli	8.29^{NS}	20.72^{NS}
B	All fresh vegetables	-079^{NS}	6.74^{NS}
	1. Fresh onions	-3.81^{NS}	4.05*
	2. Other fresh vegetables	14.97*	27.29*

* Significant at 5 percent level of portability.

Source: Gajanana and Sudha, 2004.

Table 7: Cost-Benefit Ratio for certain vegetables

Crop	State	Cost of cultivation (Rs/ ha)	Gross returns (Rs/ ha)	Cost-Benefit Ratio
Onion dry land	Karnataka	14227	23152	1.63
Onion irrigated	Karnataka	44932	111259	2.48
Bhindi	Karnataka	52314	89218	1.71
	Maharashtra	44122	57812	1.31
	AP	40788	62569	1.53
Brinjal	AP	58692	112652	1.92
	Karnataka	52576	112292	2.14
	Maharashtra	87530	111909	1.28
Beans	Karnataka	33093	59748	1.81
Tomato	Karnataka	109544	220214	2.01
Gherkin	Karnataka	27145	29789	1.1
Okra	AP	36003	57675	1.6

Source: Information collected during personal visits to the research institutes and communications with people working with the National Horticulture Mission.

Table 8: Economics of vegetables and other crops

Vegetable	Yield (t/ha)	Net income (Rs./ha)	Employment (man-days/ha)	Benefit-Cost Ratio
Tomato	15.2	9,737	236	0.45
Bhendi	14.2	12,999	314	0.60
Brinjal	29.4	34,641	439	1.13
Paddy	4.5	2,248	175	0.15
Sugarcane	10.0	4,626	285	0.13
Groundnut	2.2	2,289	105	0.16

Source: Haque, 2000.

Table 9: Vegetable consumption by different socio-economic groups

(kg/ capita/ year)

Income group	Rural		Urban		All India		Annual growth (%)		
	1983	1999	1983	1999	1983	1999	Rural	Urban	All India
Very poor	33	51	29	44	31	48	3.0	2.5	2.7
Poor	40	58	40	54	40	57	2.4	1.9	2.2
Non-poor (low)	47	71	49	69	47	70	2.6	2.0	2.4
Non-poor (high)	60	86	70	92	64	89	2.2	1.6	2.0
All group	45	74	50	78	47	76	3.0	2.6	2.9

Source: Kumar et al., 2004a.

Table 10: Revealed comparative advantage of exports of fresh fruits and vegetables from India to the world

Vegetables	1999	2000	2001	2002	2003	2004	2005
Brinjal	0.00	0.00	0.00	0.00	0.22	0.27	0.07
Cabbage	0.00	0.02	0.00	0.00	0.01	0.00	0.00
Onion	**7.48**	**9.59**	**9.48**	**8.15**	**12.41**	**10.57**	**10.63**
Peas	0.69	0.61	0.93	0.45	**1.08**	**2.32**	**2.04**
Tomato	0.01	0.01	0.01	0.08	0.04	0.03	0.05
Potato	0.35	0.35	0.08	0.23	0.46	0.42	0.60
Sweet potato	0.03	0.19	0.10	0.06	0.07	0.03	0.16
Lettuce	0.00	0.02	0.01	0.01	0.05	0.06	0.03
Beans	0.01	0.06	0.00	0.01	0.11	0.13	0.11

Note: Highlighted in bold are the ones with comparative advantage

Table 11: Trends in yield for major vegetables in India

(Unit: tonne/hectare)

Commodity	1993	2003	Gains in Yield	Potential Yield (Highest in the World)
Brinjal	15.3	16.4	1.1	Japan (34.0)
Cabbage	15.5	21.7	6.2	Korea (63.0)
Cauliflower	15.2	18.5	3.3	Morocco (45.0)
Okra	10.3	10.3	0.0	-
Onion	10.9	11.3	0.4	Netherlands (51.2)
Peas	8.4	6.7	-1.7	Belgium (18.3)
Tomato	14.3	16.2	1.9	Portugal (85.7)
Potato	16.6	18.8	2.2	Belgium (48.4)
Sweet Potato	8.5	8.9	0.4	Japan (275.2)
Lettuce	6.6	6.6	0.0	USA (36.8)
Pumpkin & Gourd	9.7	9.7	0.0	France (38.2)
Beans	2.7	2.8	0.1	Belgium (17.4)
Total Vegetables	13.5	14.8	1.3	-

Fig. 1: Change in cropping pattern, 1990-2004

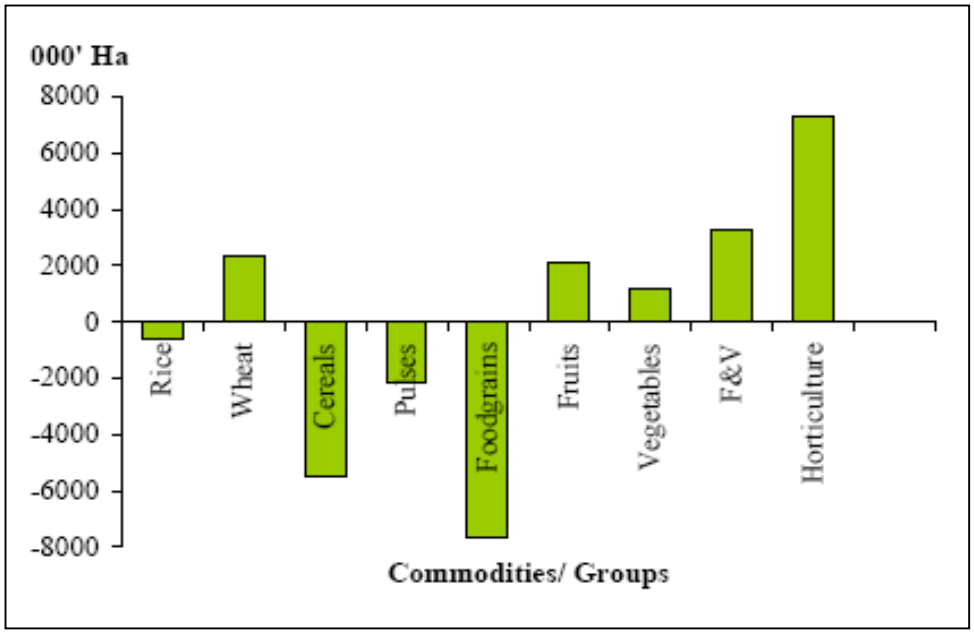


Fig. 2: Year wise production of vegetables

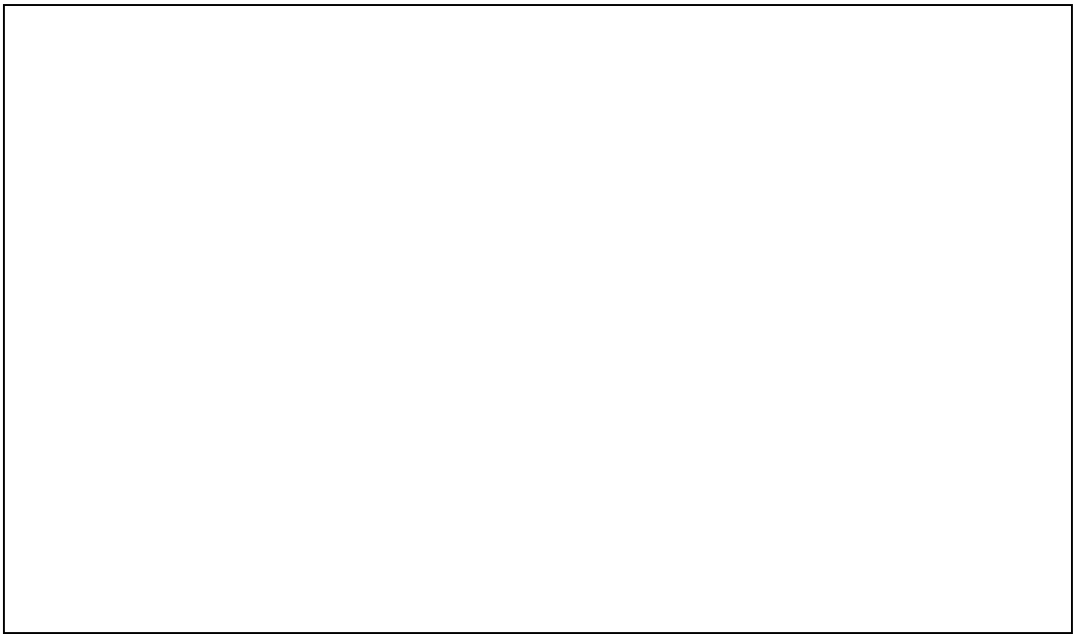


Fig. 3: Average annual rate of growth in area and production

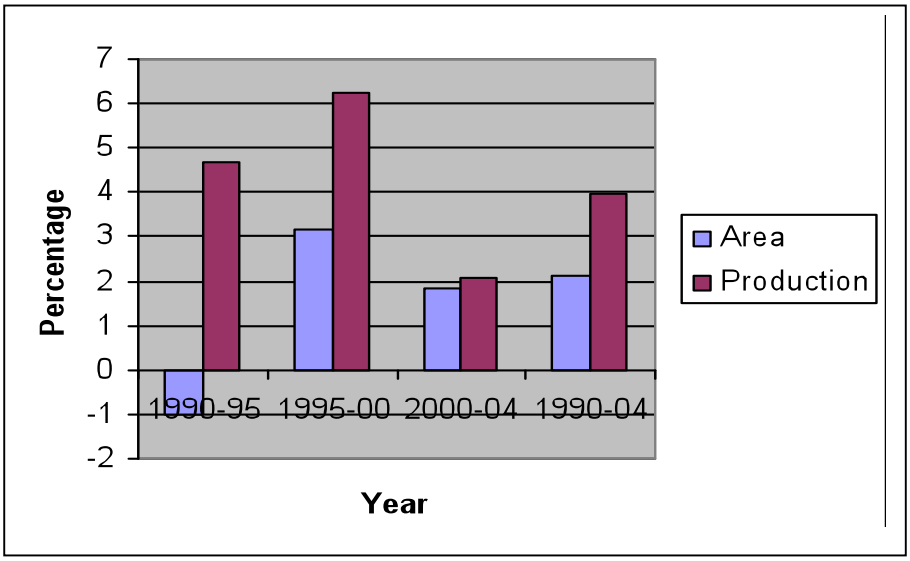


Fig. 4: Share of exports of major vegetables from India

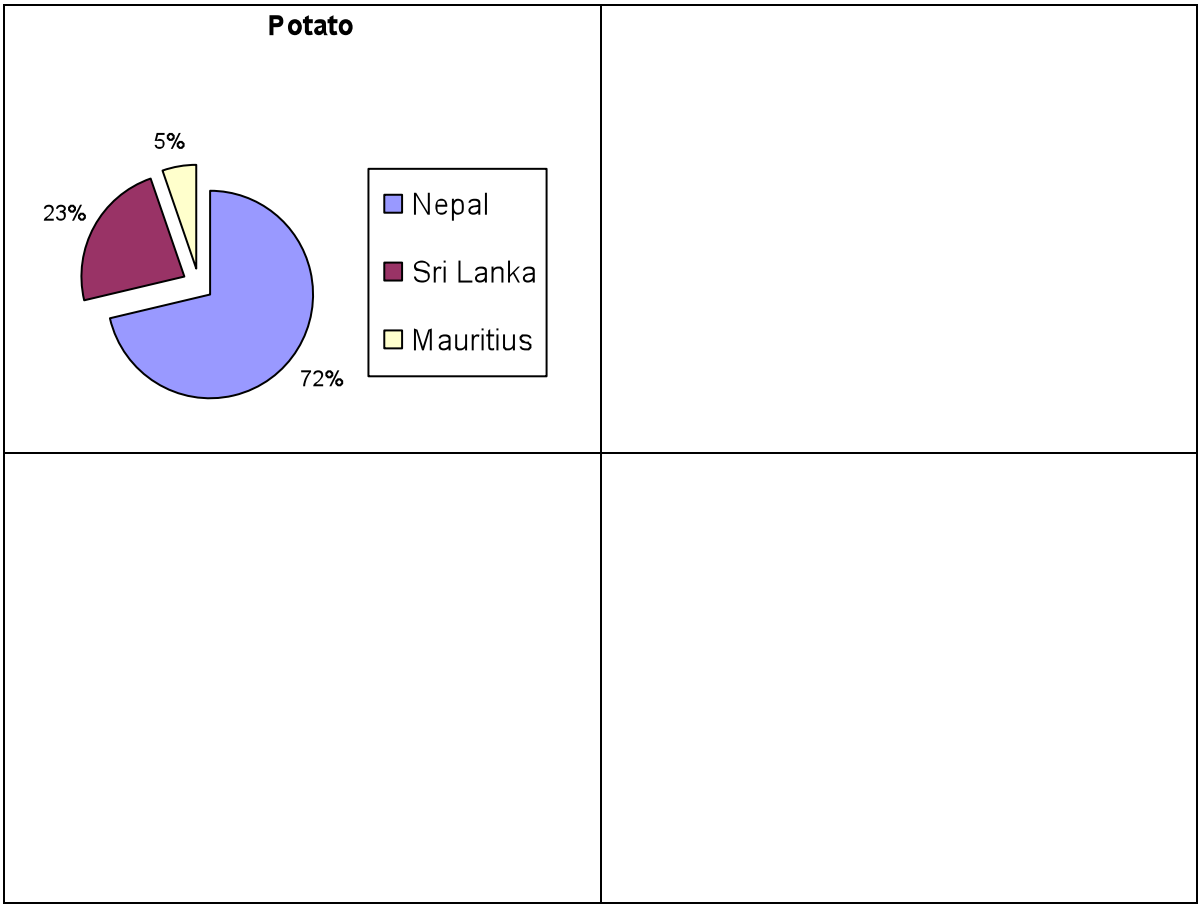


Fig. 5: Annual per capita consumption of vegetables in India

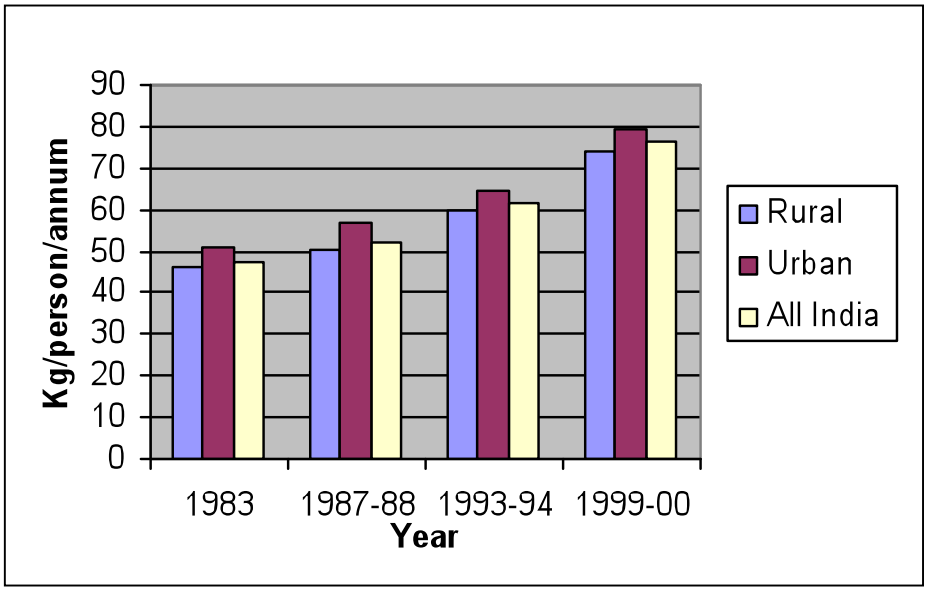


Fig. 6: Projected domestic demand of vegetables in India

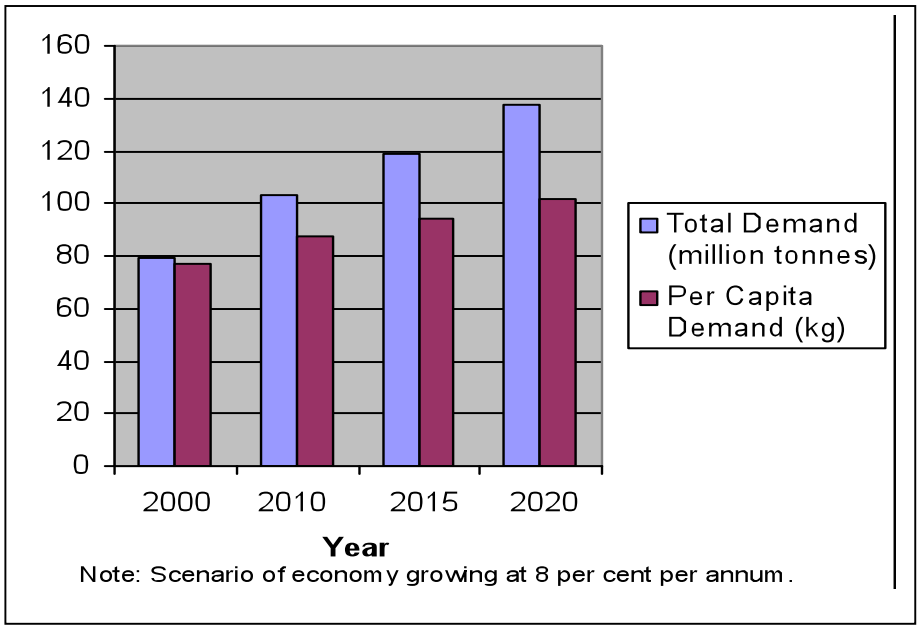
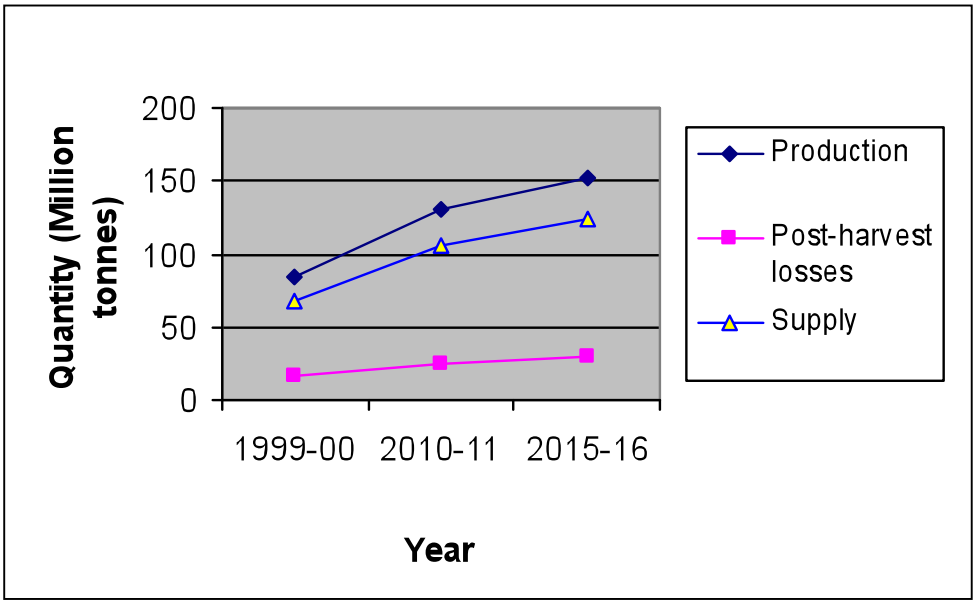
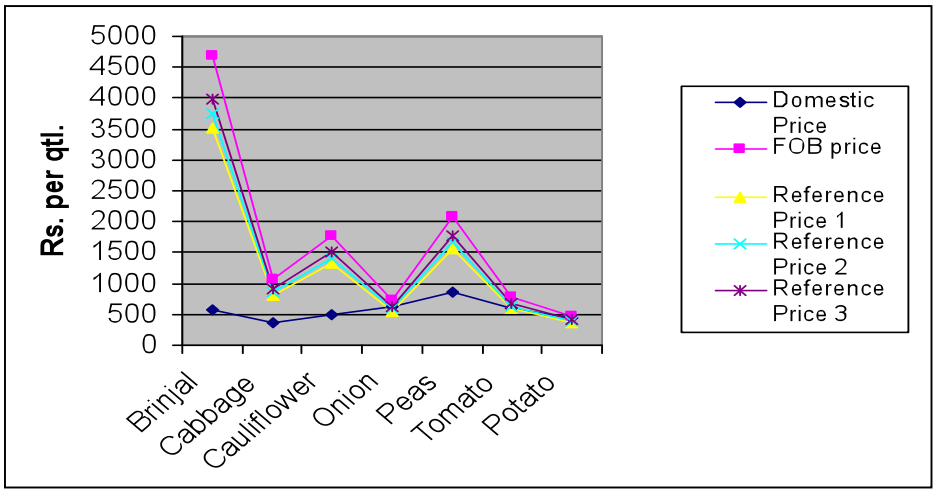


Fig. 7: Production and supply forecast of vegetables in India



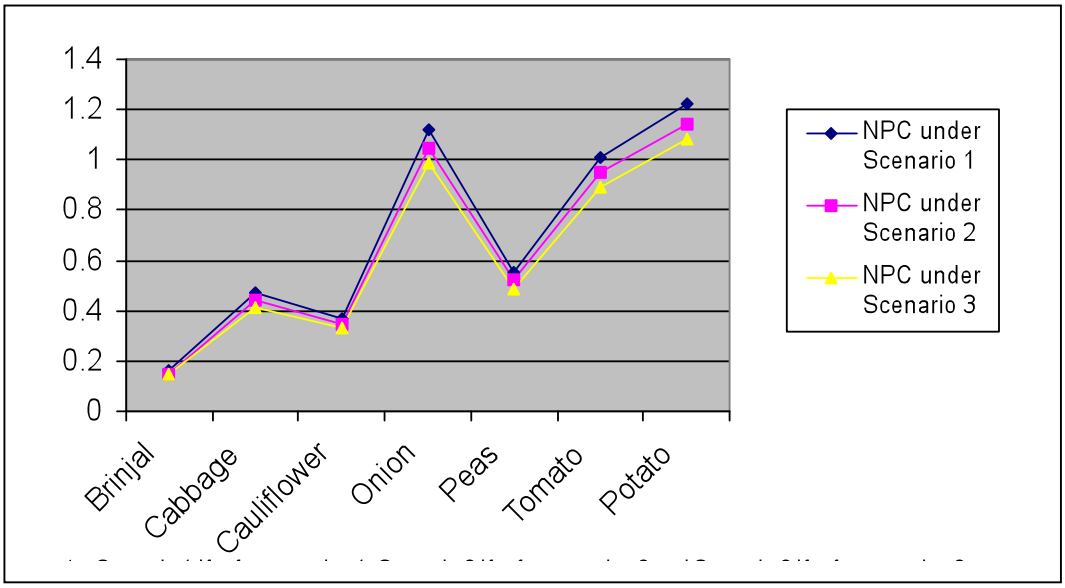
Source: Kumar and Kumar, 2003.

Fig. 8: Domestic price, FOB price and reference price of selected vegetables



Note: Reference Price 1 is the price with the transportation cost etc as 25 percent of the domestic price. Reference Price 2 is the price with the transportation cost etc as 20 percent of the domestic price. Reference Price 1 is the price with the transportation cost etc as 15 percent of the domestic price.

Fig. 9: Nominal protection coefficient under exportable hypothesis



Note: Scenario 1 if reference price 1; Scenario 2 if reference price 2 and Scenario 3 if reference price 3

Figure 10: Nominal protection coefficient of major fresh vegetables