

# **Agricultural Diversification towards High Value Commodities**

*A Study in Food Surplus States in India with Focus on  
Andhra Pradesh and Punjab*

**March 2007**



**International Food Policy Research Institute (IFPRI)  
New Delhi**

Contact Person at IFPRI  
Ashok Gulati, Director in Asia, IFPRI, New Delhi Office  
Email: [a.gulati@cgiar.org](mailto:a.gulati@cgiar.org)



## ***Acknowledgements***

This report is the synergistic product of numerous sources and people.

Ralph Cummings Jr., P K Joshi, Ashok Gulati and Kavery Ganguly finalized this report.

This consolidated report draws on several background papers and studies specifically done for IFPRI. We would like to acknowledge the following papers/ studies: ‘Agricultural Diversification in the Punjab: Trends, Constraints, and Policy Options’ (Rajinder Sidhu, P. G. Chengappa, Deepa Dhankar, and Karl M. Rich), ‘Agricultural Diversification in Andhra Pradesh, India: Patterns and Determinants’ (P Parthasarthy Rao, P.K.Joshi and Ashok Gulati ).Evolution of Food Retail Chains: Evidence from South India (P.G.Chengappa).

Several other papers and studies conducted by national and international agencies have been referred to during the course of the study, all of which have been duly acknowledged and cited in the report. Documents and data sources published by the Government of India and Governments of Punjab and Andhra Pradesh have been used extensively in this report.

Usual disclaimers apply.



## Executive Summary

1. Indian agriculture has slowed. Growth has decelerated sharply from 3.2 per cent annually between 1980/81 and 1995/96 to a trend average of 1.96 per cent subsequently. Emphasis on cereals production (especially rice and wheat) to achieve food security, which resulted in higher profitability for producers and lower output prices for consumers, is dampening agricultural growth. The food security objective has been achieved. The country has accumulated large foreign exchange reserves, if needed, to import food. Alternative options need to be explored to accelerate agricultural growth.
2. Agricultural diversification towards high-value commodities (such as fruits, vegetables, milk, meat, poultry, eggs and fish) is one of the most promising strategies to reverse the declining growth in agricultural sector. Demand for these commodities is growing with rising income, urbanization and globalization.
3. The study is undertaken in two food-surplus states, Punjab and Andhra Pradesh. Agriculture in both the states is facing a crisis. In Punjab, the agricultural growth rate, which averaged 4 percent per annum during 1970s and 5 percent in the 1980s, has declined to 2.6 percent in the 1990s (compared to the all-India average of 3.2 percent). Similarly, Andhra Pradesh agriculture, which was growing little higher (3.4%) than the national average (3.3%) during the 1980s, has significantly slumped in 1990s (2.3%). In Andhra Pradesh, an even more serious situation has emerged during the last five years; average annual growth in agriculture was a negative 1.96 percent between 2000 and 2005.
4. There are two main reasons for such a dismal performance of the agricultural sector. First, the traditional crop sector has reached a plateau; the yields of a majority of traditional crops have slowed or stopped increasing and the cost of production has risen, resulting in declining profitability. Second, the production environment has deteriorated: (i) ground water has fallen; (ii) waterlogging and soil salinity have increased in surface-irrigated areas; and (iii) imbalanced use of nutrients and excessive mining of micro-nutrients have led to a deterioration in soil quality.
5. Farmers are responding to the changing scenario and gradually diversifying production towards high-value commodities (HVCs). But the speed of agricultural diversification has been much faster in Andhra Pradesh than in Punjab. In Punjab, the rice-wheat system still dominates, with only dairying rescuing the agriculture sector. On the other hand, Andhra Pradesh has diversified much more towards

- dairy, poultry, fisheries, fruits and vegetables, by replacing coarse cereals and, to some extent, rice.
6. HVCs were a major source of agricultural growth during the decade of 1990s at all-India level as well as in both the states. Compared to cereals, the HVCs yield higher income and generate more employment, particularly for women. The HVCs also use less water and therefore conserve that precious resource.
  7. Important factors that have contributed to promoting agricultural diversification include urbanization and per capita income on demand side and watershed programs on supply side. Growing agro-processing has impacted production of fruits. Since HVCs are labor-intensive, higher wages could constrain production.
  8. The HVCs are perishable and mostly produced by smallholders. The real challenge is to reduce their transactions costs and link them with the markets. Existing marketing channels are inefficient and fragmented. But some successful innovative institutional arrangements through farmer's markets, cooperatives, and contract farming are emerging which connect producers with agro-processors, exporters and domestic retail chains.
  9. Case studies on contract farming compared with tradition marketing channels in selected commodities (such as vegetables and milk in Punjab and fruits and vegetables and poultry in Andhra Pradesh) demonstrate that contracting can minimize risk, maximize profit and guarantee procurement and prices. Contracting firms also facilitate access to improved technology, credit and better quality inputs. A case study on export of grapes from Andhra Pradesh demonstrates how contract farmers accessed higher prices from exports than their counterparts received in the domestic market.
  10. Despite numerous benefits, contract farming arrangements are receiving cautious response from the agri-business as well as from farmers. Important constraints include (i) restrictive marketing regulations; (ii) under-developed infrastructure towards HVCs; (iii) absence of organized food retailing; and (iv) farmers' instinct for household food security.
  11. The agro-processing industry for HVCs is at an incipient stage in India. The growth of agro-processing sector has been faster in Andhra Pradesh than in Punjab. Andhra Pradesh is in the business of processing fruits & vegetables, meat, marine products and dairy products. Punjab is confined mostly to dairy products. However, a new public-private venture in citrus is expected to make Punjab a hub for fruit juice in South and Southeast Asia.

12. To accelerate the speed of agricultural diversification, there is need to (i) improve incentives, (ii) strengthen existing institutions and create new ones, and (iii) increase investment in public goods, especially infrastructure and research.
- a. Incentives. Prices set by freely operating markets, unhindered by administered levels, subsidies or restrictions, can be efficient and effective allocators of resources. The package should embrace: 1) reforming minimum support prices – decoupling price support from procurement – by a) targeting public distribution, b) procuring at market prices, c) stabilizing within a band, and d) mitigating farmers against risk of precipitous fall in prices; 2) reducing market charges for HVCs, and 3) reforming input subsidies by a) repricing fertilizer, b) reforming irrigation, and c) reorienting power.
  - b. Institutions. Operation of an active, competitive marketing system is essential to successful agricultural development in general and to accelerated transition to diversification in particular. Strengthening other existing institutions and creating new institutions is also important. The package should embrace: 1) Strengthening private marketing through reforming the Agricultural Produce Marketing Act, abolishing the Essential Commodities Act, eliminating movement and storage controls; 2) establishing a system of warehouse receipts, normalizing grades and standards, and strengthening futures markets; 3) promoting agro-processing; 4) improving extension; and 5) reforming land-lease laws and regulations.
  - c. Investments. Public goods contribute to reducing inefficiencies and promoting new opportunities. The package should embrace: 1) improving the physical environment in which HVCs operate; 2) strengthening agricultural research on HVCs and access to information and communication technologies.

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## List of Acronyms

AEZ	Agri Export Zone
AEZ	Agri Export Zones
APEDA	Agricultural Produce Export Development Authority
APMC	Agricultural Produce Marketing Committee
AWB	Australian Wheat Board
CMIE	Centre for Monitoring Indian Economy
CST	Central Sales Tax
ECA	Essential Commodities Act
EU	European Union
EuroGAP	European Good Agricultural Practices
FAQ	Fair Average Quality
FPO	Food Products Order
FPO	Fruit Products Order
GDP	Gross Domestic Product
GoAP	Government of Andhra Pradesh
GSDP	Gross State Domestic Product
ha	Hectares
HACCP	Hazard Analysis and Critical Control Point
HVC	High Value Commodities
ITC	Indian Tobacco Company Limited
MSP	Minimum Support Price
NABARD	National bank for Agriculture and Rural Development
NDDB	National Dairy Development Board
NHB	National Horticulture Board
NHM	National Horticulture Mission
NSSO	National Sample Survey Office
PAFC	Punjab agro Foodgrains Corporation Limited
PAGREXCO	Punjab Agri Export Corporation Limited
PAIC	Punjab Agro Industries Corporation Limited
PAU	Punjab Agricultural University
PDS	Public Distribution System

R&D	Research and Development
Re	Indian Rupee
RRB	Regional Rural Bank
Rs	Indian Rupees
SPS	Sanitary and phyto-sanitary
TE	Triennium Average
UK	United Kingdom



# Chapter 1

## Study Domain and Approach

### 1.1 Introduction

The deteriorating performance of Indian agriculture and slowing of agricultural growth are major concerns for the government for achieving the targeted overall economic growth during the Tenth Five-Year Plan (2002-07). Agricultural growth has decelerated sharply from 3.2 per cent between 1980-81 and 1995-96 to a trend average of 1.9 per cent subsequently<sup>1</sup>. Such a poor performance of the agricultural sector is attributed to declining investment<sup>2</sup> and rising input subsidies in agriculture, fatigue in technological change, deceleration or stagnation in the productivity growth of major crops, and fall in the total factor productivity (Rao, Hanumantha and Dev, Mahendra S. 2003). The greater emphasis on cereal production (especially rice and wheat) in the past to achieve food security, which undoubtedly resulted in lower output prices and higher profitability, is now dampening agricultural growth (Barghouti *et al* 2004). Alternative options need to be explored to revitalize agriculture, make it more profitable and to improve its growth performance. Agricultural diversification towards high value commodities (HVCs)<sup>3</sup> is viewed as one of the most promising strategies to reverse the declining growth trend in agriculture (World Bank, 2002; DFID, 2002; Rosegrant and Hazell, 2000, Government of India 2005).

On the demand side, sustained economic growth (nearly 8 percent per annum in recent years), rising per capita income, growing urbanization, and unfolding globalization are causing a shift in the consumption patterns in India (Kumar *et al* 2003). Per capita cereal consumption has declined from 192.6 kg per person per annum in 1977-78 to 152.6 kg in 1999-2000 in rural households, representing a 20.77 per cent decrease (Fig 1.1a and Fig 1.1b and Table A 1.1). For urban households it declined by 14.97 per cent. In contrast, the share of HVCs in total food expenditure increased from 23.8 percent in 1977-78 to 35.75 percent in 2003 for rural consumers, and from 32.2 percent to 41.55 percent for urban consumers (NSSO 2005). The growing demand for HVCs is not only confined to rich consumers but can also be

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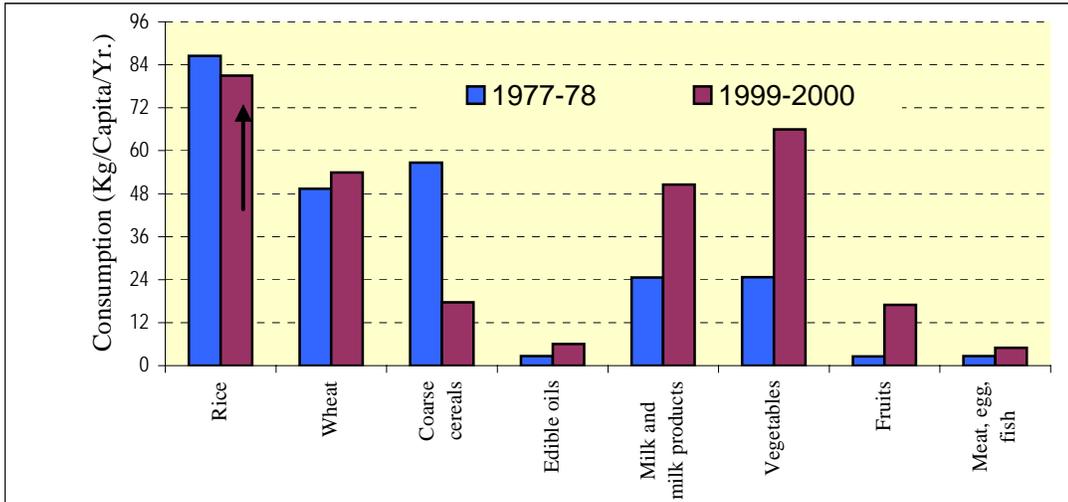
<sup>1</sup> Agricultural growth rate for the year 2004-05 is estimated at 1.1 percent (Government of India 2004-05).

<sup>2</sup> The gross fixed capital formation in the public sector as a proportion of agricultural GDP decreased from 2.19 percent in 1990-91 to 1.56 percent in 2000-01 while the share of the private sector is stagnant around 4.5 percent (Chand and Kumar 2005).

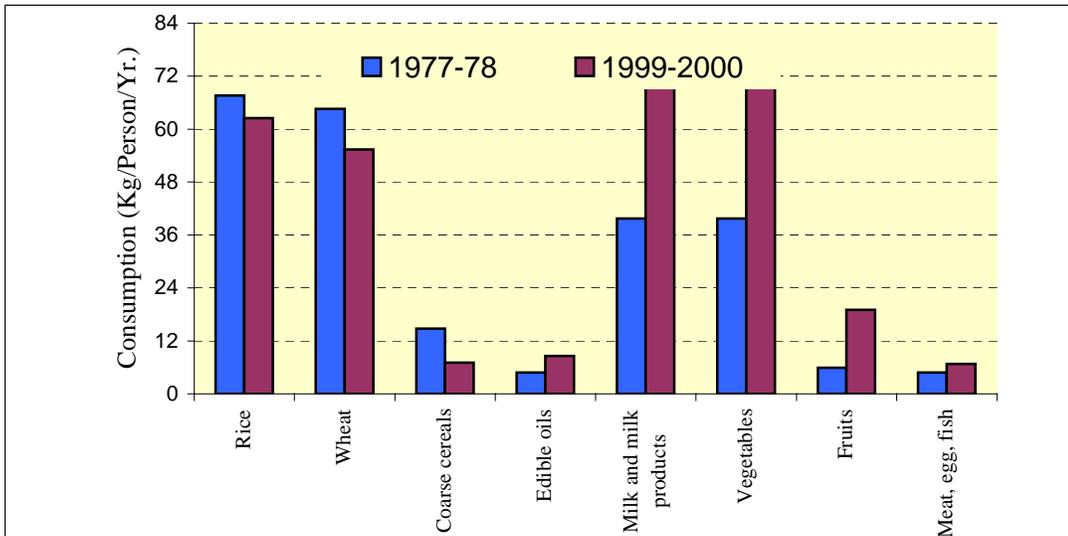
<sup>3</sup> High value commodities in our context include fruits, vegetables, milk, meat, egg and fish.

observed among poor households (Dev, Mahendra S. and Chandrashekar Rao 2004; Kumar 2003).

**Fig 1-1 a) Consumption pattern of major cereals and non cereals in India (Rural)**



**Fig 1-1 b) Consumption pattern of major cereals and non cereals (Urban)**



Such changes in consumption patterns clearly reveal that food security is no longer restricted to availability of cereals but involves a diversified food basket that includes high value commodities such as fruits, vegetables, milk, meat, eggs, fish and processed commodities (Rao, Hanumantha 2000). India has attained self-sufficiency

in food grain production but has yet to achieve nutritional security. HVCs can also play an important role in achieving nutritional security since their present consumption level is much below the recommended dietary norms (Planning commission, 2005 b).

The global trade of HVCs is growing rapidly (Table A 1.2). India is gradually responding to the increasing demand for HVCs in the international market. For example, the share of HVCs in agricultural exports increased from 21 percent in 1990 to 36 percent in 2000 (Rao, P. *et al* 2004). At present, the country is a minor exporter; contributing just 0.5 percent of global exports of fruits, 1.7 percent of global exports of vegetables and less than 1 percent of global export of dairy products during 2001-03 (World Bank 2005). Low volume of Indian export in the global market despite high production of HVCs reveals ample opportunities for India to increase its participation in the global trade.

The rapid increase in domestic and export demand for HVCs clearly demonstrates the opportunity for greater agricultural diversification. On the supply-side, the importance of diversifying agriculture towards high-value commodities has been emphasized in view of their potential for augmenting income, generating employment, alleviating poverty, and promoting export (von Braun 1995; Pingali and Rosegrant 1995; Jha 1996; Ramesh Chand 1996; Delgado and Siamwalla 1999; and Joshi *et al.* 2004).

Facilitating the transition of an agricultural production system dominated by cereals towards HVCs requires greater understanding of the processes involved in diversification and its impact on agricultural performance. Changing food demand scenario and almost stagnating agriculture motivated us to explore how Indian agriculture can position itself to meet the challenge. Experiences from many developing countries, especially Southeast Asian countries, show that diversification towards high value commodities spurs sustainable agricultural growth that benefits smallholders in particular. Therefore, in this context, the following key research questions are investigated:

- What are the factors that are enable or facilitate the shift in farm production portfolio towards high value commodities in India?
- What is the impact of shift towards high value commodities on income, employment and management of natural resources?
- Are small farmers adapting/ responding to the changes in market demand towards high value commodities?

- What are the major constraints and policy support that need to be addressed to accelerate the pace and involve greater participation of smallholders in HVCs?

## **1.2 Objectives and hypothesis**

The overall goal of the study is to assess the nature and speed of changing agricultural production portfolio towards high-value agriculture in India, understand the underlying factors that are promoting and/or retarding the process of diversification, analyze opportunities and constraints to agricultural diversification, and document evolution of innovative institutions that link farmers with the markets. The focus is on two food-surplus states, namely Andhra Pradesh and Punjab. Specifically, the objectives of the study are:

- a) Document current trends in agricultural diversification towards HVCs in India, and specifically in Andhra Pradesh and Punjab.
- b) Identify and quantify major factors driving diversification towards high value commodities.
- c) Analyze present policies and prevailing institutions promoting or impeding agricultural diversification.
- d) Assess the role of innovative institutions in promoting HVCs.
- e) Suggest strategies and policies for revitalizing the agricultural sector through the production of high-value and processed commodities.

The study postulates four main hypotheses: (i) the agricultural sector in India is gradually diversifying towards HVCs due to demand and supply forces, (ii) demand factors and environmental concerns are driving production of HVCs, while lack of adequate infrastructure and market support, and high-risk in production and marketing (including prices) are impeding supply; (iii) diversification is benefiting farmers and consumers, and (iv) current policies and institutions are constraining the creation of an enabling environment to promote required infrastructure and the agro-processing sector.

The report consists of seven chapters. After this brief introduction in Chapter 1, the study domain and analytical approaches are described in Chapter 2. Nature, speed and pattern of agricultural diversification are discussed in Chapter 3 which also identifies and analyzes the drivers of diversification. The implications of diversification in terms of profitability, employment and environmental concerns are examined in Chapter 4. Supply chain analysis of HVCs is presented in Chapter 5. Role of food

processing industry as potential engine to drive the growth of HVCs is discussed in Chapter 6. A brief summary of the study along with policy recommendations are given in Chapter 7.

### 1.3 Study domain and approach

The study addresses India, emphasizing two states in different part of the country, namely Punjab and Andhra Pradesh (Fig. 1.2)

**Fig. 1.2 Location of the states of Punjab and Andhra Pradesh in India**

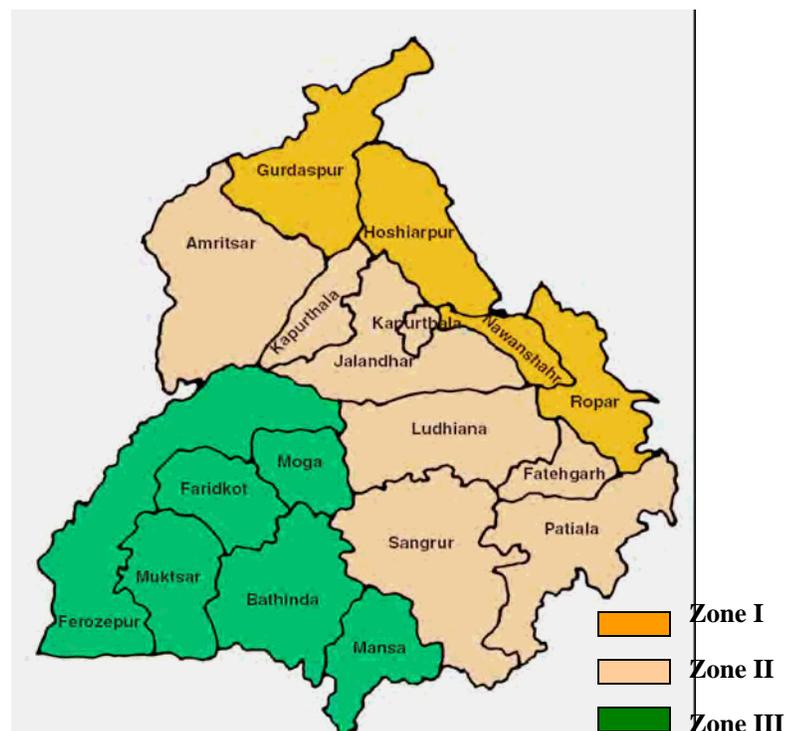


Source: Adapted from Maps of India website

These two states have a few common features<sup>4</sup>:

- Both Andhra Pradesh and Punjab are primarily agrarian states, in which more than two - thirds of the population live in rural areas and mostly rely on agriculture for their livelihoods.
- Both are characterized as food surplus, contributing substantially to the food grain buffer stock. Punjab contributed about 37 percent of rice and 55 percent of wheat in the total buffer stock in the year 2004-05; Andhra Pradesh contributed 16 per cent of rice production in the country.
- Both have three distinct agro-climatic settings<sup>5</sup> (Figs 1.3 and 1.4)..

**Fig. 1.3: Agro-climatic Zones of the Punjab**

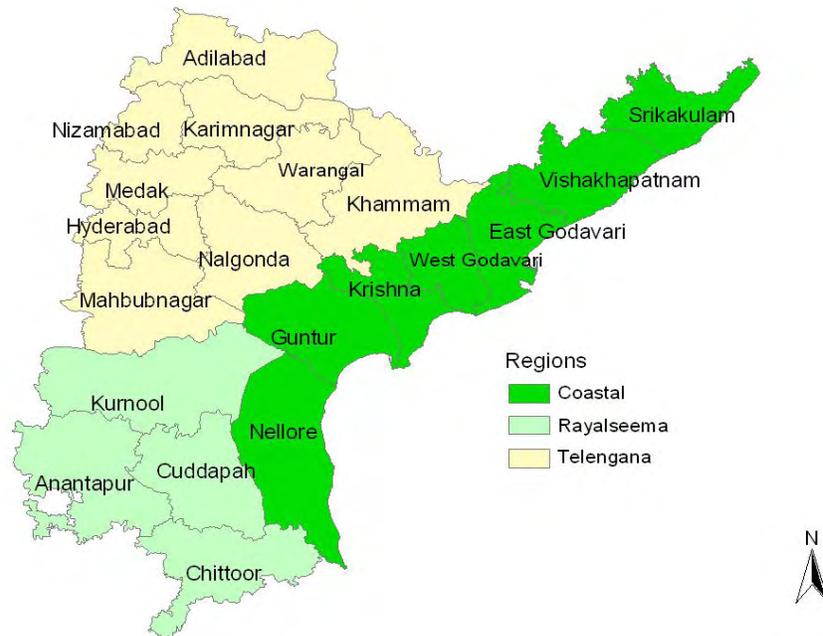


Source: Adapted from Maps of India website

<sup>4</sup> Selected indicators for Punjab, Andhra Pradesh, and India are given in Table A 1.3.

<sup>5</sup> Punjab has 17 districts that are divided into three agro climatic zones: 1) Zone I, the Sub-Mountainous Region; 2) Zone II, the Central Region; and 3) Zone III, the Southwestern Cotton Region (Fig. 1.3). The state of Andhra Pradesh has 23 districts that are divided into three agro climatic zones: 1) The Coastal Region, 2) The Telangana Region 3) and the Rayalseema Region (Fig. 1.4):.

**Fig. 1.4 Agro -climatic regions of Andhra Pradesh.**



Source: Rao et.al 2007

- Agriculture in both the states is under crisis. In Punjab, the agricultural growth rate, which averaged 4 percent per annum during 1970s and 5 percent in the 1980s (well above the corresponding national averages), has declined significantly to 2.6 percent in the 1990s (compared to the all-India average of 3.2 percent). Agriculture in Andhra Pradesh, at 3.4 % per annum, was growing at little higher than the national average (3.3%) during the 1980s, has significantly slumped in 1990s (2.3%). In Andhra Pradesh, the decline has been steep during the last five years; average annual growth in agriculture was a - 1.96 percent between 2000 and 2005 as compared to 1.98 percent at the all-India level.
- The traditional crop sector in both the states is under stress. In Punjab, rice-wheat system, which covers three-quarters of cropped area, is not performing well. Annual growth rates for yields for wheat were well over 2 percent during the 1970s and 1980s, but fell below 2 percent during the 1990s, and even further since then. The annual growth rate of yield for paddy fell from nearly 4 percent during the 1970s to 1.3 percent during the 1980s and 0.02 percent during the 1990s. In Andhra Pradesh, production and profitability of paddy, cotton and

groundnuts have declined during the last five years due to successive droughts and rising costs. Between 2000-01 and 2004-05, growth in production of paddy was -7.6 percent, cotton -1.6 percent and groundnuts -6.5 percent.

- Both the states are experiencing increasing stress on natural resources. In Punjab, groundwater is falling about one-quarter meter per year in the central zone (largely due to early sowing of paddy). In Andhra Pradesh, about 22 percent of the blocks (talukas) are now characterized as dark zones. In both the states, large areas are being lost to production due to soil salinity and waterlogging. Fertilizer, especially nitrogen, is being used at levels exceeding recommendations, contributing to imbalances among nutrients (too much of N relative to P and K), micro-nutrient deficiencies are becoming more serious (about half of soil samples show Zn deficiency) and productivity levels are falling.

But there are striking differences between the two states with respect to resource endowments and the extent of poverty.

- Punjab is well endowed with good natural resources and infrastructure (Table A1.3). In contrast, Andhra Pradesh is designated as marginal and fragile with poor resource endowments.
- The cultivated area in Punjab forms 84 percent of the geographical area and the proportion of cropped area under irrigation is quite high (95 percent). On the other hand, in Andhra Pradesh, net area sown (38.7 percent) and proportion of irrigated area (38.7 percent) are much lower.
- The road density, railway route length, market density, and communication network are much higher in Punjab compared to Andhra Pradesh.
- With respect to ports, Andhra Pradesh is better situated than Punjab. Andhra Pradesh has nine ports (including India's largest major port at Visakhapatnam). In contrast, Punjab is land-locked. Andhra Pradesh has four airports (including an international airport at Hyderabad) while Punjab has three airports (an international airport at Amritsar besides Ludhiana and Chandigarh).
- The cropping intensity in Punjab is 186 percent (much above all-India average of 135) versus 123 percent in the Andhra Pradesh due to higher percent of area under irrigation, fertilizer use, tractor density and area under high yielding varieties. There are 104 tractors per 1000 ha of net cultivated area in Punjab compared to only 6 in Andhra Pradesh.

- Andhra Pradesh is dominated by smallholders while medium and large holdings are the norm in Punjab.
- Only 6 percent of the total population is below poverty line in Punjab, while the corresponding figure is 16 percent in Andhra Pradesh.

Agriculture continues to be a dominant sector of the economy in Punjab contributing 37.93 percent of the GSDP (Gross State Domestic Product) in 2003-04. Punjab is the second largest producer of wheat and third largest producer of rice in the country. The rice-wheat system accounts for 75.36 percent of the cropped area in TE 2003-04 (Table A 1.4) and over 85 percent of the gross value of crop output. Rice- wheat in Punjab has replaced most other crops except cotton, sugarcane, fruits and vegetables (Table A 1.4). The predominance of this cropping system has caused disastrous impacts on the environment, particularly in terms of reduction in the water table and deterioration in soil fertility (Sidhu and Johl, 2002). The changing scenario threatens the sustainability and competitiveness of this cropping system, as reflected in the deceleration of growth in the agricultural sector (World Bank 2003).

In contrast, Andhra Pradesh agriculture is more diversified with rice as the major food grain crop occupying only 26 percent of total cropped area (Table A 1.4) The agriculture in the state is shifting away from the cereals (Table A 1.4), particularly coarse cereals (with the exception of maize) towards commercial crops, like oilseeds, cotton, sugarcane, and HVCs such as fruits, vegetables, dairy, poultry and fisheries (Subrahmanyam and Satya Sekhar 2003).

Along with declining growth in production and productivity, problems such as growing farmers' suicides (in Andhra Pradesh), rising costs of production, declining or stagnating farm profits, and deteriorating quality of soil and water resources are threatening the sustainability of agriculture in both Punjab and Andhra Pradesh. Both the states have attempted to respond to these challenges. To revitalize agriculture, the Government of Punjab (GOP) constituted a number of expert committees (e.g., the Johl committee, 2002 and the Alagh committee, 2004) to explore alternatives to the rice-wheat system. Similarly, the state of Andhra Pradesh prepared a document, Andhra Pradesh- Vision 2020, and through this embarked on a road map to make the state the foremost state in the country in terms of growth, equity and quality of life. The Johl and Alagh committees in Punjab and the Vision document of Andhra Pradesh unequivocally emphasized agricultural diversification to accelerate growth, augment farm income, promote exports, and conserve soil and water resources. In response, the Government of Punjab (GOP) has launched an agricultural

diversification program<sup>6</sup> through various initiatives such as amending marketing acts and promoting contract farming, agro-processing, and agri-exports. Andhra Pradesh also amended the agricultural marketing acts and encouraged contract farming in the state.

#### **1.4 Definition of Agricultural Diversification**

In the context of the present study, agricultural diversification encompasses change in production portfolio from low-value to more remunerative and high-value commodities like fruits, vegetables, milk, meat, eggs and fish that expand farm and non-farm sources of income. It not only involves production processes but also new marketing and agri-business-based industrial activities that expand the income sources of rural households and stimulate the overall rural economy. Changes in the share of different commodities in the value of agriculture are used as a proxy of agricultural diversification.

#### **1.5 Study period and data**

The study covers a span of two and a half decades from 1980-81 to 2003-04. The decade of 1980s represented the post-Green Revolution period in which growth rates were strong in traditional crop sectors, especially rice and wheat. In the 1990s, crop sector growth stagnated (Singh and Hossain, 2002, Sidhu and Johl, 2002 and Chand and Haque, 1998).

The data for the study come primarily from published sources. Surveys with farmers and agri-businesses were conducted wherever the information from published sources were not available. The details on sampling procedure adopted and data obtained are provided in the respective chapters.

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<sup>6</sup> The GOP set a target of substituting one million hectares of rice and wheat into alternative crops over the course of this decade (Government of Punjab, 2002 and 2004) The reference for GOP 2004 has not been found in the References.

## Appendix 1

**Table A 1.1 Consumption pattern of major commodities in India (quantity in kg/ person/ annum)**

Items	Rural			Urban		
	1977-78	1999-2000	% Change over 1977-78	1977-78	1999-2000	% Change over 1977-78
Rice	86.5	81.0	- 6.36	67.6	62.5	-7.54
Wheat	49.4	53.9	9.11	64.6	55.4	-14.25
Coarse cereals	56.7	17.7	-68.78	14.8	7.1	-52.02
Edible oils	2.7	6.0	122.22	4.8	8.6	79.17
Milk and milk products	24.6	50.5	105.28	39.7	72.4	82.37
Vegetables	24.7	66.0	167.25	39.7	70.0	76.32
Fruits	2.6	17.0	553.85	5.9	19.0	222.03
Meat, egg, fish	2.7	5.0	85.19	4.8	6.8	41.66

Source: Consumption of Some Important Commodities in India (various issues), National Sample Survey Organization Ministry of Statistics and Programme Implementation, Govt. of India.

**Table A 1.2: Agricultural Exports from India (Constant 1990 US CPI)**

	in Million USD													
	1980-81		1990-91		2000-01		2001-02		2002-03		2003-04		2004-05	
	Millio n USD	% share of Agri Expor ts	Million USD	% share of Agri Exports	Million USD	% share of Agri Expo rts	Million USD	% share of Agri Expor ts	Million USD	% share of Agri Exports	Millio n USD	% share of Agri Exports	Millio n USD	% share of Agri Exports
<b>Fruits &amp; Vegetables</b>	160	<b>3.9</b>	<b>120</b>	<b>3.4</b>	189	<b>4.1</b>	194	<b>4.4</b>	219	<b>4.5</b>	269	<b>5.0</b>	250	<b>4.5</b>
<b>Processed Fruits &amp; Vegetables</b>	71	<b>1.7</b>	<b>119</b>	<b>3.4</b>	93	<b>2.0</b>	79	<b>1.8</b>	86	<b>1.8</b>	262	<b>4.9</b>	238	<b>4.3</b>
<b>Meat Products</b>	111	<b>2.7</b>	<b>78</b>	<b>2.2</b>	244	<b>5.4</b>	185	<b>4.2</b>	207	<b>4.2</b>	265	<b>5.0</b>	267	<b>4.8</b>
<b>Marine Products</b>	435	<b>10.5</b>	<b>535</b>	<b>15.2</b>	1058	<b>23.2</b>	913	<b>21.0</b>	1040	<b>21.3</b>	944	<b>17.6</b>	872	<b>15.8</b>
<b>Agri Exports</b>	4126	<b>30.7</b>	<b>3521</b>	<b>19.4</b>	4557	<b>13.5</b>	4355	<b>13.5</b>	4892	<b>12.8</b>	5350	<b>11.9</b>	5536	<b>10.2</b>
<b>Total Exports</b>	13460	-	<b>18143</b>	-	33821	-	32344	-	38301	-	44785	-	54110	-
<b>HVCs as % of Agri Export</b>		<b>18.8</b>		<b>24.2</b>		<b>34.7</b>		<b>31.5</b>		<b>31.7</b>		<b>32.5</b>		<b>29.4</b>

Source: Economic Survey.

Note: HVCs include fruits & Vegetables, Processed Fruits & Vegetables, Meat Products and Marine Products.

Indicators	Punjab	Andhra Pradesh	India
<b>Demographic</b>			
Population density (No./km <sup>2</sup> )	483.67	277	312.92
Urban population (%)	33.9	27.3	27.8
Rural population (%)	66.08	72.69	72.18
Male Literacy Rate (%) (2001)	75.23	70.3	75.3
Female Literacy Rate (%) (2001)	63.4	50.4	53.7
<b>Agrarian structure/farm size* (2000-01)</b>			
Average size of land holding (ha)	4.04	1.35	1.37
No of smallholders (%)	29.7	80.80	81.1
<b>Technological</b>			
Net Area Sown as % of geographical area	84.2	38.7	46
Irrigated area (% to net area sown) -2000-01	95	40.7	39.1
Area under high yielding varieties (% to total cropped area)	75.36	33	45.87
Fertilizer (kg/ha of gross cropped area)	174.99	150.09	84.84
Tractor density (per 000 ha of NCA)	104.3	5.5	21.84
Diesel and electric pump set density (per 000 ha of NCA)	220	121	NA
% of villages covered by electrification (2002-03)	100	99.9	83.8
% Share of electricity consumption for agriculture purposes	27.56	41.19	24.88
Cropping intensity	194	123	134
Agro-climatic Average normal rainfall (mm)	462.8	874	100.3
<b>Infrastructure</b>			
Road density (km/km <sup>2</sup> of geographical area) -1998-99	1.27	0.65	0.81
Railway route length (km) per 1000 SqKm	41.73	18.89	19.22
Number of wholesale assembling and regulated markets(2000)	861	675	7127
<b>Market density (markets/100 km<sup>2</sup> of geographical area)</b>	1.32	0.31	0.23

**Table A 1.3 Selected indicators for Punjab, Andhra Pradesh and India 2001-02.**

*Source:* Statistical Abstracts of Punjab and Andhra Pradesh, Agricultural statistics at a glance, 2005org/statistics, www.indiaagristat.com

**Table A 1.4 Changes in the Cropping pattern in the Punjab, Andhra Pradesh and India (% of cropped area)**

Crops area/Years	Punjab			Andhra Pradesh			India		
	TE 1982- 83	TE 91-92	TE 2003- 04	TE 1982- 83	TE 91- 92	TE 2003- 04	TE 1982- 83	TE 91-92	TE 2003- 04
Rice	18.15	26.62	32.17	28.87	30.77	25.93	22.89	23.32	24.13
Wheat	42.29	43.25	43.17	0.13	0.07	0.09	13.06	12.97	14.73
Maize	4.92	2.54	1.98	2.57	2.33	4.51	3.39	3.23	3.89
Coarse cereals	6.90	3.25	2.38	29.51	15.65	11.56	23.96	19.64	16.54
<b>Total Cereals</b>	67.36	73.13	77.73	58.52	46.49	37.60	59.93	55.94	55.40
<b>Total pulses</b>	3.61	1.95	0.63	11.32	12.25	16.69	13.28	10.72	12.47
Groundnut	1.21	0.17	0.05	11.11	18.08	12.54	4.14	4.69	3.44
Sesamum	0.24	0.21	0.20	1.36	1.25	1.10	1.39	1.37	0.92
<b>Total oilseeds</b>	2.91	2.14	1.16	15.56	24.12	19.85	11.08	14.10	13.22
Sugarcane	1.35	1.38	1.77	1.25	1.70	1.77	1.81	2.00	2.45
Cotton	9.90	9.27	6.35	3.48	5.08	7.40	4.56	4.16	4.64
<b>Total commercial crops</b>	14.3	12.83	9.40+	21.78	32.97	31.43+	17.97	20.79	20.89+
Fruits	NA	NA	0.47	NA	NA	4.40	NA	NA	2.34
Vegetables	NA	NA	1.70	NA	NA	1.84	NA	NA	4.04

Note: Commercial crops include oilseeds, sugarcane, cotton, chilies and turmeric

Source: Land use Statistics at a glance 2001-02 and 2002-03, Directorate of Economics and Statistics, Department of Agriculture, Government of India. Various issues of Statistical Abstract India, Central Statistical Organization, Ministry of Statistics and program implementation, Government of India. Various issues of statistical Abstract of Punjab and Andhra Pradesh and various issues on Agriculture, CMIE Pvt Ltd. Mumbai

## **Chapter 2**

### **Nature and Pattern of Agricultural Diversification**

Sustained economic growth, urbanization and globalization is changing the consumption pattern of Indian consumers from food grains to high-value commodities. This is occurring both in urban and rural areas as well as among rich and poor households. To meet the changing demand, production systems are gradually shifting towards HVCs, though the nature and pattern of such shifts vary markedly across regions. In this chapter, an attempt is made to map the nature and pattern of diversification in the country, with focus on Punjab and Andhra Pradesh.

#### **2.1 Declining share of agriculture**

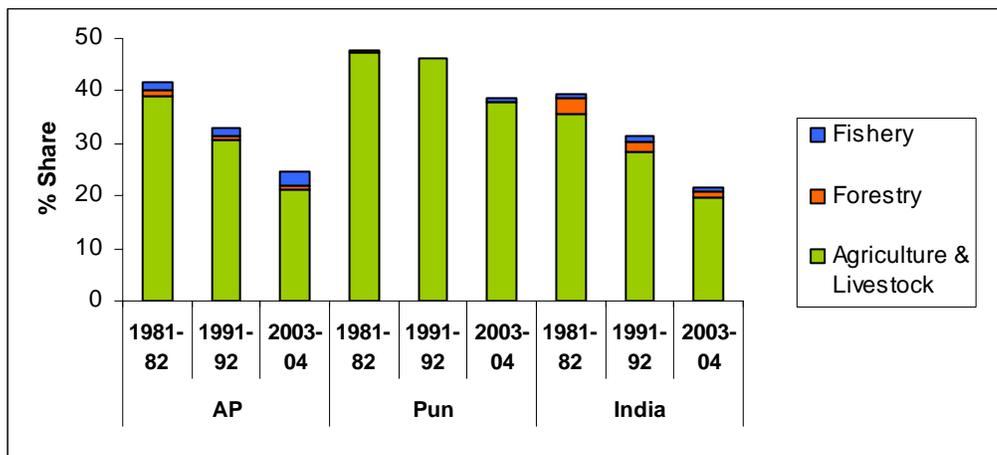
Consistent with the theory of economic development, the share of agricultural sector is declining with higher economic growth in India. The share of agriculture and allied activities in the GDP decreased from 35.63 per cent in 1981-82 to 19.80 percent in 2003-04 (Figure 2.1). Comparison of Andhra Pradesh and Punjab indicates that the former is corresponding to the national pattern as its share in gross state domestic product (GSDP) has declined from more than 35 percent in early 1980s to around 20 percent in 2003-04. However, in Punjab, agriculture continues to be a dominant sector; the share of agriculture in GSDP has declined from 47.50 to 37.93 percent during the same period (Table A 2.1).

#### **2.2 Increasing share of HVCs**

The Indian farmer is steadily responding to the changing economic scenario with gradually diversification of the production portfolio to meet the growing demand for high-value commodities (Figure 2.2). At all-India level, this is reflected in the changing share of HVCs in the total value of agricultural output which increased from 34.82 percent in TE 1982-83 to 37.03 percent in TE 1990-91 and reached to 45.61 per cent in TE 2002-03 (Table A 2.2).

During the same period, agriculture in the two foodgrain-surplus states (viz. Andhra Pradesh and Punjab) also diversified but witnessed differences in the nature and pace. In Andhra Pradesh, there is a clear shift from foodgrains towards fruits, vegetables, milk, poultry, eggs, and aquaculture.

**Fig. 2.1 Share of agriculture and other sectors in GSDP (at 1993-94 prices) in Punjab, Andhra and India ( in percent)**

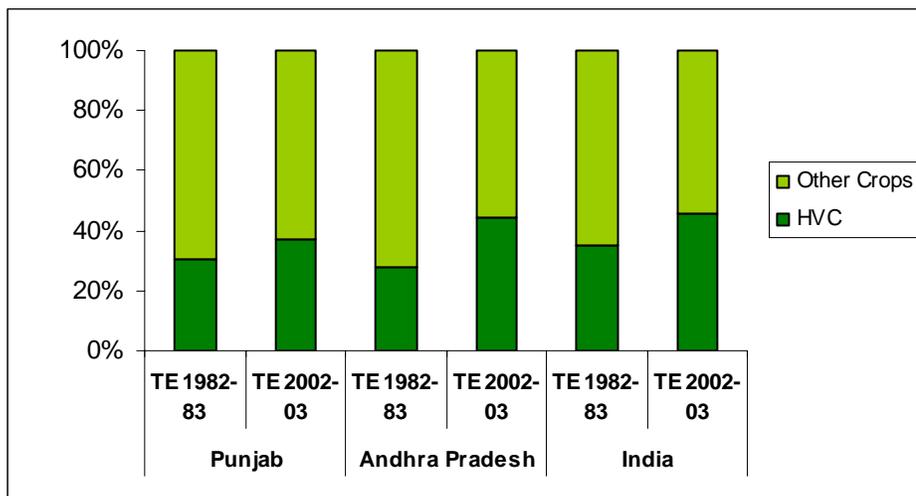


Source: Statistical Abstract of Punjab, various issues

The share of these commodities in the total value of agriculture in the state jumped from 27.55 percent in TE 1982-83 to 44.32 percent in TE 2002-03. In Punjab, on the contrary, there has been a consistent rise of the rice- wheat system that dominated the agriculture in the state. This system together formed nearly half of the total value of agriculture in TE 2002-03 compared to 42.64 percent in TE 1982-83. The prominence of this system in the state is mainly attributed to the rise in the share of rice from 16.55 percent to 22.13 percent, while the share of wheat has remained around 26 percent. Availability of low-risk and high-dividend technology contributed in spreading these two crops in the state. The favorable policy regime that ensured guaranteed prices and procurement of rice and wheat has reinforced their dominance in Punjab.

At the all-India level, the importance of livestock sector has conspicuously increased. The same trend is observed in both the states. In Punjab, the share of livestock in total value of agricultural output has increased from 27.35 per cent in TE 1982-83 to 37.87 percent in TE 2002-03. Of this, milk alone contributed about 25 percent in TE 2002-03. Milk cooperatives and Nestle India Ltd played key roles in the Punjab. During the same period in Andhra Pradesh, the share of all livestock activities (namely milk, meat and eggs) more than doubled; from 16.01 per cent in TE 1982-83 to 33.78 in TE 2002-03, but with a higher contribution of eggs and poultry.

**Figure 2.2: Composition of Value of Agricultural Output (at 1993-94 prices): Punjab, Andhra Pradesh and India**



Source: Statistical Abstract, Punjab, various issues.

The livestock sector in Andhra Pradesh expanded as a result of rising demand for products like milk, meat and eggs. And on supply side, the enabling environment created by cooperatives and contract farming/ vertical integration that linked production, processing and retail distribution of milk and poultry has also contributed to the growth of livestock sector in the state (Joshi et al 2005). The steady growth of livestock sector particularly during the 1990s is also attributed to rise in animal productivity, expansion of milk processing units, and improvements in veterinary infrastructure facilities (Sidhu and Bhullar, 2004).

### **2.3. Declining importance of coarse cereals**

At the all-India level, the proportion of area under coarse cereals has fallen from 23.96 per cent in TE 1982-83 to 16.54 percent in 2003-04. Unfortunately, there has not been much productivity gain in coarse cereals (Table 2.1). Consequently the production of coarse cereals has shrunk resulting in decline in their share in total value of agricultural output from 5.02 percent in 1982-83 to 2.97 percent in 2003-04 (Table A 2.2). In Punjab, the coarse cereals have almost vanished, contributing only about 1 percent to the total value of agricultural output, while in Andhra Pradesh their share is only 2.5 percent. However, maize performed better among coarse cereal group; its area and yield increased at all-India level, but much faster in Andhra Pradesh (Table 2.1). This is attributed to expansion of feed industry due to growing poultry sector in

Andhra Pradesh. Maize formed 53 per cent of the broiler starter and 34 per cent of the layer mash in the poultry sector (Kleigh et al 2000).

**Table 2.1 Annual compound growth rates in yield of major crops in the Punjab, Andhra Pradesh and India (percent per annum)**

Crop/ period	Punjab			Andhra Pradesh			India		
	1980- 81 to 89-90	1990- 91 to 1999- 2000	1980- 81 to 2003- 04	1980- 81 to 89-90	1990- 91 to 1999- 2000	1980- 81 to 2003- 04	1980- 81 to 89-90	1990- 91 to 1999- 2000	1980- 81 to 2003- 04
Rice	1.16	0.34	0.8	2.0	1.81	1.69	3.16	1.36	1.99
Wheat	2.88	2.01	2.00	3.91	-2.11	1.22	3.1	1.64	2.25
Sorghum	NA	NA	NA	1.2	2.3	NA	NA	NA	NA
Maize	-0.72	3.61	2.06	-0.26	3.99	3.43	2.39	3.07	2.39
Groundnut	-0.88	0.26	-0.23	1.98	-1.25	-0.57	1.8	0.87	1.1
Sesamum	0.30	0.26	-0.18	-2.26	-1.37	1.41	4.13	2.22	2.36
Sugarcane	0.38	-0.08	-0.05	-3.20	3.28	0.48	1.62	0.53	0.82
Cotton	7.32	-6.56	0.48	-3.29	-1.08	0.36	4.07	-12.9	-0.22

Source: Various issues of Statistical Abstract India, Central Statistical Organization, Ministry of Statistics and program implementation, Government of India. Various issues of statistical Abstracts of Punjab and Andhra Pradesh and various issues on Agriculture, CMIE Pvt Ltd. Mumbai.

## **2.4. Agricultural diversification in selected sectors**

We have observed a noticeable shift in production portfolio towards HVCs in India as well as in both the food grain surplus states. But it is important to note that the shift in production portfolio is broad-based in the marginal and fragile environment (i.e. Andhra Pradesh), while the move is more towards dairy sector in well-endowed region (i.e. Punjab). In the following sections, we discuss the pattern of diversification for selected agricultural sectors.

### **2.4.1 Fruits and Vegetables**

India is a major producer of fruits next to Brazil with an estimated production of 44.61 million tons in TE 2002-03 (Table 2.2). Mango and citrus are the major fruit crops, accounting for about 57 percent in the total fruit production (Figure 2.3 a). In vegetables, India is second to China with an estimated production of 93.35 million

tons in TE 2002-03 (Table 2.3). At the all-India level, the share of fruits and vegetables in the total value of agricultural output increased from 14.37 per cent in 1982-83 to 18.12 per cent 2002-03 (Table A 2.2). This has happened due to area expansion and productivity increase of both fruits and vegetables (Table 2.4).

*Andhra Pradesh:* Andhra Pradesh performed better than Punjab in fruits & vegetables production. Andhra Pradesh is the third largest producer of fruits in India next to Maharashtra and Tamil Nadu. It accounts for 13.87 percent of fruit production and 2.89 percent of vegetable production in India. The fruit production in the state has increased from 4.0 million tons in 1991-92 to 6.2 million tons in TE 2002-03 (Table 2.2), recording an annual growth rate of 2.61 percent (Table 2.4). Increase in production was mainly due to rapid area expansion that grew at an annual rate of 6.46 percent. Yields of fruits and vegetables are generally lower than the national averages. Mango is the dominant fruit crop in the state, which accounts for about 40 percent of total fruit production. Citrus group is next among all fruits grown in Andhra Pradesh (Figure 2.3 c). But in recent years, papaya and banana are also gaining importance due to their rising demand and easy availability of short-duration and high-yielding tissue cultured saplings. Area under papaya increased at an annual rate of about 30 percent during 1990-91 to 2000-01. Lemon is another crop that is modestly spreading in the state; its area increased at the rate of 5.3 percent per annum. Cultivation of grapes is also catching up in Andhra Pradesh due to infrastructure development and export promotion provided under the Agricultural Export Zone.

Andhra Pradesh is also gaining importance in vegetable production (2.55 percent per annum), which is mainly driven by area expansion, (3.89 percent per annum during 1991-02 to 2002-03: Table 2.4). Tomatoes and potatoes are the principal vegetables, which account for about 56 percent in the total vegetable production (Figure 2.4a). Growing demand for vegetables and availability of improved varieties through private seed sector were the main reasons for increasing area and production of vegetables.

During the last decade or so, it appears that the thrust provided under National Horticulture Mission (NHM), National Horticulture Board (NHB), Agri Export Zones (AEZ) and Agricultural Produce Export Development Authority (APEDA), and some scattered successes of vertical coordination in fruits and vegetables have helped in area expansion of fruits and vegetables in Andhra Pradesh.

*Punjab:* Punjab is a relatively minor producer of fruits and vegetables in India. The state has a meager share (less than 2 percent) in the total area under fruits and vegetables in India. It produced 2.3 million tons of vegetables in TE 2002-03 (Table 2.3 a), which was less than 2.5 percent of total vegetables produced in the country.

Fruit production in Punjab has fallen during the last decade. Citrus is the major fruit grown in Punjab, accounting for 44 percent of total production of fruits (Figure 2.3 b).

**Table 2.2 Area, production and productivity of fruits in Punjab, Andhra Pradesh and all-India**

	Punjab			Andhra Pradesh			India		
	1991-92*	TE 1997-98	TE 2002-03	1991-92*	TE 1997-98	TE 2002-03	1991-92*	TE 1997-98	TE 2002-03
Area ('000 Ha)	72.7	90.79	37.40	313.1	403.93	544.43	2874.5	3546.20	4023.33
Production ('000 tons)	666.89	788.42	529.94	4008.2	5675.47	6188.53	28632	41742.77	44606.67
Yield (tons)	9.17	8.70	14.16	12.8	14.05	11.32	10	11.78	11.08

Note: \*1991-92 figures do not depict TE figures due to non availability. ACGR indicates Compound Annual Growth Rate.

Source: Various issues of statistical Abstract of Punjab and Andhra Pradesh and Various issues on Agriculture, CMIE Pvt Ltd Mumbai

**Table 2.3 Area, production and productivity of vegetables in Punjab, Andhra Pradesh and all-India level**

	Punjab			Andhra Pradesh			India		
	1991-92*	TE 1997-98	TE 2002-03	1991-92*	TE 1997-98	TE 2002-03	1991-92*	TE 1997-98	TE 2002-03
Area ('000 Ha)	84.5	103.43	134.77	155.2	181.17	228.67	5592.7	5485.97	6679.50
Production ('000 tons)	1450	1673.87	2301.67	1452.6	2197.17	2697.43	58532	73117.37	93347.17
Yield (tons)	17.2	16.94	17.11	9.40	12.23	12.26	10.5	13.33	14.06

Note: \*1991-92 figures do not depict TE figures due to non-availability.

Source: Various issues of statistical Abstract of Punjab and Andhra Pradesh and Various issues on Agriculture, CMIE Pvt Ltd Mumbai

**Table 2.4 Compound growth rates in area, production and productivity of fruits and vegetables in the Punjab, Andhra Pradesh and India (in percent for the period 1994-95 to 2002-03)**

	Fruits			Vegetables		
	Area	Production	Yield	Area	Production	Yield
Andhra Pradesh	6.46	2.61	3.78	3.89	2.55	0.44
Punjab	18.44	5.89	10.05	6.59	5.89	0.63
India	2.73	1.56	1.15	4.13	4.62	0.48

Potato is the principal vegetable produced in Punjab, accounting for 59 percent of total production (Figure 2.3 b). The state was the fourth-largest producer of potatoes in India in 2002-03, but represented only 6 percent of national production. Other vegetables like chilies and onion are minor in Punjab. The Pepsi initiative during late 1980s expanded the tomato area in selected regions due to access of better technology and higher, assured prices. Though Punjab is a small player in vegetable production, productivity levels in the state are relatively high compared to national average (Table 2.5). Similarly, yields of fruits are also high in Punjab (Table 2.6). The state is ranked second in grape yields next to Maharashtra. The yields of guava and mango are also high. It can take advantage of proximity to the Delhi market (Asia's largest fruit & vegetable market) and direct flights to Gulf and Central Asian countries.

**Table 2.5 Productivity of Vegetables in the Punjab, Andhra Pradesh and India in Selected Years**

State	Productivity (tons per ha)			
	1991-92	2000-01	2001-02	2002-03
Andhra Pradesh	9.4	12.6	11.6	11.1
Punjab	17.2	17.6	16.9	16.8
National Average	10.5	15.0	14.4	13.9

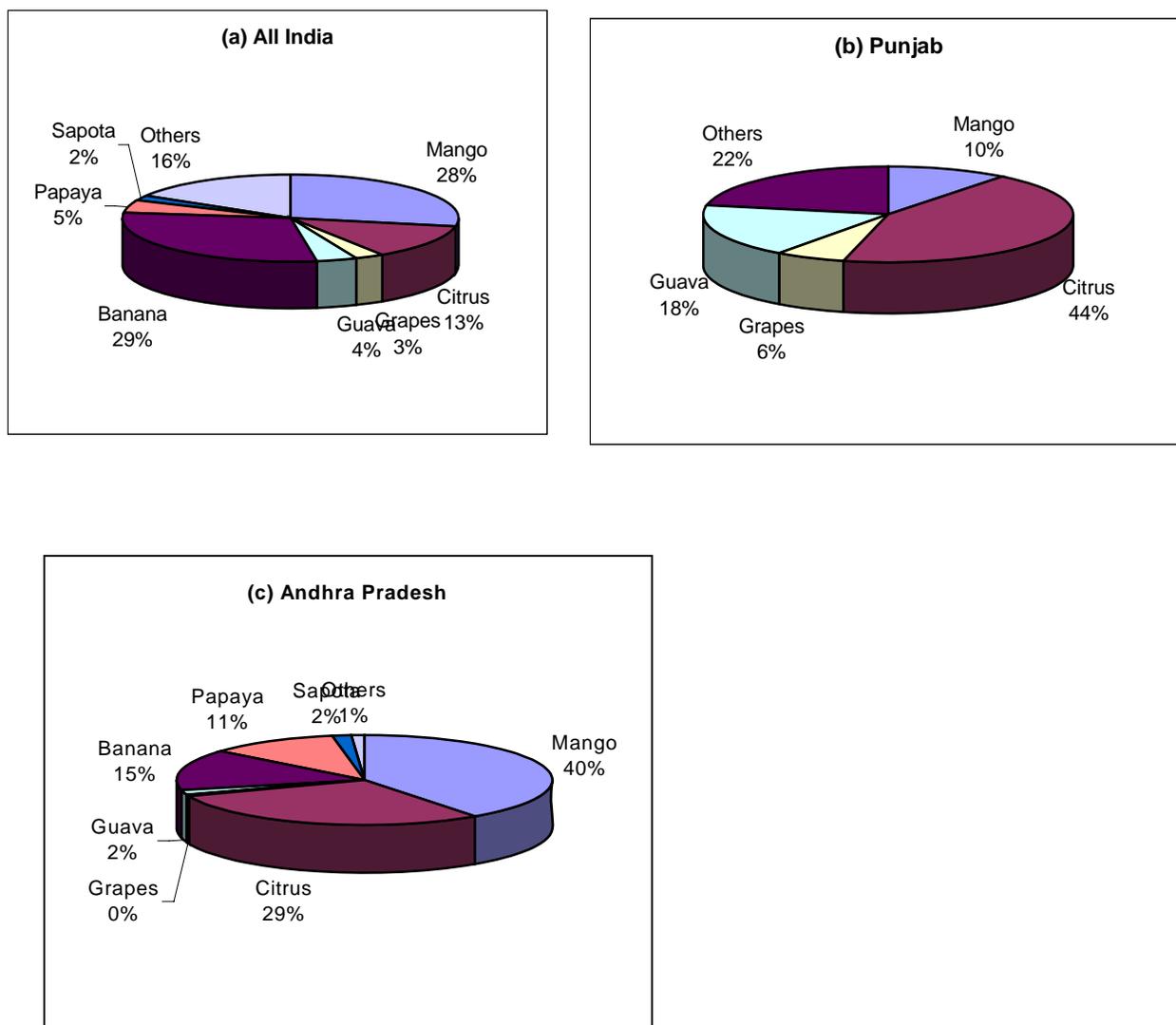
Source: National Horticulture Board, found at [http://hortibizindia.org/mainpage.asp?\\_section\\_code=02&sub\\_section\\_code=](http://hortibizindia.org/mainpage.asp?_section_code=02&sub_section_code=)

**Table 2.6 Comparison of yield levels for selected fruits in the Punjab, Andhra Pradesh and India, 2002-03 (tons/ha)**

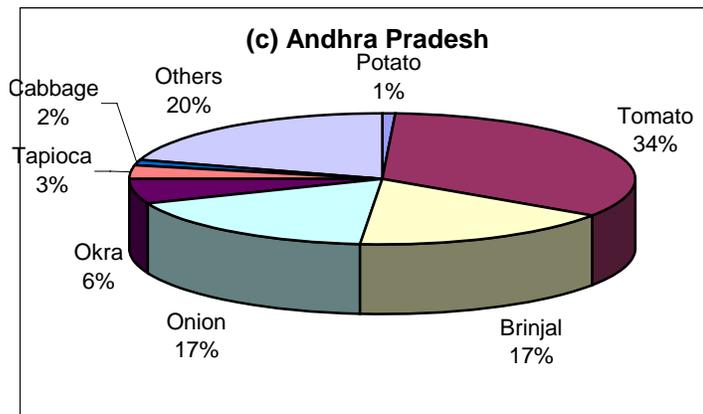
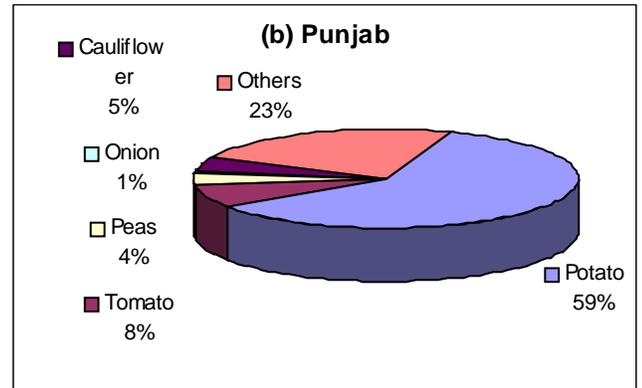
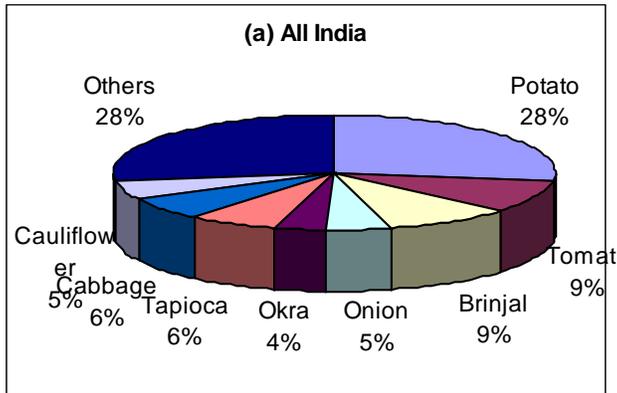
State	Grapes	Guavas*	Mangoes
Punjab	27.8	17.5	10
Andhra Pradesh	20.8	10	8
<b>India</b>	<b>19.7</b>	<b>11.1</b>	<b>6.74</b>

Source: Ministry of Agriculture, Govt. of India, National Horticulture Board, Department of Horticulture-Punjab & Economic Intelligence Service-Agriculture, March 2005, CMIE. \*Guava figures are for 2001-02.

**Figure: 2.3 (a) Fruit production in India, Punjab and Andhra Pradesh**



**Figure: 2.3 (b) Vegetable production in India, Punjab and Andhra Pradesh**



### 2.4.2. Dairy

Dairy sector in India has witnessed a steady growth in the last two decades. Its share in agricultural GDP has risen from 13.17 percent in TE 1982-83 to 18.52 percent in 2002-03 (Table A 2.2), primarily because of the implementation of operation flood program through the National Dairy Development Board (NDDB) under which milk collection centers and processing units have been set up countrywide by the milk cooperatives. More recently private players have also entered the dairy sector and are expected to give a big boost to it. Dairying has assumed greater significance for smallholders since it is land-saving, labor-intensive and regular-yielding activity. Milk production in the country has increased at an annual rate of 3.91 percent between 1992-93 and 2003-04 (Table 2.7). This increase was much faster than the population growth; the per capita availability of milk in India went-up to 230 gm per day in 2003-04 from 180 gm per day in 1991. However, it is still much below the level recommended by the Indian Council of Medical Research of 250 gm per day per person.

**Table 2.7 Growth of milk production in Punjab, Andhra Pradesh and India**

	Punjab		Andhra Pradesh		India
	Production (million ton)	Share in all-India production (%)	Production (million ton)	Share in all-India production (%)	Production (million ton)
TE1982-83	3.43	10.11	2.41	7.10	33.9
TE1991-92	5.19	9.67	2.99	5.57	53.66
TE2001-02	7.80	9.61	5.48	6.75	81.1
TE2003-04	8.16	9.44	6.45	7.46	86.4
ACGR of milk production 1992-93 to 2003-04		3.67 per cent		8.69 percent	3.91 percent

Note: ACGR indicates Annual Compound Growth Rate

Source: Various issues of statistical Abstract of Punjab and Andhra Pradesh, Various issues on Agriculture, CMIE Pvt Ltd Mumbai and Department of Animal Husbandry and Dairying, Government of India

*Punjab:* At the national level, Punjab follows Uttar Pradesh as the second-leading milk producer in the country. Dairy constitutes nearly 25 percent of the gross value of

agriculture (Table A 2.2). Milk production increased from 3.43 million tons in TE 1982-83 to 8.16 million tons in TE

2003-04 constituting about 9.5 percent of milk production in the country. Milk production is growing at a modest growth rate of 3.67 per cent per annum (for the period 1992-93 to 2003-04). The per capita availability of milk in Punjab increased from 201.96 gm/day in 1981-82 to 321.49 gm/ day in 2003-04, which is much above than the national average as well as the recommended level. In Punjab, dairy production contributed 54.6 percent of farm business income to marginal farms and 37.4 per cent to small farms during 2002-03 (Sidhu and Bhullar, 2004).

*Andhra Pradesh:* Andhra Pradesh is the 5th largest milk producer in the country; producing 7.46 million tons of milk in TE 2003-04 (7.46 % of all-India production). Between 1992-93 and 2003-04 milk production in Andhra grew by 8.69 percent per annum (Table 2.7), almost doubling the per capita availability of milk.<sup>7</sup>

### 2.4.3. Poultry

Poultry is the fastest growing sector in the agricultural economy of India, at an annual growth rate of 5.52 percent during 1992-2004. Andhra Pradesh is known as the poultry capital of India. The egg production in the state increased sharply from 2,547 million eggs in TE

**Table 2.8 Production of eggs in Punjab, Andhra Pradesh and India (million numbers)**

<b>Year</b>	<b>Punjab</b>	<b>Andhra Pradesh</b>	<b>India</b>
TE 1991-92	1249.33 (5.92)	2547 (12.07)	21096
TE 2001-02	2902.4 (8.22)	10486.7 (29.73)	35269.33
TE 2003-04	3053.33 (7.70)	14390 (36.29)	39651.67
Annual growth rate in egg production 1992-93 to 2003-04 (%)	3.07	13.22	5.52

Note: Figures in parentheses are the share in all India production.

Source: Various issues of statistical Abstract of Punjab and Andhra Pradesh, Various issues on Agriculture, CMIE Pvt Ltd Mumbai and Department of Animal Husbandry and Dairying, Government of India

<sup>7</sup> The per capita availability of milk in Andhra Pradesh is 260 gms/day compared to the All India average of 241 gm/day in 2005-06, while that in Punjab is much higher at 943 gms/day.

1991-92 to 14,390 million in TE 2003-04 at an annual growth rate of 13.22 percent (Table 2.8). Such a phenomenal increase in production has resulted in increasing the per capita availability of eggs from 64 to 151 during the same period (the figures at the all-India level for the corresponding periods are 27 and 36). Growing egg production in Andhra Pradesh has conspicuously elevated its share in the total egg production in the country from 12.07 percent in 1991-92 to 36.29 percent. The state accounts for one-fourth of egg exports from India (60 million out of 220 million exported in 2001), mainly to Gulf countries. A small quantity of egg powder is also exported to Gulf countries. Poultry meat and other meat products are also on the rise in Andhra Pradesh. The state's share in broiler production stood at 8.93 per cent of total production in the country during 2003-04. The state exports poultry meat mainly to East, South and Middle-East Asian countries. The state is also a major supplier of eggs and broilers to neighboring states of Tamil Nadu, Maharashtra, Karnataka and Madhya Pradesh. Strong network of contract farming that connects poultry producers with the domestic and global markets is credited for such an impressive performance of poultry sector in the state.

Punjab is a minor player in poultry and meat production. The state can draw lessons on contract farming models from Andhra Pradesh.

#### ***2.4.4. Fisheries***

Fish production (both marine and inland) in the country has grown at 3.41 percent per annum during the period 1990-91 to 2003-04. In Andhra Pradesh, between 1991-92 and 2003-04, fish production went-up at an annual growth rate of 10.95 percent. The state fisheries industry ranks first in the country in coastal aquaculture and fresh water prawn production and second in inland fish production and value of fish / prawn produced in India. In 2002, Andhra Pradesh produced 0.81 million tons of fish, accounting for 13.10 percent of all-India production (Table 2.9). The sector provides direct and indirect employment to over 1.4 million fishermen and is an important source of foreign exchange earning (GOAP 2002). The state contributed about Rs. 25,000 million by way of marine product exports, nearly 40 percent of the total marine exports from India in 2003-04. Japan and the United States of America are the major export markets. The success of fisheries industries in Andhra Pradesh is attributed to the various developmental programs undertaken by the government such as setting up of aquaculture authority, amending the laws on fisheries to improve the socio economic conditions of fishermen, creating infrastructure facilities for processing and marketing of fish and more recently for bringing draft comprehensive policy for the development of the fisheries sector.

Punjab, on the other hand, is a minor player (less than one per cent of national production) in fisheries. However, growing importance of fisheries suggest the potential of inland fisheries in the state owing to a strong network of rivers, canals and reservoirs.

**Table 2.9 Production of fisheries sector in Punjab, Andhra Pradesh and India**

Item	Punjab		Andhra Pradesh		India
	Production	Share in all-India production (%)	Production	Share in all-India production (%)	Production
TE1991-92	0.01	0.25	0.25	6.42	3.89
TE2001-02	0.05	0.86	0.60	10.41	5.76
TE2003-04	0.06	0.97	0.81	13.10	6.18
ACGR in fish na production 1991-92 to 2003-04			10.96 per cent		3.41 per cent

## 2.5 Drivers of agricultural diversification

The above discussion clearly reveals that Indian agriculture is diversifying out of staple food production towards market-oriented high-value food commodities such as fruits, vegetable, milk, meat, eggs and fish. Both demand and supply side factors are responsible for agricultural diversification towards HVCs. Rising income, growing urbanization and changing food preferences are found to push the demand for HVCs (Rao, P et al 2004, Pingali and Khawaja 2004). On the supply-side, agro-climatic, technological, institutional and infrastructure variables are important drivers. The All India level study by (Rao P et al 2004) shows that HVCs are negatively associated with factors promoting intensive agriculture like irrigation, mechanization, high input use, and improved cultivars. The effect of rainfall is generally positive and infrastructure facilities like roads and markets are generally promoting diversification towards HVCs. Labor wages and credit availability are other important factors driving HVC production.

To examine the drivers of agricultural diversification, econometric analysis was performed using OLS, Tobit and Seemingly Unrelated Regression Equation (SURE)

technique following Zellner (1962)<sup>8</sup>. In Punjab, the analysis is confined to milk production as it is the single largest activity in the context of agricultural diversification. For Andhra Pradesh, analysis is being done for all the HVCs.

In our model, the dependent variables are shares of selected HVCs in total value of agricultural production. The independent variables include a set of demand-side and supply-side factors. Our hypothesis is that demand-side factors have greater influence than supply-side factors in promoting agricultural diversification towards HVCs. It is also hypothesized that higher wages and poor infrastructure will adversely affect agricultural diversification towards HVCs. The results of regression analysis of different HVCs are summarized in Table A 2.3, and are briefly discussed below:

**All HVCs:** The OLS estimates for all HVCs indicate that urbanization, rainfed area covered under watershed programs, and districts with larger share of smallholders positively influence agricultural diversification and are statistically significant. On the demand side urbanization and per capita income are identified as the key drivers of diversification. Although wage rate and proportion of poor are negatively associated with production of HVCs, as expected, they are not significant. In addition the effect of technology, relative profitability of HVCs, rainfall, and size of holding are other supply-side factors affecting diversification.

**Fruits:** In Andhra Pradesh, fruit production is positively associated with rainfall, while negatively with the irrigation. The spatial analysis suggests that fruits find niches in high rainfall regions but not in districts having intensive agricultural systems with more irrigated area. Joshi et al (2004) also observes that diversification is more pronounced in rainfed areas, which are deprived of irrigation. Availability of agro-processing industry is another important factor driving fruit production. Farm wages are negatively associated with fruit production as it is a labor-intensive activity.

**Vegetables:** Production of vegetables is positively associated with urbanization on the demand side and negatively with farm wages on the supply-side. For vegetables, rainfall and irrigation do not have significant bearing on their production implying that these are grown in all types of agro-climatic situations.

**Milk Production:** In Punjab, the per capita income, growing population, and prices of milk positively influenced growth of milk production. In Andhra Pradesh, access to

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<sup>8</sup> The modified version of Tobit model for truncated dependent variable is best suited to deal with truncated dependent variable that is bound between a given maximum and minimum values (Gujarati 2003). In our model, the dependent variable is share of HVCs in the total value of agricultural production and ranges between 0 and 1. However, only OLS estimates are reported since the estimates obtained using Tobit model and OLS were not very different.

roads and credit and watershed programs positively and significantly influenced milk production. Watershed programs and milk production are related mainly due to availability of improved fodder in watershed areas. Milk production is higher where there is higher concentration of poor.

To recapitulate, the above discussion reveals that there is a clear production shift of Indian agriculture from food grains to HVCs. There has been declining importance of cereals, particularly coarse cereals, and pulses, and growing importance of fruits and vegetables, livestock and fisheries. The per capita consumption of high value commodities has increased perceptibly among both rural and urban consumers as well as rich and poor households.

However, at state levels, we observe contrasting situations. While Punjab is still specializing and dominating in the rice-wheat system, Andhra Pradesh is swiftly moving away from cereals towards high value commodities. In Punjab, the rice-wheat system, which brought the Green Revolution in India, is now responsible for dampening agricultural growth and deteriorating health and environment of agriculture. In Andhra Pradesh, all the HVCs (viz. fruits, vegetables, dairy, poultry and fish) have shown remarkable increase during the last decade. In Punjab, however, the dairy sector is flourishing as compared to other HVCs. The state government has initiated programs to promote fruits and vegetables by substituting some of the area under rice-wheat system.

By-and-large, urbanization and per capita income on demand side and rainfed areas (including watershed program) are positively influencing agricultural diversification towards HVCs. Presence of agro-processing sector is also positively influencing production of fruits. Farm wages and availability of irrigation are negatively affecting agricultural diversification. Since HVCs are labor-intensive, higher wages constrained their production. Similarly, availability of irrigation prompts farmers to go for rice and wheat which get assured prices and procurement.

Punjabi farmers known for their enterprising nature and having the advantage of large farm holdings have been slow in responding to the transition compared to the farmers in Andhra Pradesh who own much smaller holdings and are therefore more susceptible to production and market risks.

## Appendix 2

**Table A 2.1: Shares of different sectors in GSDP (at 1993-94 prices )in Punjab, Andhra Pradesh and India.(in percent)**

States	Agriculture and livestock				Forestry				Fishery			
	1981-82	1991-92	2001-02	2003-04	1981-82	1991-92	2001-02	2003-04	1981-82	1991-92	2001-02	2003-04
Andhra Pradesh	39.0	30.5	24.2	21.3	1.2	1.1	0.8	0.7	1.4	1.2	2.4	2.6
Punjab	47.5	46.1	39.3	37.9	0.6	0.2	0.1	0.1	0.03	0.2	0.4	0.5
All India	35.6	28.6	22.0	19.8	2.9	1.7	1.0	0.9	0.9	1.0	1.0	1.0

Source: 1. Various issues of Agricultural Statistic at a Glance- Ministry of Agriculture, Government of India.  
2. Various issues of Statistical abstracts of Punjab and Andhra Pradesh.

**Table A 2.2. Composition of value of agricultural output in the in the Punjab, Andhra Pradesh and India at 1993-94 prices (share in per cent)**

	Punjab			Andhra Pradesh			India		
	TE 1982-83	TE 1991-92	TE 2002-03	TE 1982-83	TE 1991-92	TE 2002-03	TE 1982-83	TE 1991-92	TE 2002-03
Paddy	16.55	21.21	22.13	29.69	28.25	21.00	14.99	15.91	13.43
Wheat	26.09	26.51	26.13	0.04	0.02	0.02	8.10	8.20	8.03
Coarse Cereals	2.43	1.07	1.03	5.82	2.90	2.54	5.02	3.96	2.97
<b>Total cereals</b>	45.07	48.79	49.29	35.55	31.17	23.56	28.11	28.07	24.43
<b>Pulses</b>	1.46	0.63	0.21	3.27	3.57	4.04	5.74	4.80	3.45
<b>Commercial crops<sup>1</sup></b>	12.07	13.67	7.48	20.77	26.49	20.61	16.68	18.52	15.68
<b>Other crops</b>	10.96	7.45	6.09	12.86	9.59	7.47	14.45	11.58	10.83
Fruits & Vegetables	3.09	3.96	5.10	11.54	8.79	10.54	14.37	13.56	18.12
Milk	20.99	19.51	24.9	9.07	10.26	14.21	13.17	15.62	18.52
Meat	1.73	2.94	4.22	4.57	7.10	9.80	3.38	4.08	4.82
Eggs	0.42	0.93	1.15	1.25	1.29	4.05	0.58	0.75	1.04
Other livestock	4.21	2.12	1.60	1.12	1.74	5.72	3.32	3.02	3.17
<b>High value commodities<sup>2</sup></b>	30.44	29.46	36.97	27.55	29.18	44.32	34.82	37.03	45.61
<b>Total value (Rs. lakh)</b>	1134834	1589058	2020661	1428628	1923109	2692917	18170492	24565648	32394504

Source: State wise estimates of value of output from agriculture and livestock (2004) Central Statistical Organization

(NSSO) Ministry of Statistics and Programme Implementation, Govt. of India.

1 Commercial crops include oilseeds, sugarcane, cotton, chilies and turmeric.

2 High value commodities include fruits, vegetable, milk, meat, eggs and other livestock products.

**Table A 2.3 Summary of the regression results (elasticities) of the variables used to capture drivers of diversification towards HVCs**

Drivers/Variable	High value commodities					
	Fruits (n=20)	Vegetab les (n=20)	Milk in (cattle) AP (n=20)	Milk in (cattle + buffalo) Punjab (n=24)	Rumin ant meat (n=20)	Total HVCs (n=20)
<b>(i) Demand side variables</b>						
Per capita Income				0.2 (2.04*)		
Urbanization	-0.9 (-3.2**)	1.0 (3.5**)	-0.1 (-0.7)		-0.1 (-0.6)	0.16 (2.6**)
Population				1.71 (8.1**)		
Price of HVC				0.06 (2.2*)		
<b>(ii) Supply side variables</b>						
Irrigated area	-1.0 (-2.7**)	-0.2 (-0.4)			-0.4	
Credit	0.0 (-0.4)		0.3 (2.0*)		-0.3 (-3.3**)	
Road density			1.1 (1.9*)			
Marginal and Small farmers						0.85 (2.2*)
Rainfall	1.7 (2.4*)	-0.2 (-0.3)			0.1 (0.5)	
Processing facility	0.6 (6.7**)	-0.1 (-0.8)				
Poverty	-1.0 (-2.6**)	0.3 (0.8)	0.7 (2.7**)		0.3 (1.8*)	-0.09 (-1.0)
Wage rate	-3.1 (-3.8**)	-3.5 (3.1**)				-0.46 (-1.0)
Rainfed area covered under watershed			0.7 (5.6**)		-0.4 (-2.7**)	0.19 (3.8**)
Availability of grazing land					0.3 (2.9**)	

Note: Figures in the parentheses indicate the t values

\*\* and \* Indicate statistical significance at 1 percent and 5 percent level of significance respectively

## Chapter 3

### Benefits of Agricultural Diversification

While grain based farming system is perceived as a means to ensure food security, it is widely accepted that the opportunities to boost income through this system is nearly exhausted. Given the fatigue in grain based technology, production of high value commodities is an attractive alternative for income augmentation. Indian agriculture dominated by smallholders can take advantage of the revolution in high value commodities. The benefits of diversification can be measured in terms of the increased profitability, employment opportunities and less demanding on natural resources and the environment. However the response to diversification is likely to be constrained by high transaction costs, market size, price volatility, lack of access to credit and information on food safety and standards. It is essential to look at agriculture as a combination of farming, processing and retailing, linking which will enhance the returns to the farmers and also benefit the consumers. Diversification can help compress the traditional supply chains, forge better linkages that are able to generate higher returns to the farmers and offer competitive prices to the consumers.

An attempt has been made to estimate the contribution of fruits and vegetables in agricultural growth during the decades of 1980s and 1990s. Fruits and vegetables are compared with major cereals, namely, rice and wheat in Punjab and rice and other cereals in Andhra Pradesh, in terms of profitability, employment, women empowerment, and sustainable use of natural resources. To assess the benefits, secondary data (mainly from 'Comprehensive Cost of Cultivation of Principal Crops in India' and NSSO, Government of India) was complemented with the primary surveys from selected growers and agro-processors. Costs and returns of different commodities in Andhra Pradesh and Punjab were estimated and their relative profitability compared. The comparison of costs and returns is based on the commercial cost of production, which includes all paid-out costs and imputed costs<sup>9</sup>. Net returns were computed by subtracting gross returns (quantity of produce multiplied by prices received) from the commercial cost of production.

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<sup>9</sup> The paid-out costs include hired labor (human, bullock and machinery charges); maintenance expenses on owned animals and machinery; expenses on inputs such as seed, fertilizer, manure, pesticide and irrigation; depreciation on implements and farm buildings; land revenue; and rent paid for leased-in land. Imputed costs include value of family labor, rent of owned land and interest on owned fixed capital.

### 3.1. Contribution in agricultural growth

Changes in the gross income<sup>10</sup> from a single crop can be decomposed into changes in sown area, changes in yield, changes in price, and a residual that represents the interaction of these three sources of growth. Changes in the gross income of total crop production can be similarly decomposed, except that there is a fourth source of growth i.e. changes in the crop mix towards higher-value crops<sup>11</sup>. Each of these sources of growth is, in turn, influenced by various policy and non-policy factors. For example, changes in total crop area reflect changes in weather, population growth, and migration, among other factors. Yields are affected by the introduction of new varieties, changes in the location of crop production, irrigation investment, and rainfall. Domestic prices are influenced by shifts in domestic supply and demand (in the case of non-tradable crops), agricultural price policy, trade policy and world prices (in the case of tradable crops), and other variables. Finally, the share of land allocated to each crop is influenced by relative prices, input costs, extension programs, and other factors. Contribution of area, yield, prices, and diversification to the growth in gross crop income were estimated using the method described by Minot (2003).<sup>12</sup> This analysis has been done at the all-India level, and due to data limitations, for northern region (to represent Punjab) and southern region (to represent Andhra Pradesh).

The results suggest that at all-India level, the sources of growth have changed dramatically over the last two decades (Figure 3.1). During 1980s yield improvements made largest contribution to crop income growth, followed by crop diversification towards fruits and vegetables. The situation changed in 1990s, when rising prices turned out to be the principal source of growth, followed by crop diversification. These results reveal that contribution of diversification towards fruits and vegetables in agricultural growth increased from 26.6 percent in 1980s to 30.7 percent in 1990s, indicating that the process of diversification from low-value crops to high-value crops was already important in the 1980s and became more so in the 1990s. In particular, the area under coarse cereals and pulses declined during the 1990s and the area under rice and oilseeds grew at less than 1 percent per year, while the area under fruits and vegetables grew at more than 4 percent per year during the decade. If the existing trends continue, it is likely that crop diversification will become the most important source of crop income growth in the near future.

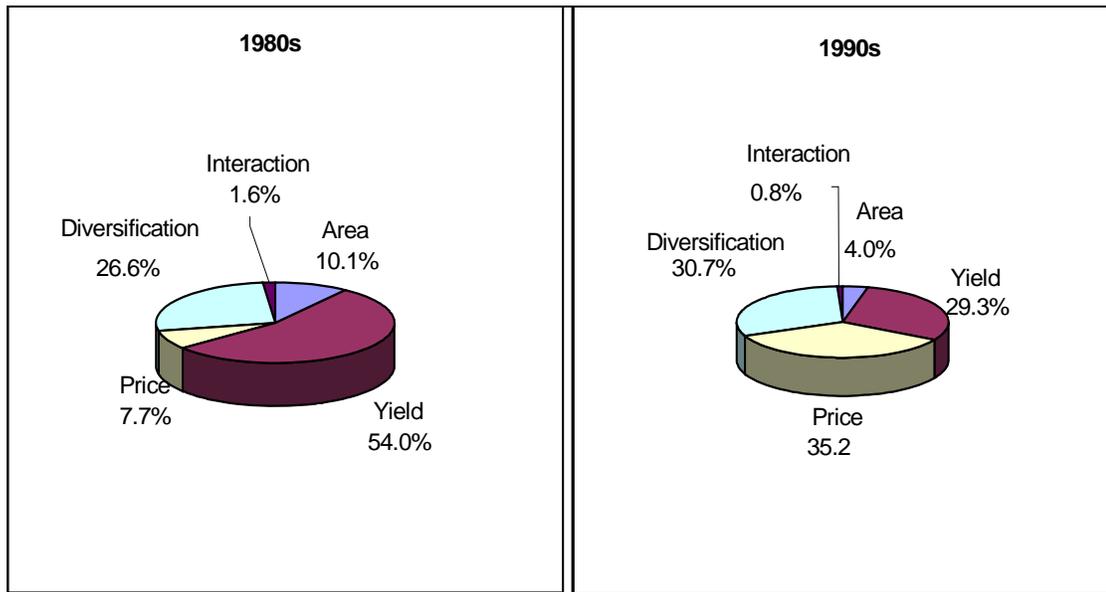
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<sup>10</sup> We define gross income from crop production as the value of crop production. Since some output is not marketed, this concept includes both cash and in-kind income.

<sup>11</sup> In this section, we have estimated the contribution of diversification towards fruits and vegetables in the crop portfolio.

<sup>12</sup> For detailed methodology refer Appendix 3.1.

**Figure 3.1. Share of different sources of agricultural crop income growth in India**



In northern region (including Punjab) decomposition of crop income growth shows that during 1980s, the real prices of major commodities declined in the region but were well compensated for by (i) phenomenal rise in the yield levels of important crops, and (ii) crop diversification in favor of rice, wheat, sugarcane and fruits and vegetables (Table 3.1). The situation changed dramatically during the decade of 1990s, when increase in the real prices of rice, wheat and sugarcane dominated in the value of crop output. Expansion in area towards rice and wheat continued but the pace slowed down. However, area expansion and crop diversification picked-up speed for fruits and vegetables due to their rising demand and easy access to growing market of Delhi. The future growth opportunities in this region will depend upon another technological breakthrough to augment yield of important crops, conserve soil and water resources, and promote agricultural diversification towards more remunerative commodities for processing and value-addition.

**Table 3.1 Contribution of different sources of growth in crop sector by region (percent)**

Region	Period	Area	Yield	Prices	Diversification	Interaction	Total
Northern	1980s	1.4	75.4	-6.5	29.7	0.1	100.0
	1990s	10.1	16.6	44.0	28.2	1.1	100.0
Southern	1980s	10.4	39.5	16.8	32.1	1.3	100.0
	1990s	-8.7	36.2	29.3	45.0	-1.8	100.0

Source: Minot (2003)

In the southern region (including Andhra Pradesh) yield increase remained an important source of growth in crop sector both during 1980s and 1990s, although its share in growth fell slightly during the latter period mainly due to deceleration in yield growth of rice and oilseeds (Table 3.1). Diversification emerged as the main source of growth during 1990s with a share of 45 percent in the gross value of crop output. Fruits and vegetables, spices and beverages gained from land reallocation away from oilseeds, cotton, coarse cereals and pulses. During 1980s the diversification was more towards oilseeds (because of government policy of achieving self-sufficiency), and coarse cereals (because of increasing demand especially of maize as feed in the poultry sector), which witnessed phenomenal growth during this period. The contribution of prices to agriculture growth too increased in 1990s due to rise in the real prices, mainly of rice. Greater emphasis on the watershed development in the region helped sustain crop yields and crop diversification towards more remunerative crops. Institutional developments like contract farming and cooperatives in the region, too, have helped diversification towards high value export crops like gherkins (a variety of small cucumbers), grapes and mangoes.

### **3.2. Profitability of High Value Commodities**

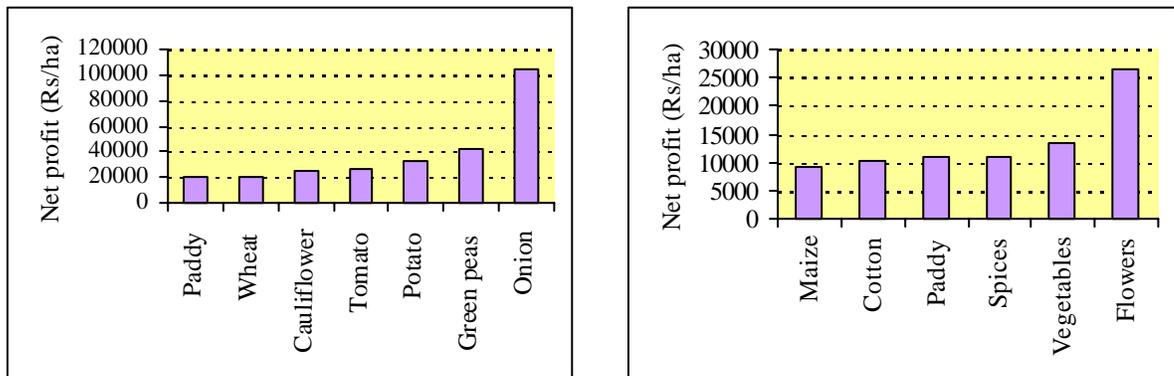
HVCs are intrinsically more profitable than the traditional crops such as rice and wheat. Higher returns serve as an incentive for the farmers to switch to these commodities. However the economics of these commodities is not straight forward as these involve very different cultivation practices, are perishable and are more susceptible to production risks. Also price volatility and market gluts for fruits and vegetables expose the farmers to greater market risks. Lack of organized supply chain result in poor mobilization of small marketable surplus that the farmers generate, resulting in low returns. In addition, fixed prices and assured markets for rice and wheat act as an opium for the farmers and are unable to move out this cropping

system. In this situation, emerging contract farming models in production of fruits and vegetables will help linking up the farmers with the processors and retailers. Vertical linkages can effectively address the problem of high transport cost, lack of assured markets and check price fluctuations. It is essential to recognize that the expanding demand for high value commodities will necessitate scaling up of operations, overcoming seasonality factors and ensuring a continuous and smooth supply of these commodities.

In both Andhra Pradesh and Punjab, it is observed that fruits and vegetables are more profitable than cereals and other commercial crops, like cotton (Figure 3.2). In Punjab, kinnow production was highly lucrative (net annual profit of Rs. 283,370 /ha) during 2003-04.<sup>13</sup> The state government in partnership with farmers and PepsiCo India Ltd. has launched a public-private venture of production and processing of sweet oranges for juice and making Punjab a hub of citrus juice for the South and Southeast Asia. In view of high prospects, it is often referred that such a venture would convert Punjab as of California or Florida in United States of America.

In Andhra Pradesh, crops like flowers and vegetables were more profitable than traditional crops in the major growing districts in Andhra Pradesh (Figure 3.2). Similarly, a study on economics of shrimp farming in Andhra Pradesh reported up to 8-13 times higher returns from shrimp farming than paddy and groundnut crops depending on the variety (Ratna Reddy et al 2004). Tiger prawn is the most remunerative shrimp followed by scampi. Earlier studies from many developing countries have also shown that agricultural diversification towards high value commodities augment income of rural poor (Barghouti, et al (forthcoming); von Braun 1995; Joshi, et al 2004).

**Figure 3.2 Net profit of cereals and vegetable crops in Punjab and Andhra Pradesh**

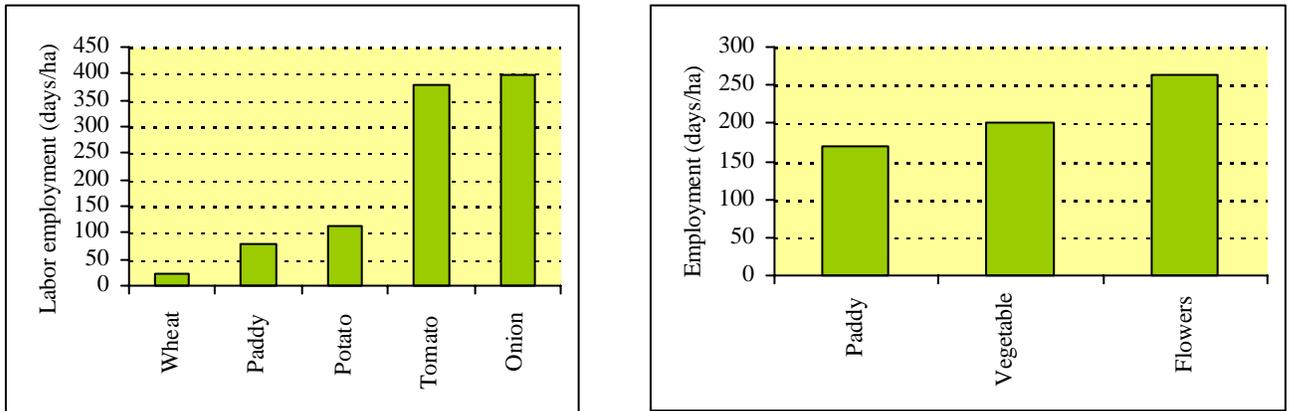


<sup>13</sup> This figure overstates the profitability of kinnow on an annualized basis. There is a several-year long gestation period with less or no income before kinnows begin production.

### 3.3. Employment

Agricultural diversification towards HVCs, in most instances, augments employment at the farm level as these commodities are labor-intensive. The advantage of higher employment opportunities are expected to benefit smallholders more as they possess more family labor (Ali and Abedullah, 2002; Joshi et al., 2003) The data on labor days employed in the production of various crops collected from Andhra Pradesh and Punjab tend to confirm these observations(Figure 3.3).

**Figure 3.3. Employment generation in important HVCs and other crops in Punjab and Andhra Pradesh**



In addition to the employment generated in production at the farm level, substantial demand for employment is expected in non-farm agricultural sector, agribusiness and agro-based industry since the HVCs require scientific pre- and post-harvest handling (Barghouti *et al* 2004). The employment involved in the entire supply chain of HVCs is high since many value-addition activities such as grading, packing, processing, cold chain management and logistics management are necessary. However, higher labor requirement for HVCs could be a deterrent for their cultivation for the households that are labor constrained. Wages in Punjab are almost double those prevailing in Andhra Pradesh which may give Punjab a significant disadvantage.

### 3.4. Empowering women

HVCs have the potential of creating increased employment opportunities and is more gender sensitive than the traditional crops. Women have better chances of being

engaged in picking, sorting and grading of fruits and vegetables. About half of the total workforce in production of vegetables in Andhra Pradesh are women (Table 3.2). In Punjab, as high as 93 percent of women are engaged in livestock. At the all-India level, more than 70 percent of the total workforce engaged in livestock production were women. Women also participate in large numbers in commercial crops, like cotton, sugarcane, groundnut, etc. Promoting high-value commodities in Andhra Pradesh and Punjab will open new avenues for women workers. Higher participation of women workforce in high-value commodities means empowering them in rural areas.

**Table 3.2. Participation of women in different activities in agriculture, 1999-2000 (percent of all workers)**

<b>Crop group</b>	<b>Andhra Pradesh</b>	<b>Punjab</b>	<b>All-India</b>
Cereals & pulses	47.2	7.1	37.1
Commercial crops	49.3	84.0	41.8
Vegetables*	50.3	39.0	45.1
Fruits	39.8	n.a.	40.0
Livestock	41.1	92.5	71.7
Forestry	46.6	n.a.	49.5
Fishing	19.7	16.5	12.5
Other activities	51.4	n.a.	40.0
<b>Total agriculture</b>	<b>47.0</b>	<b>41.2</b>	<b>39.8</b>

\*Note: Includes vegetables and seeds of horticultural commodities; n.a. refers to not available  
Source: NSS 55<sup>th</sup> round

### **3.5. Sustainable use of water**

Water is a critical input in agriculture and the demand for it is rapidly growing. Both Punjab and Andhra Pradesh are encountering problems related with water in agricultural sector. The water table in these states is falling in certain areas consistently due to excessive use of ground water. Similarly in canal irrigated areas in both the states, low water rates are encouraging mismanagement and injudicious use of surface irrigation, leading to soil salinity and waterlogging. Approximately 150,000

ha in Andhra Pradesh and 603,300 ha in Punjab are affected by these problems. Groundwater level in Punjab has been falling due to early sowing of paddy, particularly in the Central Zone at the rate of almost one-quarter meter per year. HVCs play important role in managing water-related problems as their water requirement is lower than rice and other crops. In Andhra Pradesh, it was found that water requirement (hrs/ha) was highest for blue-water crops like paddy and sugarcane (Shiferaw et al. 2003). In contrast, for other crops like flowers, vegetables, cotton and chickpea, water requirement was less. The water productivity of HVCs was highest with low-water demand crops, while it was lowest for high-water demand crops like rice and sugarcane. However, rice, which occupies less than a quarter of the irrigated area, uses over sixty percent of the water (Table 3.3). Agricultural diversification can result in improved management of water (Barghouti et al 2004).

**Table 3.3. Farmers' irrigation decisions and water productivity relationships, Medak district, Andhra Pradesh, 2002-03**

Crops	Intensity of water use (hrs/ha)	Net water productivity (Rs./hr)	Actual irrigation (hrs)	Percent of total water applied
Cotton	26.19	391	0.473	0.49
Flowers	71.96	368	4.875	5.02
Chickpea	21.24	339	0.902	0.93
Vegetables	76.92	174	11.562	11.90
Turmeric	94.38	165	4.723	4.86
Maize	56.61	160	0.563	0.58
Wheat	109.01	49	3.446	3.54
Rice	530.96	21	59.473	61.21
Sugarcane	1541.94	15	11.143	11.47
Total			97.16	100

Note: Estimates are based on average cropping and irrigation decisions of 120 sample farmers in Medak district of Andhra Pradesh. The data is based on ICRISAT survey pertaining to the year 2002-03.

### **3.6. Environmental concerns due to aquaculture**

Shrimp farming in Andhra Pradesh has raised income substantially, but has caused environmental problems. These include: (i) diversion of farm land, (ii) pollution of water bodies, (iii) degradation of land - salinization of soil leading to reduced

agricultural production, and (iv) depletion of drinking water quality (Aquaculture Authority 2001). There are reports of abandoning agricultural production on a large scale on lands around the shrimp farms since they have become unsuitable for growing crops. As a consequence, livestock population has also depleted due to fodder and water shortage. The shift from shrimp farming to any other crop takes at least two years to minimize the adverse effects developed during the shrimp farming. The problem became so severe that the Supreme Court of India had to intervene and a landmark judgment was delivered in 1996 to reduce the adverse environmental impact of shrimp farming following public interest litigation (Box 3.1). The problem arising out of extensive aquaculture in coastal region of Andhra Pradesh needs to be addressed through better management as the activity yields high dividends and generate considerable employment opportunities.

### **Box 3.1 Supreme Court Judgment on Aquaculture**

The Supreme Court of India directed the government of Andhra Pradesh to set up an Aquaculture Authority to overcome the environmental problems that have arisen out of intensive shrimp farming. The Aquaculture Authority was set up in 1997 under the Environmental Protection Act (1986). The main function of the authority is to ensure that no shrimp culture pond is set up within the coastal regulation zone and up to 1000 m of two important lakes, namely Chilka and Pulicat lakes. It is mandatory on the part of the Aquaculture Authority to implement the precautionary principle and the polluter pays principle in coastal shrimp culture, and give approval to farmers for shrimp farming after ascertaining the quality and fertility of crop land being converted. Important activities of the Authority include: (i) preparing master plans and consider setting up of aquaculture estates with adequate forward and backward linkages; (ii) Advising farmers to form local associations or farmers group for resolving conflicts in water usage, (iii) Encouraging stakeholder participation and community based participatory approach in aquaculture development, decision-making and policy planning; (iii) Continuous monitoring of the environment to promote practical and economically viable farming and management practices that are environmentally responsible and socially acceptable; (iv) bring legislation to regulate construction of shrimp farms in mangrove areas, other sensitive areas and in agricultural lands; and (v) Effect institutional arrangement, policy, planning and regulatory frameworks in aquaculture and other relevant sectors to support aquaculture development.

These guidelines have helped in checking indiscriminate use of agricultural land for shrimp farming and sustainable shrimp culture.

There is a vast scope for agricultural diversification to high value commodities such as horticulture and dairy enterprises as indicated by their high potential to increase

agricultural growth and augment farm income and employment. For certain enterprises, notably citrus (to a large extent kinnows) onions, flowers and dairy, returns and employment generation were higher compared to rice and wheat. The water requirement of high-value crops such as fruits and vegetables are lower as compared to blue-water crops such as rice and sugarcane, which will help in efficient use of water and containing the problem of ground water depletion. Although, the analysis in this section is quite exploratory and partial, it nonetheless tentatively demonstrates that most of the high-value alternatives considered could generate higher net revenue and employment than the traditional crops. The lack of price support program and risk mitigation strategies such as crop insurance and market infrastructure for HVCs come in the way of replacing rice and wheat crops which enjoy such supports. The production of these enterprises also depends on the ability of the farmers to effectively market the produce since these commodities are more capital intensive and lack sufficient infrastructure to facilitate their sales.

In addition to fruits and vegetables, which comprise of less than 3 percent of the gross cropped area in Punjab, it is essential to explore the potential of introducing certain traditional crops, which can help expand the production frontier. Once the fortunes from wheat and rice start weakening, traditional commodities such as cotton, pulses and maize will rise in importance. Particularly the growing poultry industry in Punjab will boost the demand for maize in the state. Legumes, particularly the short duration types are extremely environment friendly owing to their low fertilizer requirements, ability to restore nitrogen in the soil and low irrigation requirement can replace the rice-wheat cropping system in place. The state is tuned for organic cultivation, particularly rice which has a niche market and fetches good premium for the farmers. Andhra Pradesh is ahead of Punjab in terms of moving into high value agriculture.

### Appendix 3.1 Method of decomposition of agricultural growth

Changes in the gross income<sup>14</sup> from a single crop can be decomposed into changes in sown area, changes in yield, changes in price, and a residual that represents the interaction of these three sources of growth. Changes in the gross income of total crop production can be similarly decomposed, except that there is an fourth source of growth: changes in the crop mix toward higher-value crops. A key contribution of this paper is estimating the contribution of diversification into higher-value crops to the growth in crop income in India.

Each of these sources of growth is, in turn, influenced by various policy and non-policy factors. For example, changes in total crop area reflect changes in weather, population growth, and migration, among other trends. Yields are affected by the introduction of new varieties, changes in the location of crop production, irrigation investment, and rainfall. Prices are influenced by trade policy and world prices (in the case of tradable crops), shifts in domestic supply and demand (in the case of non-tradables), agricultural price policy, and other variables. Finally, the share of land allocated to each crop is influenced by relative prices, input costs, extension programs, and other factors.

We calculate the contribution of area, yield, prices, and diversification to the growth in gross crop income using the method described by Minot (2003). If  $A_i$  is the area under crop  $i$ ,  $Y_i$  is its production per unit area, and  $P_i$  is the real price per unit of production, then the gross income or revenue ( $R$ ) from producing  $n$  crops is:

$$R = \sum_{i=1}^n A_i Y_i P_i \quad (1)$$

Expressing  $A_i$  as share of crop  $i$  in the total cropped area,  $a_i = (A_i / \sum A_i)$ , equation (1) can be rewritten as:

$$R = \left( \sum_{i=1}^n a_i Y_i P_i \right) \sum_{i=1}^n A_i \quad (2)$$

To measure the change in gross crop income, we take total derivatives of both sides of equation (2), yielding:

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<sup>14</sup> We define gross income from crop production as the value of crop production. Since some output is not marketed, this concept includes both cash and in-kind income.

$$dR \cong \left( \sum_{i=1}^n a_i Y_i P_i \right) d \left( \sum_{i=1}^n A_i \right) + \left( \sum_{i=1}^n A_i \right) d \left( \sum_{i=1}^n a_i Y_i P_i \right) \quad (3)$$

This equation holds only approximately because it excludes the interaction term<sup>15</sup>. The second term on the right-hand side of equation (3) can be further decomposed from a change in sums to the sum of changes, as follows:

$$dR \cong \left( \sum_{i=1}^n a_i Y_i P_i \right) d \left( \sum_{i=1}^n A_i \right) + \sum_{i=1}^n A_i \sum_{i=1}^n d(a_i Y_i P_i) \quad (4)$$

Further expansion of the second term in equation (4) gives the following expression:

$$\begin{aligned} dR \cong & \left( \sum_{i=1}^n a_i Y_i P_i \right) d \left( \sum_{i=1}^n A_i \right) + \sum_{i=1}^n A_i \sum_{i=1}^n a_i Y_i dP_i + \sum_{i=1}^n A_i \sum_{i=1}^n (a_i P_i dY_i) \\ & + \sum_{i=1}^n A_i \sum_{i=1}^n (Y_i P_i da_i) \end{aligned} \quad (5)$$

The first term on the right-hand side of equation (5) denotes the change in the gross crop income due to changes in total cropped area. The second term gives the effect of changes in real prices. The third term captures the effect of change in crop yields. And the fourth term describes the change in gross crop income associated with changes in the area composition of crops over time. If the fourth term is positive, this indicates a reallocation of cropland from lower-value crops to higher-value crops, so this term represents the effect of crop diversification on gross crop income. Dividing both sides of equation (5) by the overall change in gross crop income (dR) gives the proportional contribution of each component in the growth.

The pattern in the sources of growth has implications for the agricultural development policies (Minot, 2003). For example, if a large share of the growth in crop income is associated with area expansion, this may reflect an unsustainable trend, particularly if arable land is limited. Similarly, a pattern in which much of the growth is related to price increases may reflect changes in policy or reduced transportation costs, but it is probably not sustainable in the long run. In either case, the implication is that greater efforts should be made to improve yields and help farmers diversify into higher-value crops.

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<sup>15</sup> To take a simple example, if area increases 20 percent and yield increases 20 percent, total output expands by 44 percent ( $1.2 \times 1.2 = 1.44$ ). Area contributed 20 percentage points, yield contributed 20 percentage points, and the remaining 4 percentage points represent the interaction of area and yield changes.

## Chapter 4

### Supply Chain of High-value Commodities

#### 4.1. Background

HVCs are susceptible to inaccessibility of markets and high price volatility. Smallholders face the added problems of high transactions costs due to meager marketable surplus and production risk. Though the demand for HVCs is increasing and there are considerable benefits emanating from their production, absence of well-developed market arrangements inhibit their expansion. The existing markets of HVCs are inefficient, unorganized and disintegrated. The entire marketing process of HVCs, compared to foodgrains marketing, is complex and risky due to the perishable nature of produce, seasonal production, and bulkiness. It is further complicated by the absence of sufficient infrastructure, such as specialized markets, cold chains, packing, etc., and lack of agro-processing facilities. Regulated markets<sup>16</sup> for HVCs are very few and cover only a few cities in the country. For HVCs marketing from production centers to retailing requires close coordination between producers, distributors, processors and retailers to maintain desired quality and quantity to meet consumers' demands.

To promote agricultural diversification towards HVCs in the wake of urbanization, liberalization and globalization, the agricultural marketing strategy requires a paradigm shift by strengthening marketing institutions, developing synergies between producers and agri-business, and consolidating the supply chain. In this chapter an attempt has been made to examine how the farm producers of HVCs are integrated with the markets and how innovative supply chains are emerging for HVCs to meet the growing domestic and global demands. Information for different case studies was collected through a combination of secondary data, primary surveys and informant interviews with growers, processors, government officials and personnel of the corporate sector involved in contract farming. In all, we interviewed 279 farmers in Punjab, which were spread over the districts of Jalandhar, Hosiarpur, Amritsar, Abhor, Patiala and Kapurthala; and 120 farmers from Medak district in Andhra Pradesh. To compare the performance of contract farming versus non-contract farming, the following case studies were conducted: (i) vegetables, namely potato, green peas, and chilies in Punjab; (ii) fruits, namely grapes in Andhra Pradesh; (iii) milk in Punjab, and (iv) poultry in Andhra Pradesh. Data on cost components, crop yields, input and

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<sup>16</sup> As on March 2001, 861 regulated markets were functioning in Andhra Pradesh and 675 in Punjab, mainly for foodgrains. Separate regulated markets for fruits and vegetable are established as per the provisions of APMC Act but such markets are few in number.

output prices, and inputs supplied by the contracting firms to the farm producers were collected. The information was supplemented from farmers and contracting firms on their perception about contract farming, especially the benefits and problems. Partial budgets were developed to quantify the benefits emanating from contract farming.

The chapter is structured as follows. The following section lays down the existing supply chains in HVCs, especially in fruits and vegetables. The subsequent section illustrates the innovative institutional arrangements, which are gradually emerging in HVCs. It is then followed by four case studies on contract farming in vegetables and milk in Punjab and fruit and poultry in Andhra Pradesh. The last part discusses the lessons learnt from the case studies and identifies constraints in up-scaling the contract farming models.

#### **4.2. Traditional marketing channels**

The existing supply chains of fruits and vegetables involve numbers of intermediaries that add to market inefficiency and increase price spread between farmers and the consumers. Most of the traditional supply chains are conducted in spot markets. Producers typically sell to traders or wholesalers who market the product in other markets. Coordinated sales between producers and processors are uncommon but slowly emerging with changing demand scenario. Important supply chains for vegetables and fruits include:

(a) Supply chains for vegetables<sup>17</sup>:

- Supply chain 1: Producer → commission agent → wholesaler → retailer → consumer
- Supply chain 2: Producer → commission agent → primary wholesaler → secondary wholesaler → retailer → consumer
- Supply chain 3: Producer → Processor → consumer
- Supply chain 4: Producer → Collector/Consolidator /Agent → Wholesaler at distant markets → Retailer → Consumer

The most prominent supply chain involves farmers selling the fresh vegetables produced by them in the primary wholesale markets (mandis) through commission agents to wholesalers who in turn further sell to secondary wholesalers located in small cities and

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<sup>17</sup> A different form of supply chain is in operation for potato.

towns and local retailers (supply chain 1). This supply chain accounts for about 50 percent of the total vegetables sold in Punjab and Andhra Pradesh.

(b) Supply chains for fruits

- Supply chain 1: Producer→Pre-harvest contractor→Commission agent → Wholesaler→ Retailer →Consumer
- Supply chain 2: Producer→ commission agent → wholesaler → retailer → consumer
- Supply chain 3: Producer → Collector/consolidator /agent→Wholesaler at distant markets → Retailer → Consumer
- Supply chain 4: Producer → Processor → consumer

Supply chains 1 and 2 are the most prominent marketing channels in fruits, accounting for about 80 percent of total sales of fruits. Pre-harvest contractors provide advance payments to the farmers during the time of agreement. In this approach, farmers minimize risk due to price volatility and post-harvest losses. In the processing, marketing channels, processors procure the fresh vegetables and fruits from farmers through either contract farming or directly from the wet markets.

Owing to number of intermediaries in the supply chain, the transactions and marketing costs increase, resulting in low marketing efficiency. The Commission Agents also exploit the farmers by charging higher commissions than the stipulated amount(8-10 percent compared to the official rate of 4 percent fixed by the government (Rao, P. et.al. 2006)). In wholesale markets, farmers have limited bargaining power, since most of the farmers have taken loans/advances from commission agents and are forced to sell the produce to them. These add to the cost, increase the price spread and reduce the producer's share in consumer's price. In the case of vegetables, producer's share in retail prices varies from 40 to 56 percent depending on the channel and crop. Similarly, for fruits the producer's share varies from 28 to 42 percent depending on the supply chain and crop.

### **4.3. Innovations in marketing**

Farmers' markets are an innovative marketing approach introduced by about 10 state governments in India mainly to overcome the problems of marketing and exploitation of farmers by the middlemen. The farmers' markets are referred by different names in different states depending on the vernacular in each state: 'Raythu Bazar' in Andhra

Pradesh, Apna mandi in Punjab and other northern states, 'Ulvar Santhai' in Tamil Nadu, and Raithar Santhe in Karnataka. All these, literally mean the same- "farmers' market". The concept of farmers' market involves establishing a 'trader less' market wherein the producers directly sell their produce (mostly vegetables and, to a lesser extent, fruits) to consumers. Thus, the market is totally devoid of middlemen. The main aim of farmers' market is to ensure fresh vegetables and fruits at remunerative prices to the farmers and reasonable prices to consumers. The total transactions through these markets form only a small portion (less than 1%) of the marketed surplus, as few farmers are able to sell in these markets.

However, these innovative markets are getting prominence in Andhra Pradesh. There are over a hundred such Raythu Bazars in the state, of which a third have permanent structures. On an average, it is estimated that every week 20,000 to 25,000 tons of vegetables are sold through these markets. The Government of Andhra Pradesh has estimated that by participating in the Raythu Bazar, a farmer household has gained an annual additional income of about Rs.25,000 which is projected to be about Rs.1000 million at state level.

An exploratory survey was undertaken in two Raythu Bazars located in Hyderabad<sup>18</sup>, namely Mehdipatnam and Erragudda, to better understand the functioning and to quantify the benefits derived by the farmers. An officer is appointed by the Department of Agricultural Marketing, Government Andhra Pradesh, who acts as the administrator of the market. In both these markets, about 350-500 farmers transact business. The hinterland of the market comprises 80-100 nearby villages. The estimates revealed that on an average each farmer sold 2 to 2.5 quintals of vegetables per day. The sale prices of the vegetables are fixed at 25 percent above the wholesale market prices but 25 percent below the local retail prices to attract consumers. The producer's shares in consumer's prices for selected vegetables in these markets varied between 82 to 90 percent, compared to 40-56 percent for sale in the traditional supply chain (Table 4.1). Besides, transport costs, which are around 5 to 10 percent, other hidden costs (such as opportunity cost of labor), have also been factored to compute the marketing costs.

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<sup>18</sup> Hyderabad is the capital city of Andhra Pradesh

**Table 4.1 Price spread for selected vegetables in Raythu Bazars, Andhra Pradesh, 2004**

Vegetables	Medhipatnam Market					Erragadda Market			
	Tomato	Green chillies	Cabbage	Egg plant	Potato	Tomato	Carrot	Cabbage	Lady finger
Consumer price (Rs/100 kg)	600	1000	700	600	700	600	900	700	900
Marketing costs incurred by producer (Rs/100 kg)	103	99	110	109	105	105	106	113	104
Net price received by producer (Rs/100 kg)	497	901	590	491	595	495	794	587	796
Producers' share in consumer price (%)	82.8	90.1	84.3	81.8	85.0	82.5	88.2	83.9	88.4

Note: Costs incurred by producer includes transport cost + other hidden costs.

About 50 per cent of the interviewed farmers revealed that middlemen are slowly gaining control of these markets with the connivance of farmers and the officials. Thus, Raythu Bazars are gradually losing the character of a 'trader less' market and are slowly weaning away from the objective of direct marketing.

Farmers suggested that cold storage facilities in the Raythu Bazar would help them store unsold produce for the following day with least deterioration in quality. It would be worth exploring the possibility of involving private players to set up cold storage facilities in such markets. Encouraging formation of producers' associations and establishing common facilities for storage and transportation and improving the facilities to maintain cleanliness and hygiene will help the farmers and consumers greatly.

#### **4.4 Contract farming for promoting high value agriculture**

The most serious constraints on small farm production are related to the problems of access to inputs, services information and markets. The smallholders often lack production and marketing information necessary for new commodities. They also they lack financial resources necessary for profitable investment for realizing the

economies of scale in production. The smallholders are also risk averters and sacrifice production of HVCs despite prospects of higher returns.

Contract farming is an institutional response to missing markets for credit, insurance, information, factors of production in an environment of pervasive risks (Simmons, Winters and Patrick 2005, Key and Runsten 1999). The concept has potential to reduce transactions costs by coordinating production, marketing, processing and retailing. It also distributes risks between producers and the agri-business firm. It is defined as a system for the production and supply of agricultural produce under forward contracts, the essence of such contracts being a commitment to provide an agricultural commodity of a type and in the quality required by a known buyer (Sukhpal Singh 2002). It is defined as agricultural production carried out according to an agreement between farmers and buyers which places conditions on the production and marketing of the commodity (Minot 1986).

The concept of contract farming is not new in India. Sugar mills have long used contracts with growers to procure specific quantities of sugarcane at pre-agreed prices. Seed production of high-yielding varieties of rice and wheat is another successful example of contract farming that benefits seed producers, seed companies and seed users. Cooperative model in milk is another distinct form of contract farming, which enables farmers to dispose of their milk in production centers. The concept is gradually emerging with growing demand for HVCs and entry of corporate agri-business houses in export, processing and retailing of agricultural commodities. Each firm is evolving its own model depending upon its requirements and needs of final consumers. The model eliminates the intermediaries and a part of saving is distributed between producers and consumers. The Punjab government is engaged in aggressively promoting contract farming. Therefore a number of corporate agri-business firms have signed a memorandum of understanding with the government of Punjab to take up contract farming in the state to promote number of commodities. Andhra Pradesh also demonstrates few successful contract farming models. These include poultry, gherkins, grapes, oil palm, etc.

In this section, contract-farming models practiced in the Punjab and Andhra Pradesh are discussed. The benefits of contract farming over non-contract farming are compared in terms of reducing transactions costs, increasing profits and enabling access to markets. Different forms of models can be broadly divided in to three categories: (a) government promoted contract-farming; (b) corporate sector driven contract farming; and (c) informal contract farming. The type of contract depends upon the commodity and the nature and destination of the final product.

#### ***4.4.1. Government-promoted contract farming***

Since 2003, the government of Punjab has launched contract farming in a number of crops such as maize, barley, sunflower, hyola, basmati rice, etc. to substitute for a sizable area under rice–wheat system.<sup>19</sup> This model involves four parties in the contracted transaction: farmer, extension firm<sup>20</sup>, buyer (marketing firm) and the Punjab Agro Foods Corporation (PAFC) acting as facilitator between farmer, the extension firm and the buyer. The basic philosophy of this program is to provide technical know-how to the producers, mitigate price fluctuations and strengthen the marketing infrastructure for selected agricultural commodities. PAFC engages extension companies to enter into contracts with farmers of selected crops at contracted prices. The contract is a formal written agreement between the farmer and the extension firm, but is not considered a legal document. The contract specifies the quality, quantity, prices, and time of delivery. As per the contract, the farmer brings produce as per the specified quality at the designated place. In case the farmer can get a higher price from the market, he is free to sell his produce to the highest bidder/buyer, bypassing the contract as per the open-end clause provided in the contract. If the market prices are lower than the contracted prices, the PAFC offers a ‘comfort price’ that are slightly higher than the market price (Table 4.2) As a means to encourage contract farming in the state, the government of Punjab reduces the combination of market fees (2%), rural development fund charges (2%), and infrastructure taxes (1%) from a total of 5 percent to 0.5 percent. Organizations that wish to engage in direct linkages with farmers without contracts do not receive such exemptions.

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<sup>19</sup> Box 5-1 provides information on the key government players in this type of contract farming.

<sup>20</sup> Extension companies as per the model contract developed by the PAIC (may be expanded) provide support in terms of advising the quality and quantity of crops to be grown, provision of high quality seeds, information/knowledge to promote production through improved farm practices and facilitate marketing of agriculture produce of the farmers by entering in to understanding with buyers/exporters/processors, which will be purchased at the contracted price.

**Table 4.2 Characteristics of contract farming programs launched by PAFC, 2004-05**

<b>Name of Crop</b>	<b>Area (ha)</b>	<b>Farmers (Nos)</b>	<b>Average Yield (q/ha)</b>	<b>Buyback Price (Rs/q)</b>	<b>Comfort Price (Rs/q)</b>	<b>Market Price (Rs/q)</b>	<b>Qty. Procured (q)</b>
Hyola	25602	15,000	20 to 28	1,600	NA	1,300-1,400	22,346
Sunflower	12615	NA	20 to 23	1,500	1,340	1,200-1,300	53,963
Barley	1569	1,324	38 to 59	540	NA	560-580	NA
Basmati	23066	9,504	38 to 25	900-1,300	800-1,200	1,150-1,250	NA
Maize	12743	6,662	38 to 50	500	NA	450-480	NA
Durum	2562	2,100	50 to 55	660	NA	NA	NA
Wheat Green gram	1120	NA	13 to 15	1,520	NA	1,700-1,800	NA

Source: PAFC.

#### **Box 4.1 State Agencies Tasked with Contract Farming in the Punjab**

PAIC, PAGREXCO AND PAFC are three sister agencies that work together to promote agribusiness activities in the state. PAIC, or the Punjab Agro Industries Corporation (referred to as Punjab Agro), is a state-funded organization that was originally funded in 1966 to provide inputs and services such as extension to farmers. It is presently tasked with promoting agricultural and agro-based industries by contributing equity shares to projects and brokering linkages with domestic and foreign investors.

PAGREXCO was established in 1997 to assist in the marketing of fresh and processed produce to export markets, financing of cold chain infrastructure, and improving the crop productivity of export-oriented products through ancillary support in pre- and post-harvest techniques and varieties to growers. PAGREXCO specifically provides support to sales to distant markets through a variety of incentive schemes to support packaging, transport, and value-adding activities.

PAFC is a wholly owned subsidiary of PAIC and was incorporated in July 2002. Its main task is to facilitate contract farming and promote agricultural diversification in the state. PAFC provides technical support and materials to farmers so they can meet the specified standards of buyers. PAFC primarily acts as a facilitator between the grower and buyer on mutually beneficial terms and establishes guaranteed buyback prices to farmers. PAFC is also tasked with the procurement of small amounts (less than 10 percent of statewide procurement) of rice and wheat for the FCI and is developing a warehouse receipt program.

Source: <http://www.punjabagro.com>, retrieved 18 November 2005.

Examples of companies that entered into this type of contract arrangement with farmers included Advanta for sunflower; Punjab Agro Foods Corporation for Hyola; Pro-Agro and Mahindra Shubh Labh for winter maize; United Beverages for Barley; and Rallis India, Mahindra Shubhlabh, Escorts and DCM Shriram for basmati rice. There is considerable growth in number of farmers participating in such arrangements; their number increased from about 8,000 in 2002-03 to 32,500 in 2004-05. During the same period the area covered increased from about 9,000 ha to 79,000 ha. For sunflower PAFC paid comfort prices higher than the market price, while in basmati rice it was below the market price (Table 4.2). Preliminary evidence in 2003-04 suggests that farmers in PAFC contract farming programs have higher yields than the state average (Table 4.3). The program is in the evolution stage and government is making all efforts to bring more farmers and crops into its fold.

**Table 4.3 Comparisons of state yields with contract farming yields under PAFC contract farming program, 2004**

Crop	Yield (t/ac)		Increase in yield (%)
	Contract farming under PAFC	State average	
Maize	4.75	2.98	59.40
Basmati	2.25	1.8	25.0
Barley	4.75	3.35	41.80
Durum Wheat	5.25	NA	-
Sunflower	2.13	1.73	23.12
Hyola	2.38	1.20	98.34
Green gram	1.38	0.83	66.26

Source: Unpublished data from Punjab Agro and Statistical Abstract, Punjab.

#### ***4.4.2. Private industry-driven contract farming***

This is the most common model of contract farming, driven by private industry comprising processors, exporters and domestic wholesalers /retailers. This model has different variants promoted by different agro-firms: (i) processors; (ii) exporters; and (iii) vertically integrated franchises.

Processor-driven contract farming: The first type of arrangement consists of a processor who enters into a contract with growers to regularly source raw material of a desired quality to the plant. An important example of this is ‘PepsiCo model’, that pioneered the concept of contract farming for the competitive bulk procurement of a variety of crops like potato, tomato, groundnut, chilies and paddy in Punjab (see Box 4.2). Initially the Pepsi Co. initiative was quite successful in augmenting tomato yields by 25-50 percent and incomes by about 40 percent. Later due to dispute and breach of contract, the tomato processing plant was closed but the firm is continuing contract farming in other commodities. In this model, the processors supply seeds and seedlings of specific varieties to the producers for meeting the processing requirements. The firms regularly supervise and monitor their production throughout the growing season. The firms also provide technical advice to farmers. Purchasing decisions vary by company in terms of the amount and quality of products that are accepted. For instance, Pepsi applies stringent quality standards prescribed in the contract in their procurement. Another example is Nijjer Foods Ltd. (started in 1991 in Amritsar), which started contract farming in Punjab to process tomatoes and chilies. By contrast, Nijjer Foods accepts all production that is brought to the factory and engages in the cleaning of red ripe chilies at the factory to ensure that aflatoxin levels

are low. In both cases, farmers are required to bring the produce to the factory, but transportation costs are adjusted in the contracted price. While the contract is a written agreement and signed by both parties (farmer and processor), it is not a legally valid document.

#### **Box 4.2 Pepsi co Model- Originator of Contract Farming in the Punjab**

The model of contract farming in perishables in the Punjab started with Pepsi Co. in 1989, which began engaging in contractual relationships with farmers to produce potatoes and tomatoes. Pepsi was allowed to enter the Indian market for its soft drinks business on the condition that it also contributes to the processing of fruits and vegetables and establish linkages with farmers. Pepsi remained in the Punjab for over a decade and successfully utilized contract farming to supply its processing plants. However, in 2001, Pepsi Co sold its tomato processing facility to Hindustan Lever Ltd. (HLL). It re-acquired the facility shortly afterwards, but completely disbanded production by 2004-05. Pepsi's departure from the market was not due to problems with contract farming per se, but rather the poor profitability of the plant on account of subsidized imports of tomato paste from China and difficulties obtaining year-round supplies of raw material from the Punjab (World Bank, 2003). Transportation costs from the Punjab to international port were also prohibitive. Pepsi maintains contract-farming arrangements to supply its potato chip processing unit in the district of Sangrur. The germplasm is provided by the company, with production taking place under its direct supervision. Quality standards in terms of size, shape, and other parameters are specified in the contract. Produce that does not fulfill those exacting parameters is not accepted. Contracts are renewed every year for almost all contracting farmers, unless farmers break the contract or fail to follow company recommendations on production practices. The incidence of breaking contracts is less than 5 per cent.

Pepsi recently partnered with the Punjab Agro Industries Corporation (PAIC) to support the Government of Punjab's (GOP) initiative of promoting citrus production in the state. Pepsi aims to establish a processing plant for processing oranges, though is currently constrained by unsuitable varieties for juice production. Pepsi plans to invest Rs. 50 million to establish state-of-the-art facilities for raising citrus saplings which will be provided to farmers. It is hoped that farmers will be enticed by such a program, since orange production can yield income of up to Rs. 60,000/acre/year compared to only 20,000/acre/year from paddy. By 2006, 250,000 plants will be ready for transplantation. GOP has established a goal of bringing 1 million acres under citrus cultivation by 2015.

Sources: Presentation by Mr. Abhiram Seth, Executive Director, Pepsi Co. India at the Rural Marketing Summit, 7-8 October 2005; Rashme Sehgal, "Contract Farming in the Punjab," Info Charge News and Features, June 2005.

A slight variation in this model involves contract farming facilitated by the Punjab Agro Industries Corporation (PAIC) through joint ventures with private processors. In this model, the PAIC acts as a facilitator and broker in the joint venture company through equity participation. It also procures some of the commodities. Table 4.4 lists some of the projects that have been facilitated by PAIC. For example, PAIC procures green peas grown in the district of Patiala for local processors. In this case, farmers grow the improved varieties<sup>21</sup>, which are procured by the processing unit. Pea processors do not provide any inputs or technical advice to the farmers. The processing unit grades the produce and rejects those not conforming to their prescribed specifications and standards. Prices are fixed on the basis of the market prices that prevailed in the local markets over the last 3 to 4 years.

**Table 4.4 Major contract farming initiatives facilitated by the PAIC in Punjab**

<b>Company</b>	<b>Capital (Rs. million)</b>	<b>Capacity (million tons)</b>	<b>Raw material</b>	<b>End Product</b>
Nijjer Agro Foods Ltd	194.9	<ul style="list-style-type: none"> <li>• 15 tons per hour of tomatoes</li> <li>• 150,000 litres of milk per day</li> </ul>	<ul style="list-style-type: none"> <li>• Tomatoes</li> <li>• Milk</li> <li>• Chilies</li> </ul>	<ul style="list-style-type: none"> <li>• Tomato Paste</li> <li>• Chili Paste</li> <li>• Guava concentrate</li> <li>• Hybrid Seed</li> <li>• Ghee</li> <li>• Milk powder</li> <li>• Condensed milk</li> </ul>
Agro Dutch Industries Ltd.	235	28,000 tons per annum (expanded from 3,500)	<ul style="list-style-type: none"> <li>• Paddy</li> <li>• Straw</li> <li>• Mushroom</li> <li>• Spawn</li> </ul>	Canned mushrooms
Golden Agro Winery Ltd.	8.75	375 kg litres of wine per annum producing 500,000-750 ml bottle of wine	Grapes	Wine
Himalayan Frozen Foods Ltd.	97	5,400 tons per annum of raw materials; freezing rate of 2 tons per hour	Fruits and Vegetables	Frozen fruits and vegetables
Gloosy Food	61	2,700 tons per	Fruits and	Dehydration plus

<sup>21</sup> Recommended by the Punjab Agricultural University, Ludhiana.

Ltd.		annum	Vegetables	canning/bottling of fruits and vegetables
Green Bagh Ltd.	77	3,000 tons per annum	Fruits and Vegetables	Juice concentrate and fruit and vegetable pastes
Pagro Foods Ltd.	75	11,600 tons per annum	Fruits and Vegetables	Frozen/Processed fruits and vegetables

Source: PAIC

Export-driven contract farming: Second type of private industry-driven contract farming is akin to the one practiced by the processors but exclusively followed in Agri Export Zones (AEZ) for the commodities meant for exports only. Here the exporters (comprising processors and traders engaged in exports) enter into contract farming agreements with the farmers adhering to the AEZ norms. Exports of gherkins (Box 4.3) and grapes from Andhra Pradesh and fresh vegetables by FieldFresh are typical examples of this model. Since these exports are directed to European markets, they invariably adhere to Euro-GAP and GMP (European Good Agricultural Practices and Good Manufacturing Practices ) including HACCP.

#### **Box 4.3 Contract farming for gherkins in Andhra Pradesh: A successful model**

Gherkins is a short duration crop (60-70 days only) and farmers are realizing net income of Rs 15,000 to 17,000 per ha per crop, and have the option of cultivating a second crop or grow alternative crops. The returns over variable costs are about 30 percent for farmers growing at least one gherkin crop during the year. The company bears the marketing risk and makes prompt payment as per the specified quality standards and keeps well-organized record keeping system. The area under gherkin contract farming at present is 3500 ha and is expected to double in the next 2-3 years. Growing gherkins under contract farming has brought into light a number of new insights related to contract farming. For instance in contrast to the popular belief that contract farming is beneficial for large farmers, for gherkins a large number of small and marginal farmers are also involved in growing gherkins. The benefits of contract farming for gherkin production include (i) employing family labor throughout the crop period, (ii) empowering women as the crop provides employment opportunities (about 250-300 days/ha/crop); and (iii) reducing migration of family members engaged in gherkins production due to availability of wage employment during the off-seasons.

**Farmers' perception:** Most of the farmers had experience in cultivation of vegetables and hence could easily adopt the improved practices. They were also assured buy-back at pre-determined prices where the prices offered by the company were remunerative and farmers knew well in advance the quality requirements and incentive by way of higher prices for best grades. Other advantages are that middlemen are completely eliminated in the marketing chain, marketing costs are reduced as the company is bearing transport charges and other costs and providing, appropriate technical guidance. On the flip side the farmers expected the company to take measures to insure the crop and in case of crop failure. At present the farmer has to bear the production risk, especially for new cultivars introduced by the company for the first time. The farmers also felt that the price gap between different grades is too wide and the company should consider reducing the gap.

**Sponsors' (company) perception:** While the company is assured of quality product at fixed prices they too face problems: Sometimes farmers do not follow the advice given by the company related to management practices. It is noted that some times fertilizer application is diverted to other crops. Thus farmers realize lower yields than potential yields. In addition, farmers often withdraw from contracts due to water shortage.

This necessitates the exporter to provide good seed, recommended fertilizers, and plant protection chemicals in right proportions, and agronomical and pre- and post-harvest advice to source the right type of material. To maintain quality standards, the exporters choose such farmers who are able to adhere to the strict quality norms. Gherkin exporters prefer small holders since the crop is highly labor intensive and timely operation is necessary which otherwise makes the produce useless since there is hardly any domestic demand for gherkins in India. Ramesh (1999) observed that high labor requirement deterred farmers from expanding area under gherkins. In grapes also, the preference is for small orchard owners since many large orchard owners become exporters after gaining two to three years of operational experience from the exporters. This puts additional burden to the exporters to identify and train new farmers. The exporters provide extension support to the farmers so that the produce complies with the certification norms in terms of quality, traceability, pesticide residues and aflatoxin levels.

Input producers led contract farming: The third type of private industry-driven contract farming is practiced by the input producing firms. Typical example of this type of contract farming is of broiler industry in India. This is a vertically integrated agro-business model in which few companies (integrators) franchise chicken (broilers) growing to contract growers, to whom they supply newly hatched chicks and most other inputs such as feed, vitamins, vaccines and antibiotics. These inputs account for about 75 per cent of the total cost of broiler production and are the critical inputs for productivity and profitability (Birthal et al 2005). This model is based on the principle of franchising and, as such, the company takes the full responsibility of marketing the produce by paying a pre-agreed amount of growing charges on live weight of the bird. The grower is thus insulated from the wide price fluctuations in the market. The companies have arrangements to sell live birds and dressed chickens or other processed products to wholesalers and retailers.

#### ***4.4.3 Informal contract farming***

Informal contract farming arrangements are sprouting for different commodities in different parts of the country. These are very successful in dairy sector throughout the country for procurement of milk. In this model, the contract is not a formal (written), but rather an informal commitment between the producer and processor to supply and buy milk. The foundation of this model relies on the mutual trust between producers and the processors. Milk is collected at the village level and prices are determined on a daily basis. In Punjab, the Punjab Cooperative Milk Federation (commonly referred to as Milkfed under the brand name of 'VERKA') and Nestle India Limited, a multinational company, are the two leading players in dairy sector, and together in the

organized sector constitute 52 percent of the total milk collected and processed (Dhaliwal, 2003). Both the firms promote milk production in the state by linking milk producers with processing and distribution facilities. Milkfed, located in Ludhiana, has milk cooperative societies at the village level, which are managed by the paid secretaries of the society, while Nestle India Limited appoints one of its milk producers as the nodal person who is responsible for the milk collection operations in the village. The number of milk collection centers in a village depends on the volume of milk supplied to the company. In addition, cattle feed and veterinary services are provided by the processing units at a subsidized or 'no profit, no loss' basis directly to the milk producers. The processing units also carry out animal improvement programs through artificial insemination and provision of quality bulls. Motivation is provided by these firms (Milkfed and Nestle) to ensure a regular supply of milk for processing throughout the year.

#### **4.5 Case studies on contract farming**

In this section, four contract farming case studies are assessed: (i) dairy in Punjab, (ii) vegetables in Punjab, (iii) grapes in Andhra Pradesh, and (iv) broilers in Andhra Pradesh. The purpose is to examine the benefits of contract farming over non-contract farming in different commodities under different arrangements.

##### ***4.5.1. Milk production under private versus cooperative model***

The profitability of milk production under two different models is given in Table 4.5. Nestle-linked farmers had two-and-a-half times more animals than those associated with Milkfed. Normalizing the returns on per-animal basis, the gross and net profits of sampled dairy units with Nestle were significantly higher than those with Milkfed. The variable and fixed costs of milk production per animal of Nestle farmers were higher than of Milkfed farmers. However, due to higher quality of livestock, feeding, housing, and sanitation conditions, higher productivity is realized with the dairy animals associated with Nestle, which compensated for the higher costs. This brings down the unit cost of milk production with Nestle by 32 percent compared to Milkfed. The net returns per unit of milk of those contracted with Nestle were almost 80 percent higher than the Milkfed farmers. The determinants of better economic performance of milk producers integrated with Nestle is due to higher milk productivity per animal, better stock of milch animals, higher proportion of cross-bred cows, and better herd management practices. A comparison of selected parameters illustrating the differences is given in Table 4.6.

The milk productivity per milch animal in Nestle integrated dairy units was higher by 77.5 percent compared to cooperative dairy producers. Better livestock maintenance and management on Nestle integrated dairy units, as reflected through higher fixed costs and expenditures on feed and labor per unit of milch animal (Table 4.5), has resulted in higher productivity (Table 4.6). While prices for buffalo milk are generally higher than cow milk, the productivity of dairy cows is higher, which contributes in part to the higher net returns from dairy production by Nestle than through Milkfed. Nestle India emphasizes breeding of milch animals to raise their productivity. (Table 4.7).

**Table 4.5 Economics of milk production under two vertically integrated market systems (Milkfed and Nestle Ltd)**

Item	Per Dairy farm based		Per milch animal based		Per liter of milk procured	
	Milkfed Linked	Nestle Linked	Milkfed Linked	Nestle Linked	Milkfed Linked	Nestle Linked
No. of adult animals	8.8	21.4	-	-		
Gross Income	209,269	687,781	23,725	31,850	11.55	10.15
Variable Costs	173,029	442,555	19,662	20,680	9.55	6.53
Feed	83,366	213,720	9,473	9,987	4.60	3.15
Dry fodder	13,688	37,083	1,555	1,733	0.76	0.55
Green fodder	61,095	124,318	6,943	5,809	3.37	1.83
Veterinary care	3,960	9,600	450	449	0.22	0.14
Labor	6,480	48,000	736	2,243	0.36	0.71
Power charges	3,160	8,273	359	387	0.17	0.12
Minor repairs	1,280	1,560	145	73	0.07	0.02
Returns over VC	36,240	245,226	4,063	11,170	2.00	3.62
Fixed Cost	12,920	74,483	1,468	3,481	0.71	1.10
Net Returns	22,833	164,560	2,595	7,690	1.26	2.43

Source: Primary survey conducted in 2005

Nestle focused on crossbred cows due to their higher milk yield potential. Nestle introduced special incentives through better prices for cow milk that are based not

only on fat content but also taking into consideration SNF (solids not fat) contents. Consequently, the share of cow milk as a proportion of the total milk procured by the Nestle, now stands at 44 percent in 2002 against nil in 1980. In order to improve the quality of livestock, Nestle also provides quality bulls at a 75 percent subsidy or sometimes free of cost. Nestle runs 51 Artificial Insemination centers and arranges for good quality semen from reliable and established sources. Farmers are only required to pay the labor costs of the inseminator. Extension activities have been organized to impart knowledge and training to dairy producers in scientific farm management techniques, improvements in the health and pedigree of livestock, production and delivery of hygienic milk, and techniques that improve the productivity of milking animals. Recently, the company introduced a 'herd management' program, where dairy farmers were trained on various aspects of management, feeding, and housing for animals aimed at improving their productivity.

**Table 4.6 Determinants of the economic efficiency of milk production in the Punjab**

<b>Parameter</b>	<b>Cooperative integrated production system</b>	<b>Nestle integrated production system</b>
<b>Milk yield/milch animal in kg</b>		
Cow	2,129	3,779
Buffalo	1,990	1,784
Overall	2,060	3,166
<b>Milk price received per kg (6.5% fat) in Rs</b>		
Cow	9.63	9.81
Buffalo	13.60	13.52
<b>Stock of milch animals (in percent)</b>		
Cross bred cows	50	83.8
Buffalo	50	16.2
<b>Composition of herd (Number)</b>		
Adult animals	8.80	21.40
Calves	4.75	7.20
<b>Variability in milk production (Per day/milch animal) measured through CV</b>		
Lowest supply (during June-July)	0.9	6.01
Highest supply (August-January)	6.1	9.03

Source: Primary survey conducted in 2005

**Table 4.7 Comparative prices received for in different seasons on sample farmers in Punjab (Rs/kg)**

Period	Buffalo			Cows		
	Cooperative linked	Nestle linked	Difference	Cooperative linked	Nestle linked	Difference
Feb. to May	13.59	13.56	+0.03	9.62	9.84	-0.22
June to July	14.00	13.95	+0.05	9.70	9.92	-0.22
August to Jan.	13.58	13.41	+0.17	9.63	9.77	-0.14

Source: Primary survey conducted in 2005

#### ***4.5.2 Contract farming in vegetables***

SAFAL (a subsidiary of the National Dairy Development Board) is the most successful example of contract farming in fruits and vegetables. It has a network of farmers' associations throughout the country in production centers and retail chains in Delhi (BIRTHAL et al 2005).

In Punjab, some corporate houses are establishing their presence in vegetables through contract farming for export, processing and/or retailing; the major companies are Mahendra Subhlabh, Bharti, and Pepsi. Recently, one of the India's leading corporate house (namely the Reliance Industries Ltd.), announced a mega project on agri-business and retailing in Punjab and other states in India. The early experience has not been as lucrative as expected and not as successful as in dairy. The lukewarm response and success is attributed to the dominance of rice-wheat system (Box 4.6)

#### **Box 4.6 Experiences with Contract Farming in the Punjab**

The experiences of farmers in contract farming in the Malwa region of the Punjab have been less than ideal. While the PAFC has been active in establishing private sector partnerships to encourage contract farming, there have been reports that buyers have not kept their promises. In one instance, paddy farmers engaged in contract farming arrangements were promised Rs. 1,350 per quintal prior to planting, but were offered only Rs. 700 per quintal at harvest; after protests and negotiations, farmers eventually received Rs. 900 per quintal.

A farmer's organization estimated that farmers have to incur additional costs of about Rs. 750 per ha towards a fee for private extension services. Farmers claim that such arrangement never materialized despite paying the fee. Farmers are also not convinced that contract farming would provide any sort of income and/or food security as was through the prevailing rice-wheat system.

Despite these problems, the private sector is aggressively promoting contract farming. For instance, Pepsi has maintained its presence in potato sector for over a decade and plans to import 15,000 citrus plants to facilitate citrus and juice production in the state. A number of millers are also convincing farmers to diversify towards basmati rice, while United Breweries is working with PAFC to establish contract farming arrangements in barley. The possible entry of AWB from Australia into contract farming and food retail could further strengthens this initiative. One of the areas that AWB specializes in is the use of multi-period contracts that enable farmers to repay loans over a longer period of time in case of crop failures. Such risk mitigation measures may be the key to reduce the perceived uncertainty associated by many farmers with contract farming.

Source: Rashme Sehgal, "Contract Farming in the Punjab," InfoChange India News and Features, June 2005; Nidhi Nath Srinivas, "Indian farm retail to get its first foreigner," The Economic Times, New Delhi, 7 December 2005.

A comparison of contract and non-contract farming in selected vegetables reveals that the former was more profitable during 2003-04 in case of potato and green peas, but not in chilies (Table 4.8). In both, potato and green peas, contracted farmers incurred higher variable costs (43.65 percent and 8.40 percent higher respectively) than non-contract producers. And, the yields of potato and green peas were also lower by 5.9 and 15.11 percent respectively in contract model. But by contracting, potato farmers realized 72.76 percent higher price and green peas farmers 27.10 percent higher prices compared to their respective non-contracted counterparts. Higher prices were

responsible for more than double the net returns in potato and by about 49 percent higher in case of green peas. The productivity of potatoes under contract model was 5.9 per cent lower than the non-contract farming since the contracting firm (in this case Pepsi) mainly procures the Kufri Jyoti variety that is better suited for processing but is lower-yielding than Kufri badshah, Kufri sandhuri, and other varieties generally grown by the majority of farmers. The variable cost was 43.65 percent higher for contract farmers than non-contract farmers mainly due to higher costs on seed, grading, packing, transportation, etc.

**Table 4.8 Comparison of variable costs, yield levels, prices and net profit in contract and non contract farming situations**

Commodity	Contract farmers	Non contract farmers	Percent change
<b>Variable cost(Rs/q)</b>			
Potato	274.19	190.87	43.65
Green Peas	309.81	285.80	8.40
Chilies	435.73	504.52	15.79
<b>Yield levels(q/ha)</b>			
Potato	119.81	203.12	5.90
Green Peas	126.98	142.09	15.11
Chilies	86.49	78.96	9.54
<b>Prices received(Rs/q)</b>			
Potato	545.62	315.83	72.76
Green Peas	680.00	535.00	27.10
Chilies	600.00	688.13	14.69
<b>Net profit(Rs/ q)</b>			
Potato	271.43	124.96	117.21
Green Peas	370.19	249.20	48.55
Chilies	164.27	183.61	(-) 11.77

Source: Primary survey conducted in 2005

A comparison of contract and non-contract farmers in the production of chilies indicates slightly higher net profits (by 11.77 percent) for farmers outside of contracts (Table 4.8). On an average, production cost was lower by about 16 percent for contract farmers, though the composition of such costs differed markedly. Contract farmers realized higher yields than non-contract farmers, but received lower prices than non-contract farmers. It is important to note that there was significant price variability for chilies in the open market, with prices ranging from Rs 500 to Rs 750 per quintal while the contracted price was Rs 600 per quintal. The threshold price, at which contract farmers of chilies, will receive same profit as their non-contract

counterparts is Rs. 619.34; just 3 percent higher than the agreed prices. This suggests that if firms are flexible (5-10%) in agreed prices, the chances of breach of contract may be avoided.

#### ***4.5.3. Case study on broiler production<sup>22</sup>***

Vertical coordination is very strong and successful in case of broiler production in Andhra Pradesh. High risk due to outbreak of diseases and fluctuating prices led to the closure of several small-scale broiler farms. In the mid-1990s, Venkateshwara Hatcheries Limited, a leading poultry integrator based in Hyderabad, came up with a contract-farming scheme in Andhra Pradesh and a few other southern and western states.

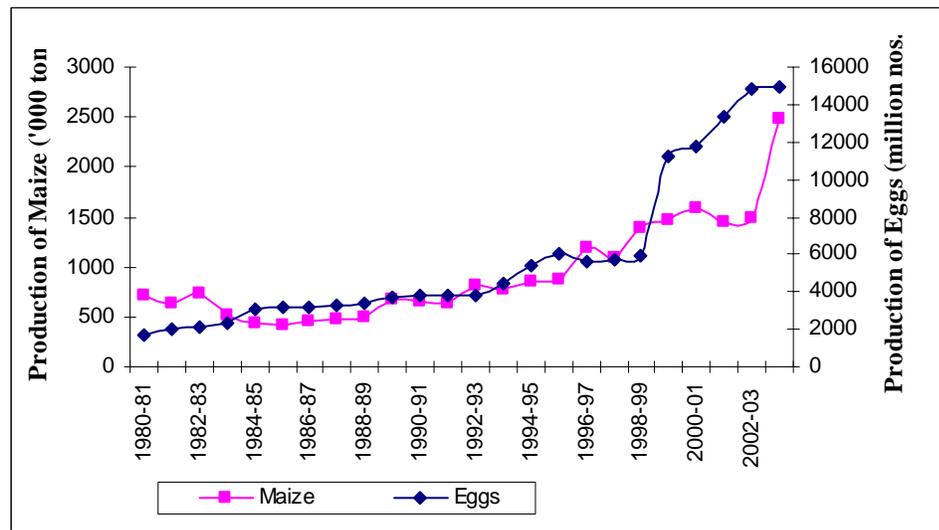
Motivation for contract farming: Under the agreement the integrating firm supplies chicks, medicines and feed to the farmers which constitutes 75 percent in the total cost of broiler production. The firm also provides technical guidance and transportation for acquiring inputs. The broiler producers' inputs include land with shed, water facilities, electricity connections and labor.

At the end of the production cycle, the producers receive a net price (by weight) that is determined by a group of hatcheries (not the retail price). The industry price fluctuates within a narrow band and is more stable than the retail prices. Thus, the producers receive considerable price insurance. In addition, the firm shares profits due to rise in market prices with the farmers. The firm also shares mortality risk of 5 percent with remaining risk borne by the farmer. A premium of 25 percent is paid on the price if the feed-conversion ratio is higher than some stipulated average. Thus the firm bears the market risk while the producer bears the production risk. This type of risk-sharing mechanism protects farmers, specially the smallholders, under volatile market conditions. Ramaswami et al. (2005) have estimated that contract farming in broiler industry shifts about 88 percent of risk from the farmer to the processor. Such a risk-sharing mechanism helps the smallholders in improving their management strategies and minimizing production and price risks. The contract farmers made 13 percent more profit compared to non-contract farmers in broiler production (Table 4.9). The growing poultry industry in the state as a result of contract farming has induced maize production (especially for feed) to dramatically increase (Figure 4.1).

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<sup>22</sup> This section has been drawn heavily from Birthal (2005) and Ramaswami (2005)

**Figure 4.1: Production of Maize and Eggs in Andhra Pradesh**



**Table 4.9. Costs and profits in broiler production under contract and non-contract farming1 (Rs/t)**

Item	Production	Transaction	Total	Net
	Cost	Cost	cost	profit
Non-contract producer	27322	90	27412	2003
Contract producer2	808	38	846	2255
Percent change over non-contract mode	-	- 57.78	-	12.58

1. Sample size is 25 contract farmers and equal number of non-contract farmers

2. Firm supplies free chicks, medicines and feed to farmers.

Source: Birthal et al 2005.

#### **4.5.4. Case study on grapes in Andhra Pradesh**

Grape is one of the largest traded fruits in the world. Europe is the largest market with annual trading of about 1.1 million tonnes (Naik, Gopal, 2004). Indian grape industry has found a niche of 30 days (15 April to 15 May) for exports. During this period, there is no competition from other countries; European market is dominated by Chilean grapes prior to mid April, while South Africa, Brazil and Spain compete after May.

In India, grape is becoming one of the most remunerative farming enterprises. The crop is grown in diverse agro-climatic regions, namely sub-tropical, hot-tropical and mild-tropical; hot-tropical region<sup>23</sup> accounts for about 70 percent of total grape production in the country (Shikamany 2001).

Andhra Pradesh is well placed to harness the opportunities from the growing global grape market. About 1,675 ha area is under grape, which is 3.5 percent of all-India grape area during 2000-01(CMIE 2002). The grape production in the state is largely concentrated in southern Telengana region (including Rangareddy, Medak, Ananthapur and Mahabubnagar districts) with 85 percent of the total area concentrated around 75 km radius of twin cities of Secunderabad and Hyderabad.

There are many exporters of grapes from Andhra Pradesh but Sam Agri tech is the leader. The firm has been adopting contract-farming model since 2002<sup>24</sup>. Its exports have grown from 2 containers (14.5 tons per container) in 2002 to 30 containers in 2005. This firm exports grapes through ‘category managers’ who have direct tie-ups with supermarkets in EU and UK.<sup>25</sup>

To meet the required standards for exports, growers have to adopt appropriate agronomic practices, perform certain mechanical practices<sup>26</sup>, and follow right post-harvest management<sup>27</sup> as prescribed by the importing countries. Grape quality is graded based on physical and chemical parameters for export purpose. Quality standards vary across importing countries and are considerably different from those sold in domestic market (such as color, size, packaging, bunch weight, sugar acid, etc).

Motivation for contract farming: Contract farmers received 55 percent higher net returns from grape production for export compared to those producing for domestic

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<sup>23</sup> Andhra Pradesh, Maharashtra and northern Karnataka constitute hot tropical climate.

<sup>24</sup> The firm selects farmers based on the condition of the orchard and background of farmers. During initial years the company relied mostly on large farmers but now it concentrates on small farmers to get regular supply. Large farmers do not maintain long-term agreement with the company because they start exporting independently after obtaining technical know-how and knowledge of export procedures. The selection process starts after winter pruning in the month of September. The company has contract agreement with 10 farmers during 2005. Contract agreement is formal and written and usually lasts for a period of three years.

<sup>25</sup> Detailed information on the processes that involved from grape production to the super market in the importing country is given in Figure 4.2.

<sup>26</sup> For example, the pre-harvest practices involve use of shade nets, which are used to protect the fruit from sunlight to meet color specifications.

<sup>27</sup> Produce is packed in different sizes of boxes depending upon the requirement of importing country. Most of the farmers have their own pack houses in garden premises. From pack house the produce is taken to pre cooling unit. In pre cooling unit produce is kept for 5 –6 days depending on export demand. From pre cooling unit the produce is transported to cold storage. When the sufficient amount of produce is available for one container (14.5 tonnes) then the produce is sent to the port through refrigerated containers.

markets (Table 4.10). Though the unit cost of production of contract farmers for export markets was higher (33%) than for the domestic market, better prices (approximately 61 percent higher) generate higher dividends.. The grape yields of the contract farmers were less to maintain quality for export purpose. The cost of production for export market is also higher due to following better management practices as well as incurring additional post-harvest costs towards packaging, pre-cooling and cold storage. They also have to follow recommended practices to get Euro-GAP certificate that costs 10 percent more than routine cultural practices. Besides higher returns, the contract producers also benefit from improved genetic stock and management practices. From smallholders' perspective, the arrangement provides opportunity to share the global prices and take advantage of globalization, which otherwise was not possible.

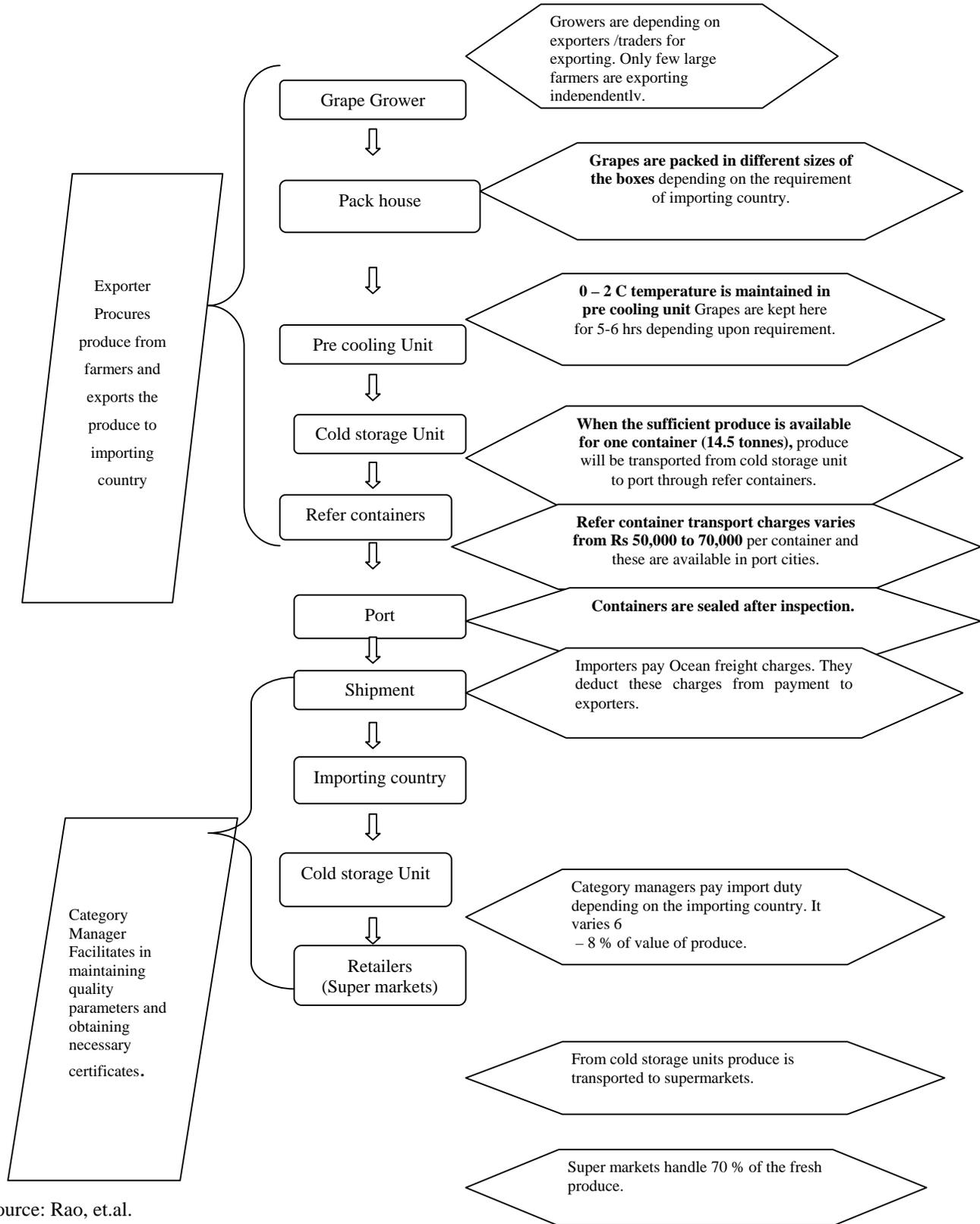
**Table 4.10: Cost and returns of contract and non-contract farming in grapes for export and domestic markets**

Item	Unit	Market		Percent change
		Export	Domestic	
Cost of production	Rs/kg	9.28	6.28	32.65
Yield	ton/ha	25.0	30.0	(-) 20.00
Prices received by farmers	Rs/kg	31.0 (20.0-40.0)	12.0	61.29
Gross returns	Rs/kg	21.96	12.0	45.35
Net returns	Rs/kg	12.68	5.75	54.65

Note: Prices received vary from market-to-market. For example, prices received by the farmer for UK market is Rs 40/kg, for Europe it is Rs 33/kg, and for Gulf countries Rs. 20/kg.

The farmers' shares in the prices paid by the consumers in the importing countries ranges from 33 percent in UK to 37.5 percent in EU. The share of exporter and category manager is 18-19 percent in the entire supply chain (Rao, P. et.al. 2006).

**Figure 4.2. Flow chart of processes involved in the export of grapes**



Source: Rao, et.al.

#### ***4.5.5 Lessons drawn from innovative marketing institutions***

Innovative institutions in the form of either *Apana mandi*, *Raythu Bazar*, or contract farming are compressing supply chain and improving marketing efficiency and encouraging participation of smallholders. Concepts of *Apana Maandi* and *Raythu Bazar* benefit the farmers near urban centers. The farmers through contract farming can benefit even away from the urban centers, and can take advantage of growing international markets. The benefits are in terms of better access to markets, technology and credit and hence increased income and higher employment opportunities in addition to being connected with the global markets. In the absence of contract farming it would have not been possible for smallholders to take up production of grapes for export purpose. This is also true for gherkins in Andhra Pradesh.

The high-value crops require considerable knowledge of technology and SPS compliance to meet the standards of importing countries. This is possible through emerging innovative institutional arrangements by involving number of smallholders and sharing benefits with them. In the case of broiler contract farming, the firm favored smallholders that reduced absolute and relative poverty.

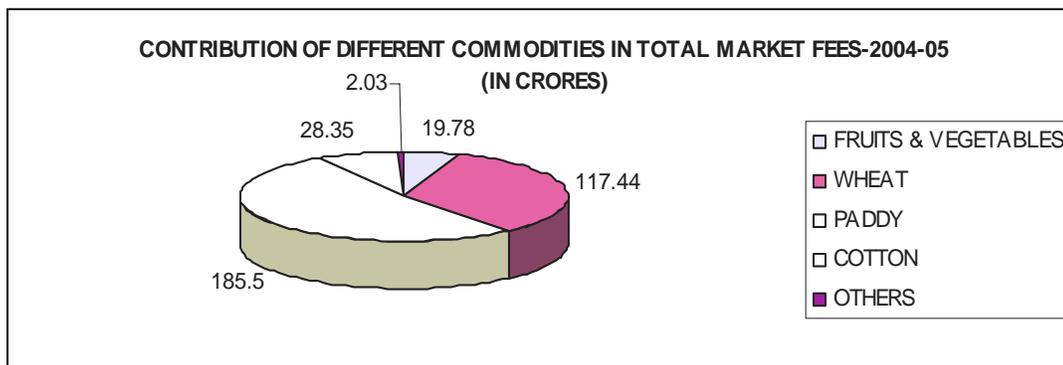
#### **4.6 Constraints in up-scaling contract farming**

The constraints which are inhibiting up-scaling of the contract farming to promote agricultural diversification include (i) existing marketing regulations, (ii) under-developed infrastructure towards HVCs, (iii) absence of organized food retailing, and (iv) farmers' instinct for household food security.

##### ***4.6.1. Existing marketing regulations***

Agricultural Marketing laws, particularly the Agricultural Produce Market Committee (APMC) Act, inhibit the up-scaling of innovative institutional arrangements, such as contract farming and linking farmers with markets and agri-business. As per the APMC Act, it is mandatory that all notified agricultural commodities, including horticulture products, must be marketed through regulated markets (*mandis*). While Punjab has a dense *mandi* system with purchase centers within the radius of 10 km from most villages, the system has not adapted to the changing demands for horticulture products (World Bank 2003 ). The existing *mandis* all over the country have been developed to handle mainly food grains, oilseed, cotton, and not the HVCs. In Punjab for the year 2003-04, rice and wheat accounted for about 86 per cent of the market fee while the share of fruits and vegetables stood at only 5.6 per cent. (Figure 4.3)

**Fig. 4.3 Contribution of different commodities in the total market fee collected in the Punjab during 2003-04**



Source: Mandi Board, Government of Punjab.

The APMC Act, stipulates establishment of special commodities markets for fruits, vegetables, flower, fish and meat. However, such specialized markets are yet to emerge in the country with an exception of the modern auction market established by the National Dairy Development Board in Bangalore. Recently, Reliance India Limited has shown keen interest in agri-business and made agreements with the states of Haryana, Punjab and West Bengal to source agricultural produce for its planned organized food retailing in the country.

The mandatory regulated system of marketing has two major implications. First, the regulated marketing system prevents producers from direct sales (except limited sales in farmers' markets) to market functionaries such as processors and exporters. This obstructs the firms from entering into contract farming and buying directly from the farmers. Secondly, it reduces the competitiveness of production (particularly that geared for export) and adds unnecessary intermediaries to the supply chain. Such increase in intermediaries normally results in producers receiving a smaller share of the final sales price of the commodity.

To encourage contract farming the central government has formulated a model market Act that provides option for farmers to sell their produce to processors and contracted buyers at reduced market charges. Though a few states have agreed to implement the Act, it is yet to be operationalized. However, some of the state governments have started allowing agri-business firms for contract farming on case-to-case basis.

One of the major problems of marketing through *mandis* is obligatory market charges that add to the cost. The market fee, commission charges and other market charges for performing various market functions varied between the Punjab and Andhra Pradesh

(Table 4.11), but the total marketing charges inclusive of sales tax etc. work out to 11%

In Punjab and about 7 percent in Andhra Pradesh. These were fixed a long time ago and are high in view of the limited services provided by the regulated markets. The World Bank (2003) has indicated that the facilities for grading, storage, and information are poor in *mandis*, and market charges add 11.5 percent to the cost of commodities sold there. Reducing the marketing charges can help farmers in realizing higher prices and in making the agricultural products more export competitive.

**Table 4.11- Marketing charges levied at the regulated markets of Punjab and Andhra Pradesh, 2003-04**

Market Fee		Market charges Rs./unit		Commission charges	
Punjab	Andhra Pradesh	Punjab (Wheat/Paddy ) Category D-	Andhra Pradesh (Per bag)	Punjab	Andhra Pradesh
All agricultural produce-2% (on purchase / sale transactions) plus 2% levied for Rural development fund.	All commodities – 1% (except fish) Fish – 0.5 %	Unloading 1.04	Weighing 0.50 to 0.75	For categories B, C, D, E & F about 2% F & V – 5%	All crops (except F&V) 1 to 2% F & V- 4%
		Weighing and Filling 2	Unloading 0.50 to 0.75		
		Stitching by machine 0.75	Hamal 0.50 to 0.75		
		Sieving (power operated cleaner): 1.86. Separate charges for the weigh man and laborers	Cleaning 0.75 to 1.00 Loading 0.50 to 0.75		

Source: <http://www.pbmandiboard.gov.in/byelaws.html> for Punjab and Department of Agricultural Marketing Government of AP.

#### **4.6.2. Under-developed infrastructure**

The post-harvest losses in HVCs are high and occur at different stages of marketing mainly due to the absence of well-developed infrastructure. In Andhra Pradesh, it is estimated that 30 percent losses occur at various stages for fruits and vegetables. The losses take place at field level (10%), transport (5%), packing (2%), storage (9%) and processing (4%) (GOAP 2003). Post harvest losses vary with the type of fruit (Table 4.12). The loss for horticultural products throughout the value chain was estimated at 12 percent, including 8 percent between the farm and *mandi*, 2 percent within the

district in Punjab (World Bank 2003). Absence of cold chains<sup>28</sup>, crop insurance, and other forms of infrastructure that mitigate risk and dampen the seasonality of production and unfavorable prices discourages diversification particularly when

**Table 4.12 Post harvest losses of selected fruits and vegetables crops in percent ( All India)**

<b>Fruits</b>	<b>Banana</b>	<b>Citrus</b>	<b>Mango</b>	<b>Guava</b>	<b>Papaya</b>	<b>Apple</b>	<b>Grapes</b>	<b>Tomato</b>	<b>Onion</b>
Per cent of loss	20 – 80	20-5	17-36	10 – 15	40-100	14	20-25	5- 50	25

Source: National Horticultural Board.

alternatives such as rice and wheat have guaranteed prices and procurement from the government. Cold chains provide an opportunity to producers and processors to store their products and sell them when market conditions are more favorable. In India, there are 4,701 cold storage units with an installed capacity of 19.4 million tons (Table 4.13). Of these, 5 percent are in Andhra Pradesh and 8.1 percent in Punjab. In Punjab, cold storages are mainly used for storing potatoes. In Andhra Pradesh cold storage units are used to store grapes, potatoes and mango. Awareness among farmers is also very poor. The units are not fully occupied round the year. High levels of power tariff and erratic power supply are other reasons for poor maintenance of cold storage units. The use of generators escalates the cost of storage. Consequently, the costs of such storage remain high, which raises marketing costs and sometimes makes the storage unprofitable. The distribution of units is not uniform across districts making them inaccessible to majority of farmers.

<sup>28</sup> A typical cold chain for fruits and vegetables consists of pre-cooling and cold storage facilities at the production centers, refrigerated transport to reach consuming centers and cold storages to hold the required stocks at the terminal markets. Cold chains ensure the farmers to realize higher price, which are normally appropriated by the middlemen. Secondly, cold storages are essential to preserve the quality of the product over a longer period – reduces the loss due to wastage and quality deterioration. Thirdly, it facilitates in transportation to distant markets by holding (the meaning is not clear) the products

**Table 4.13 Distribution of cold storage facilities in Andhra Pradesh, Punjab and India (as on 31-12-2004)**

States	Private sector		Cooperative sector		Public sector		Total	
	No.	Capacity (MT)	No.	Capacity (MT)	No.	Capacity (MT)	No.	Capacity (MT)
Punjab	364	1192593	18	39092	0	0	382	1231685
Andhra Pradesh	213	556147	13	9270	8	1190	234	566607
All India	4179	18349522	392	967324	180	86816	4701	19439307

Source: website: www.indiastat.com

Some of the contracting firms are developing their own infrastructure as per the requirement of their products. For example, Milkfed and Nestle have developed cold chains, and refrigerated vans for storage and transportation of milk for production centers to processing units. Nestle has also developed its own extension service, veterinary service and breeding service to support the contract farmers. Such arrangements build the confidence of producers for long-term commitment with the firm. That is why the informal contracts with Milkfed and Nestle, in which key services and markets are assured to farmers, were quite successful. Such arrangements limit the problems in an environment characterized by high transactions costs in formal contract enforcement and applicability (Klein 1996).

#### ***4.6.3. Absence of organized food retailing***

**Organized food retail is a relatively recent phenomenon in India and comprises a very small part of the food retail business in the country. However, it is growing at a rapid pace and will eventually capture a considerable segment of the food retail trade.** Rising incomes, changing family structures, and increased women employment are driving the modern makeover of the retail sector in India, particularly that of fresh fruits and vegetables. Although organized retailing in processed, dry and packaged foods has been there for quite some time, the scale of operations are increasing and retailing in fresh foods is taking off. Supermarkets and organized retail food chains source agricultural commodities from the farmers through contract farming in many developing countries. The lead has been taken by Latin American

countries, where the supermarkets have risen to 50-60 percent of national food retail in 2000. In Southeast Asian countries, the average food retail share is 33 percent but it is 63 percent in East Asian countries. The super market share of Chinese urban food market has grown to 48 percent in 2001. The evolution of supermarkets and organized retail chains in food sector in India is very low but is growing fast. For example, there are approximately 12 million retail outlets but organized retail contributes only 2 percent to overall revenue, and of that, 96 percent is in the ten biggest cities and 86 percent in the biggest six, including Hyderabad in Andhra Pradesh (The Economist 2006 and Economic Times 2003). Growing supermarkets and retail chains in Andhra Pradesh as compared to Punjab contribute to the success of contract farming and higher growth of HVCs in the former.

Andhra Pradesh seems to be the first stop for retail ventures, particularly of fresh fruits and vegetables. Punjab, although dominated by large farmers is gradually responding to the revolution. In Andhra Pradesh, the twin cities, Hyderabad and Secunderabad, are attracting supermarkets (or hypermarkets) and retail chains. Food World of the RPG group was the first to set up a hypermarket in Hyderabad, Andhra Pradesh. About 15,000 customers are visiting the Hyderabad store everyday (Chengappa et al 2005). Other important business players in supermarkets and retail chains operating in Andhra Pradesh are Trinethra, Subhiksha, Spencer, Nilgiris and Food Bazar. Reliance Fresh and ITC ChoupalFresh are the two recent players who have entered the fresh fruits and vegetables retail sector. While the former is into sourcing daily requirements from farmers, the latter offers extension services to the farmers as well. . Currently there are 3 stores, one each in Hyderabad, Chandigarh and Pune. The company plans to open up 140 stores in 54 towns in the next three-four years (Business Line, 2007).<sup>29</sup> ITC has plans to enter into the pushcart vending as well and Hyderabad is the destination to kickstart. It has sought the approval of the Municipal Corporation of Hyderabad to deploy around 300 pushcarts to sell quality fruits and vegetables at competitive prices (The Hindu 2007)<sup>30</sup>.

Punjab has also been part of this retail race and have been the hub of high value operations of Bharti FieldFresh Food Limited (in Ladhowal). While FieldFresh targets the export market for fruits and vegetables, Reliance Fresh and ITC ChoupalFresh are entering the state with similar retail and wholesale ventures they have been experimenting in other states. This is a good opportunity for the state to successfully

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<sup>29</sup> Business Line (2007), ITC Plans more Choupal Fresh stores, K.V. Kurmanath, 18<sup>th</sup> January 2007

<sup>30</sup> The Hindu (2007), Pushcarts to get a brand name soon, V.Geetanath, AP, Hyderabad, 8<sup>th</sup> February 2007

swing out of the rice wheat cycle and reap the benefits of high value farming, processing and retailing.

#### **4.7 Concluding Comments**

In summary, the markets for HVCs are thin, fragmented and unorganized, which lead to inefficiencies in marketing. The farmers' share in retail price is low in the existing supply chains. However, innovative marketing arrangements are evolving. One way is by creating farmers' markets that bring farmers and consumers together at one place by eliminating middlemen. But transactions through such markets are limited and concentrated around urban centers. More recently, agri-business is entering in HVCs for export, retailing and processing. Punjab is encouraging corporate houses for promoting contract farming to replace a sizable area under rice-wheat system that is threatening the sustainability of farming in the state. In Andhra Pradesh, contract farming is successful in poultry and is gradually spreading in fruits and vegetables for export, retailing and processing. Existing marketing regulations, under-developed infrastructure, absence of organized retailing and farmers' (particularly smallholders) instinct for food security pose as serious constraints in up-scaling the success of contract farming. However, given the scale of operations and the pace of growth of the organized food industry, back-end operations will scale up rapidly inducting more and more suppliers i.e. farmers, big or small for feeding these stores. Similarly there will tremendous pressure to build up the processing mechanism in place to ensure sustainability. Therefore what will be essential are massive investments in R & D in production techniques, extension services, infrastructure. These in turn will steer in incentives and insurance for the farmers who are most vulnerable to production and market risks.

## **Chapter 5**

### **Agro-processing Industry: Prospects and Constraints**

In India, the agro-processing industry for HVCs is viewed as a sunrise sector with immense potential. However, the sector has been ignored in the past in the guise of achieving food security. Conservative estimates put processing levels in the Fruits and vegetables sector at 2 %, Meat & poultry at 2 %, Milk by way of modern dairies at 14 %, Fish at 4 %, Bulk meat de-boning is to the tune of 21 % (Ministry of Food Processing Industry 2005). In contrast, 70 percent of fruits and vegetables are processed in Brazil and U.S., 78 percent in Philippines, 83 percent in Malaysia and 30 percent in Thailand (Kaul 1997). The experience from these countries reveals that a buoyant food processing sector serves many important goals: (i) links producers with other actors in the supply chain, including processors, distributors, and consumers; (ii) adds value to agricultural products, thus allowing for higher incomes throughout the supply chain; and (iii) reduces transactions costs through better supply chain coordination.

In this chapter, role of agro-processing sector as a catalyst in promoting the growth of HVCs is examined.

#### **5.1. Structure and performance of agro-processing industry**

The agro-processing industry in India accounts for 18 percent of agricultural GDP (Bharati et al 2004). It is projected that the market potential of agro-processing industry will grow from Rs. 4,600 billion in 2003-04 to Rs 13,500 billion in 2014-15 (Rabobank 2005). The total investment in the agro-processing sector was Rs 560 billion in 2003-04. The share of foreign investment was about 15 percent. At the all-India level, within the food category, grain milling dominates with 44 percent share, edible oils and sugar accounts for 23 percent while other foods account for 33 percent. Although grain milling has dominated in market share, it contributed only 7 percent in value addition and 20 percent in labor absorption. In contrast, other commodities, including HVCs, have 49 percent share in total value addition and 43 percent in employment.

The market share of HVCs was 26.77 percent in 2003, and is projected to be 38.06 percent in 2014-15. Among HVCs, dairy dominates with 25.21 percent market share while other commodities (fruits, vegetables and meats) account for only 1.64 percent. The projections reveal that the market share of dairy will increase to 32.59 percent and of other HVCs to 6.47 percent by 2014-15.

Andhra Pradesh is the second most important food processing state with 40 percent of the factories in the manufacturing sector falling under the agro-food industries category, accounting for 10 percent of the total fixed capital.<sup>26</sup> In 1999-2000, there were 5,350 food manufacturing industries in the organized sector in Andhra Pradesh with an investment of Rs. 12,100 million (Dev Mahendra S. and Chandrasekhar Rao 2004). Of these, the largest number of units are in grain milling, which accounts for about 67 percent of the total units, followed by edible nuts, bakery products, and dairy products. In the state, grain milling contributes only 23 percent of the net value-added in the food industry compared to 25 percent from HVCs. The food processing industry in Andhra Pradesh contributes about 18 percent of the total output from the manufacturing sector in the state, 18 percent of the total employment and 27 percent of total net value-added.

Punjab is way behind in food processing despite being the leading producer of foodgrains in the country. The agro-processing industry in the state is mainly devoted to grains processing, flourmills, oil mills, cotton ginning, and rice milling.

## **5.2. Processing of High value Commodities**

### ***5.2.1 Fruit and vegetable processing***

The number of licensed processing units under Fruit Products Order (FPO) in India increased from 3,925 in 1991 to 5,293 in the year 2000 (Table 5.1). The installed capacity of fruit and vegetable processing industry increased from 0.98 million tons in 1991 to 2.11 million tons in 2001. During the same period the production of processed fruits and vegetables increased from 0.28 million tons to 0.99 million tons, indicating that capacity utilization is less than half and there is enormous scope of increasing production.

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<sup>26</sup> Maharashtra is the leading state in the country with 10 percent share of total value-added from agro-processing industry.

**Table 5.1 Number, production and capacity utilization of fruit and vegetable processing industry in India**

Year	Units under FPO (Nos)	Installed capacity (million tons)	Processed products (million tons)	Capacity utilized (%)
1991	3925	0.89	0.28	31.32
1995	4368	1.40	0.68	48.36
2000	5293	2.10	0.98	46.67

Source: Various issues of Annual Report, Department of Food Processing Industries, Government of India(2002).

Nearly, 70 percent of the licensed processing units are in the cottage and household sector (estimated production of 50 tons per annum per unit). Another 17 percent are in small-scale sector (production between 50 and 250 tons per annum per unit) (Sidhu 2005). Traditional methods of processing and preservation dominate the cottage and small scale sector 127 while bigger and new units are employing modern technologies like vacuum concentration, aseptic packaging, freezing, drying and individual quick freezing. The processing industry is dominated by mango and mango-based products (Box 5.1). Fruit juices and pulp account for 25 per cent of the total processed products, followed by ready-to-serve beverages (27%), pickles, preserves and chutneys (11%), frozen and dehydrated fruits, and vegetables (12 %).

At present, the value-addition in fruits and vegetable processing is estimated at 7 percent and processing is only 2 per cent. The expert committee constituted by the government of India has recommended increasing the value-addition to 35 percent and processing to at least 10 percent by 2014-15. The projected investment to achieve the target is about Rs.15, 000 billion (Table 5.2). The largest investment is proposed for Maharashtra followed by West Bengal and Kerala. Punjab and Andhra Pradesh account for less than 10 percent share in proposed investment.

Andhra Pradesh is the second largest producer of fruits and vegetables in the country. Mango, grapes, banana, papaya, sweet orange, pomegranate, onions, tomato and okra are the highest potential fruits and vegetables for processing 31. The state has recently

<sup>27</sup> An industrial undertaking is considered to be a small scale undertaking when the investment in fixed assets in plant and machinery does not exceed Rs 10 million. This criterion is in force from the year 1999 and applies to all units whether held on ownership terms or on lease or on hire purchase (subject to the condition that the unit is not owned, controlled or subsidiary of any other industrial unit).

<sup>28</sup> The fruit processing units in the state are concentrated mainly in Chittoor district due to the availability of mango the main raw material.

started exporting a small quantity of processed fruits and vegetables. At present, only fruit pulps, juices, canned fruits, jams, pickle and squashes are manufactured. The recent additions are frozen fruits, pulps, dehydrated and freeze dried vegetables, fruit juice concentrates and canned mushrooms.

Processing of fruits and vegetables is relatively underdeveloped in Punjab. Specific processed products that are produced from the horticulture sector in Punjab include tomato paste, potato chips, juices, squashes, jams, chutney pickles, *murabbas*, frozen vegetables, and ready-to-eat items (Box 5.2).

**Table 5.2 Projected investment in food processing sector in India.**

State	Projected investment	Share in projected investment (%)
Andhra Pradesh	6433	4.29
Karnataka	9864.4	6.58
Kerala	14142.2	9.45
Maharashtra	22786.4	15.19
Punjab	6529.6	4.40
West Bengal	15451.8	10.3
Total	1,50,000	100

Note: Based on the estimates of Department of Food Processing Industries, Government of India.

Source: Report of Expert committee on Strengthening and Developing of Agricultural Marketing, Department of Agriculture and Cooperation, Government of India (2001) pp 52

### **Box 5.1: Processing of mango pulp is dominant in Andhra Pradesh**

The value of mango pulp exports from India increased from Rs 267.5 million in 1991 to Rs 2,970.10 million in 2002-03. Andhra Pradesh accounted for about 40 percent (0.17 million t) of these exports. The state however, processes only 1.8 percent of its mango production (0.4 million t out of 2.4 million t production) (GOAP, 2001). Farmers benefit more if they have a tie-up with the processing units. It is reported that the net margins realized by the farmer was 21 percent if mangos are sold to processing unit compared to 4.6 percent if sold to traditional markets (NABARD 2001).

In Andhra Pradesh, Chittoor district of Andhra Pradesh is an important source for export of mango pulp. The success of Chittoor district in the export of processed mango products can be attributed to the successful functioning of the Agri-Export Zone (AEZ) for mangoes in Andhra Pradesh.

Despite high production of mangos, slow growth in mango pulp industry is attributed to: (i), lack of suitable varieties for pulp; (ii) high cost of complying HACCP (Hazard Analysis Critical Control Point); (iii) non-availability of credit as food-industry is treated as risky; (iv) high middlemen margins, taxes and packing cost that escalate prices; and (v) high incidence of pests in the raw material (especially fruit fly). Besides, the production constraints that affect the quality supply are related to lack of uniform practices for assessing fruit maturity, uncertain yields, and age-old crop management facilities

To revamp the existing processing industries to comply with HACCP, cost would rise approximately 40 percent that will make most units unviable and uncompetitive. Also, most of the processing units are small. Meeting HACCP requirements substantially raises their cost. Therefore, the mango pulp processors (exporters) are targeting low price markets (e.g. Gulf countries) where HACCP is yet to be enforced.

### **Box 5.2 Processing of Fruits and Vegetables in Punjab**

The Punjab has three categories of processing firms: (i) small scale (annual turnover of less than Rs. 10 million), (ii) medium scale (Rs. 10-100 million annual turnover); and large scale (>Rs 100 million turnover). Small firms universally rely on spot purchases and do not coordinate upstream with suppliers for raw materials. Such firms have limited contact with growers and relatively weak marketing and branding capabilities. On the other hand, large firms have high levels of market coordination, both in terms of the procurement of raw materials and in the creation and development of the market. One of the larger units (a mushroom canning unit) coordinates all production activities, from the growing of mushrooms, final packaging of end products in cans, and sales in foreign markets. Similarly, PepsiCo and Nijjer Agro Foods Ltd. were found to have a high level of market coordination in their activities. These firms procure raw potatoes, tomatoes and chilies under contract farming arrangements and sold its finished products (potato chips, tomato and chili paste) in both national and international markets under pre-negotiated conditions. Medium-sized firms had either medium or high levels of market coordination.

Small units operate in small local markets that rarely transcend state boundaries. Because most small companies produce traditional products, their sales are further limited by the small size of these markets in terms of demand. Medium sized units largely covered regional and state markets, yet their market penetration is low. Larger companies operate in national and global markets, tend to view their market as sufficiently large, and are confident of expanding their market. For example, Pepsi Co sells its potato chips throughout the country, while the mushroom processor exports its products to the US, EU, and other developed Asian countries.

#### ***5.2.2 Processing of meat products***

There is enormous potential to export buffalo meat. During 2002-03, buffalo meat export accounted for about 73 percent of total livestock export (APEDA 2002-03). But the slaughter laws do not permit culling of young animals so the quality of meat is not up to export standards. By-products from slaughter of animals form an important component and can be processed into high value-added products. However, due to poor abattoir conditions and improper recovery, the by-products are lost at the production point itself.

The poultry industry in the state of Andhra Pradesh is the fastest growing in the country. However, processed poultry meat accounts for less than 5 percent of total meat production. About one percent of egg production is processed for egg powder. In the state there are two plants that produce whole egg, yolk and albumen powder. Andhra Pradesh levies a four percent tax on poultry products in addition to the usual

sales tax on poultry feed. The poultry industry needs to be given a fillip since the state has a surplus production of eggs.

### ***5.2.3 Processing of marine products***

Shrimps accounted for 70 percent in the total value of marine products exports from India during 2001-02. However, the unit value realization remains low due to high compliance cost of SPS measures. Japan. (31%), USA (24%) and EU (19%) accounted for 74 percent of the value of India's marine product exports. These countries prescribe stringent measures under the guise of WTO. It is estimated that 10 percent of the market arrivals are wasted due to quality deterioration in the absence of proper cold storage and transport. Hence, it is important that the infrastructure at the primary market level be strengthened so that fishermen will be able to realize better prices.

In the short run, the government of Andhra Pradesh needs to take steps for enactment of aquaculture seed quality control Act, establishment of disease diagnostic centers, popularize alternative species that reduce cost of production and are in high demand, conduct farmer awareness, levy power and water charges to aquaculture at par with agricultural sector, and promulgate a comprehensive act for inland fisheries conservation, development and exploitation. The government has developed a draft comprehensive policy and schemes for the development of fisheries sector aimed at improving both production and quality through better regulation, improved infrastructure and modern technology.

### ***5.2.4 Summary***

In summary, the level of food processing is higher in Andhra Pradesh than in Punjab. In both the states, grain milling dominates the food processing industry. In Andhra Pradesh value-addition and processing is carried out in several HVCs such as mango, grapes, pomegranate, gherkin, tomato, broiler, egg and fish. In Punjab, agro processing is limited to dairy, potato, tomato and chilies. The higher level of diversification seen in Andhra Pradesh can be linked with the spread of processing to more number of HVCs, establishing the hypothesis that food processing acts as a catalyst in promoting diversification towards HVCs.

## **5. 3. Constraints faced by the agro-processing industry**

The food processing industry in the country is facing number of problems. These include (i) non availability of raw materials in adequate quantity and right quality, (ii) small size of units and obsolete technology, (iii) hostile regulations, government

policies, and high taxes, (iv) lack of post-harvest infrastructure, (v) inadequate labs for testing and certification of food standards, and (vi) lack of adequate financial support for product and market development.

All of the agro-processing units irrespective their size invariably face problems in sourcing the right quality (variety) of raw materials in required quantities for processing. Another problem is related with regular supply due to seasonality of the raw materials. To overcome such problems, some large processors (e.g., Pepsico), medium processors (e.g, Himalayan Foods and Sandles Air Con), and even small processing units (e.g, Swastik) source raw materials outside of the state and, sometimes, the country. These problems add to costs and escalate prices of final products.

In Punjab, some of the large scale firms have strong backward linkages within and outside the state. For example, the Nijjer Agro in Punjab is successful in sourcing raw materials by resorting to backward integration through contract farming and captive farming (Box 5.3). One of the units imported its raw materials of tomato paste from China to meet the quality standards, particularly related to *lycopene*<sup>32</sup> content, fixed by the marketing firm to whom it supplied the final product. Similarly, Pepsi procures raw material from outside the state during the off- season, when potatoes are not produced in Punjab.

### **Box 5.3 Overcoming raw material constraints by the Nijjer Agro Ltd**

Non-availability of raw material throughout the year has been one of the reasons for the failure of many processing units. Since the production of vegetables and fruits is seasonal, many units have to remain idle during the off-season, which increases their overhead and production costs, leading to unviable finance. The success of Nijjer Agro Ltd., in processing of vegetables is attributed to a good network of value-chain and adoption of multi-utility lines which facilitate cheaper and regular procurement and processing of vegetables. The multi-utility units optimize overheads and other capacities by diversifying product types and product ranges. The required raw materials are organized by entering into contract farming as well by practicing captive farming through leasing-in of land. The processing unit is optimally using the installed capacity through these arrangements.

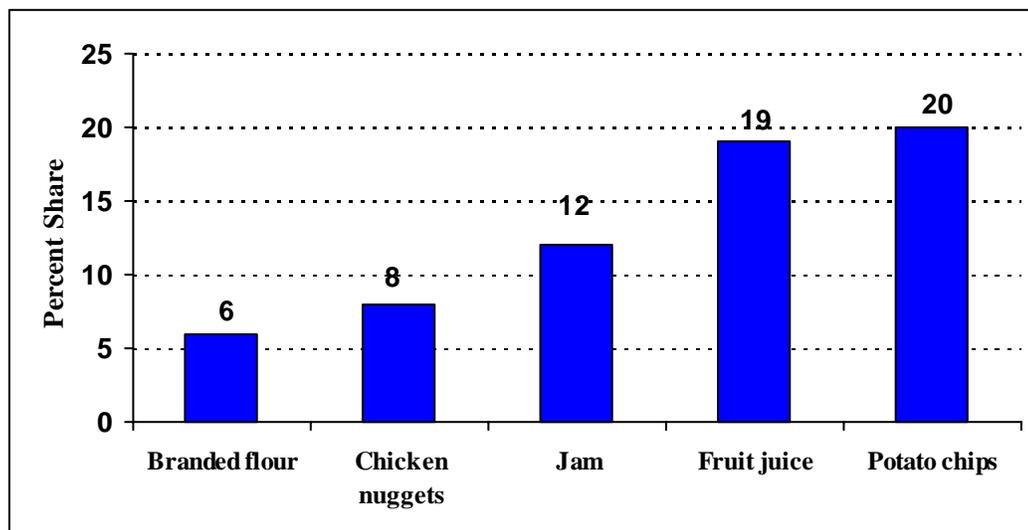
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<sup>32</sup> *Lycopene*, a red plant pigment, is a proven anti-oxidant that may lower the risk of certain diseases including cancer and heart disease.

The prevalence of multi-layered taxes on processed foods was also indicated as a major constraint by medium and large-sized firms and contributes to high prices and the slow growth in demand for processed food products by the processing industry as a whole. The tax levels on the processed foods in the country are one of the highest in the world. For instance there are central sales taxes (CST) on food products, state sales taxes, octroi, market fees and entry taxes and customs duties levied at various levels. The total of all types of taxes add to 21-23 percent (MOFPI 2004). Comparative taxes on processed commodities are 10 percent in Philippines, Indonesia and Malaysia, 14-15 percent in Netherlands and United Kingdom, and 17 percent in China and Ireland. High taxes add to the cost of final product that affects the prices and consequently demand.

The high cost of packaging is another major constraint considered to be adversely affecting the growth of agro-processing sector in India. Estimates reveal that the share of packaging cost in consumer price is as high as 20 percent for potato chips and 19 percent for fruit juice (Figure 5.1). Undoubtedly, good packaging is essential not only to preserve the freshness of the product but also to prevent spoilage and increase shelf life. High taxes on packaging material and absence of suitable technologies increase the cost of packaging.

**Figure 5.1 Share of packaging cost of important processed commodities in consumer price**



Source: Rabobank 2005

The plethora of laws<sup>1</sup> governing the food industry is another major problem faced by the food processors. Some of these regulations are administered by the central government and others come under the purview of the state government. For instance, while the central government imposes excise duty, the state governments impose sales tax, etc. Processors face a stiff challenge to meet all the regulations.

#### **5.4 Prospects for agro-processing in Andhra Pradesh and Punjab**

There are immense opportunities for promoting agro-processing in Andhra Pradesh and Punjab. In Andhra Pradesh, the most unfavorable and poverty-ridden area is dominated by sorghum production. The crop can be processed for livestock feed, manufacturing of beer and production of ethanol. Similarly, in Punjab, maize and barley crops are grown in relatively backward areas. Maize can become an important source of livestock feed as well as source of ethanol production. Particularly with the revival of the poultry industry in the state, demand for maize is bound to increase. Similarly, barley can be promoted for beer. Though barley beer is popular, sorghum beer is something new in India. Sorghum beer production is increasing in Africa where SABMiller, one of the world's largest brewers, has launched a new brand of clear sorghum beer which aims to help African sorghum producers, expand the sorghum growing industries, and create new job opportunities. ([http:// business.iafrica.com/news](http://business.iafrica.com/news)). Similarly, sweet sorghum and maize are now available for ethanol production to blend with petrol and diesel for producing Gasohol. Mango is a case where Andhra Pradesh (especially coastal region) can take lead. Punjab can lead on citrus juice. A joint venture of PepsiCo with the government of Punjab has aggressively launched production of citrus fruits. It is projected that Punjab would be the hub for PepsiCos's orange juice for South and Southeast Asia. Other examples are grapes for wine and tomato for ketchup.

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<sup>30</sup>There are laws that govern a specific commodity or a group of commodities. And, there are separate laws relating to weights and measurements, packaging, adulteration, etc. These laws are administered and implemented by different departments and/or ministries. For instance, Prevention of Food Adulteration Act 1954 is implemented by the Ministry of Health; Agriculture Produce (Grading and Marking) Act by the Ministry of Rural Development; laws related to standards, weights and measurements are under the jurisdiction of Ministry of Civil Supplies, Consumer Affairs and Public Distribution and the laws related to environment are implemented by the Ministry of Environment and Forests. For setting up an agro-processing unit an investor has to get clearance from all the concerned departments. Such multiplicity often results in conflicting approaches, lack of coordination and administrative delays.

## 5.5 Policies initiated to promote food-processing industries

To address some of the concerns relating to the food processing industry, the government of India has initiated a series of measures during the last few years to reform policies related to agro-processing industry. These include (i) liberalized import of technology and foreign technology tie-ups, (ii) 100 percent foreign direct investment in agro-processing sector, (iii) reduced duties on import of capital goods, (iv) equity participation, (v) hiring of foreign consultants to facilitate flow of investment and managerial capabilities, and (vi) agri-export zones.

Besides the above measures, all food processing industries, barring those manufacturing beer, potable alcohol and wine, have been de-licensed. A draft 'Food Processing Policy' has been prepared by the government of India (Box 5.4). The government of Andhra Pradesh has also come out with a separate policy document based on the food policy of the central government.

### Box 5.4 Food processing policy draft (2005)

The document has been developed for speedy development of food processing sector in the country. The policy expects food-processing industry should grow at the rate of 7.3 percent per annum in the next five years. Emphasis has been proposed on the following aspects: (i) measures to reduce cost of production and make processed foods affordable; (ii) consolidation of the supply chain to reduce transaction costs; (iii) enhance research on packaging to arrive at cost-effective solutions; (iv) incentives to large food retailers for procuring fresh produce from farmers or at best villages and make it directly available to consumers; (v) improve infrastructure facilities like post-harvest handling, cleaning, grading, packaging and storage; (vi) upgrade physical marketing and warehousing infrastructure; and (vii) entry of government in joint ventures to build and operate infrastructure facilities.

Source: Ministry of Food Processing, Government of India 2005 Draft food processing policy 2005. <http://www.mofpi.nic.in/fpipolicy.htm>

To ensure proper quality of processed foods, the enforcement of the Food Products Order (FPO) 1955, has been made more stringent. This Order regulates product specifications and hygienic conditions in the manufacture of food products. The quality aspect is being spruced up to comply the sanitary and phyto-sanitary and hygiene norms that are becoming stringent in international trade. The Export

Inspection Act provides for pre-shipment inspection of export consignments by the Union Ministry of Food Processing Industries. This has helped in creation of quality consciousness among the exporters of processed fruit and vegetables.

### **5.6 Concluding Comments**

The food processing industry in India is in a nascent stage and is dominated by the grain-milling sector. There is a vast scope for improving the level of agro-processing for high-value agricultural commodities as the level of value-addition and processing are low. Hardly 50 per cent of the installed capacity is utilized in case of fruits and vegetable processing units. Food processing is subjected to many problems that relate to non-availability of raw material, multiplicity of laws relating to its functioning and high level of taxation. The preferences for fresh foods further constraints the effective demand for processed foods aggravating the problem of processors. The government is setting up food parks, agri-export zones, supporting investments through tax concessions in different parts of the country to encourage processing and value addition. However, the success achieved so far is limited and hence more thrust is needed to make this sector vibrant. The creation of infrastructure for preservation, cold storage, refrigerated transport, rapid transit from production to processing centers, grading, processing, packaging and quality control go hand in hand for the success of the food processing industries.

## Chapter 6

### Conclusions and Policy Recommendations

Indian agriculture is diversifying towards HVCs in response to rising per capita income, changing food consumption, increasing urbanization, unfolding globalization, improving infrastructure and reforming policies. However, the speed and pattern vary in different regions. For example, Punjab with better natural resource endowment is less-diversified as compared to Andhra Pradesh with less-favorable natural resources.

Agricultural diversification towards HVCs suits the needs of smallholders. HVCs yield higher, more regular and earlier returns compared to food grains. Employment generation and conservation of water resources are additional advantages of agricultural diversification. Smallholders and women are participating more in production of HVCs.

But the speed of agricultural diversification towards HVCs has not met expectations mainly due to lack of appropriate markets, institutions and infrastructure as well as lukewarm policy response. Higher wages in labor-scarce regions may also inhibit their growth as HVCs are generally labor-intensive.

We would suggest that the changing scenario demands a much different role for Government in the future than it has exercised in the past. Food security is much more than foodgrains self-sufficiency alone.<sup>34</sup> Economic forces, led by market demand – domestically and globally – if allowed to operate, will drive the road to diversification. The private sector will provide the leadership. Increased incentives can contribute to “getting prices right”. Strengthened institutions can change the rules of the game in addition to the organizations in which they are embedded, for example prices will never truly be effective allocators of resources if markets are not effective, so the challenge is also to “get markets right”. Increased investment can provide the physical infrastructure and technologies to create and move inputs, services, and commodities.

In the changing environment, it is as important to specify what Government should not do as well as what it should do. It is equally important to present policies as a package in order to provide tradeoffs to gain the necessary political support. Political forces will dictate whether, and what parts of, the recommendations are adopted. Some individuals will benefit more and some will benefit less or even lose on individual parts. Often many individuals benefit a little, a few lose a lot; and the few organize

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<sup>34</sup> Availability is the key and as long as India has adequate foreign exchange reserves, based on comparative advantage, it is perfectly ok to import foodgrains or any other food. There are many foods other than foodgrains in the diet.

and defeat the many. If done correctly, a package of investments and policies can provide trade-offs in which all individuals – or at least, most -- net benefit. The role of Government, therefore, should be to provide 1) public goods – particularly infrastructure and research – and 2) policies to facilitate, guide, and monitor an inclusive process so that the pace accelerates and benefits are distributed widely. It should focus on improving incentives, strengthening old and creating new institutions, and increasing investments.

## **6.1 Improving Incentives – “Getting Prices Right”**

Prices set by freely operating markets, unhindered by administered levels, subsidies, or restrictions, are powerfully efficient and effective allocators of economic resources. The package should embrace changes in grain management, market charges, subsidies, and trade/tariffs.

### ***6.1.1. Reform Grain Management***

Why is the current, outdated system of public foodgrains management a constraint to diversification? The Government, through a Minimum Support Price (MSP), “contracts” with farmers to purchase all the wheat and rice they produce at high, stable and assured prices to provide food for the Public Distribution System (PDS). The rationale for continuing this practice is highly questionable

- Benefits have declined and costs have sky-rocketed.
- Development of private sector marketing, which can do the jobs more effectively and efficiently, is inhibited.
- Guaranteed high returns for wheat and rice and their assured procurement provide incentives for which high-value commodities, for which both production and price risks are high, have difficulty competing.

The grain management policies cease to be cost effective and pose as a hindrance to promote high value agriculture. The key challenge is to moderate the role of public sector that provides a level playing field for the private sector in the foodgrains management. In order to smoothen the distortions in the foodgrains market and promote high value agriculture, the following are suggested:

- Decouple price support from procurement, that is, decouple MSP as protection against price risk from using it to augment income.
- Mitigate farmers against the risk of precipitous fall in prices by setting the MSP at A2/paid –out-cash-cost levels.

- Stabilize market prices in an open economy environment somewhere within a band bordered by f.o.b and c.i.f prices. A variable tariff policy consistent with WTO rules (bound rates)
- Procure foodgrains at market prices, where markets are freed from movement, storage and trade restrictions.
- Target public distribution to the poor through introduction of food coupons in due course.

### ***6.1.2 Reform input subsidies.***

Why are input subsidies a constraint to diversification? Subsidies have accomplished the objectives for which they were originally intended. Fertilizers, irrigation, and electric power are now being provided at low, sometimes zero, costs. But:

- Subsidies are promoting input-intensive agriculture, specifically wheat and rice.
- Productivity of wheat and rice is stagnating (marginal returns to fertilizers and water are low).
- Distribution of benefits is increasing inequities in incomes and regions. Because of landholding distribution, the largest amount of subsidies goes to medium and large farmers despite the fact that the subsidies have been justified, in part, to benefit the smallholder.
- Effectiveness of institutions supplying irrigation and power is severely compromised.
- Resources are misallocated (paddy is being sown too early, too much nitrogen is applied relative to phosphorus and potash, too much water pumped and applied, especially for rice). There is harmful effect on the environment— the water table is declining rapidly in the central region and land is being lost to salinity, especially in the south-western region), threatening irreversibility.
- Costs of subsidies are massive and mounting rapidly, diverting budgetary support from investments with higher return, that could support diversification.

As far as the irrigation and power sectors go, we find ourselves in a Catch-22 situation (Gulati and Narayanan, 2002). Given that the input-supplying institutions are in financial doldrums, as is the state that must ultimately bear the burden of the subsidy, it is imperative that these agencies recover the costs so that they become financially

viable. This would entail a manifold increase in water and power rates. The subsidy on fertilizer is huge and fertilizer is being applied on wheat and rice at or above recommended levels. Fertilizer components are out of balance (too much nitrogen relative to phosphorus and potash) and marginal responses to fertilizer are low, if not negative. This probably explains to a certain extent the stagnating yields of rice and wheat. Therefore it is suggested

- Dismantle the Retention Price Scheme that increasingly rewards the industry rather than the farmer and bring fertilizer prices more in line with economic costs.
- Gradually increase irrigation pricing to at least cover operations and maintenance (O&M) costs.
- Introduce variable pricing for peak/slack power periods, using metering and target subsidies (using pre-paid cards) to smallholders.
- Dismantle/unbundle the State Electricity Boards and privatize parts – generation, transmission, and/or (especially) distribution -- of its components with the objective of improving quality and establish and promote user committees to monitor quality improvements in power distribution.
- Establish and promote water-user associations to improve maintenance and equitable allocation of water, make them truly participatory, and devolve powers by the irrigation department

This will enable to free up public resources for investment in rural infrastructure essential to promote diversification from the traditional crops towards high value commodities.

### ***6.1.3. Reduce market charges for HVCs***

The Punjab government has tried to promote agricultural diversification by exempting market fees for those engaged in contract farming in fruits and vegetables. Market fees are also exempted for private entities that purchase wheat or rice for processing purposes, while fruit and vegetable processors that are not involved with contract farming receive a four-year exemption from market fees. These fee reductions are important from the standpoint of cost savings by buyers, given the structure of market fees currently in place. In essence, taxes for buyers fall from their current 11.5 percent, the highest in India, to 4 percent, since private sales via contract farming would also avoid commission charges by agents in *mandi* yards.

While these reductions on market fees are important to remain competitive with other states and in overseas markets, they should be applicable to all elements of agribusiness activities in addition to contract farming. Naturally, however, such a proposal would have a fiscal cost, as exempting high-value produce from the market fees currently imposed in *mandi* yards would reduce the amount of state revenue available for rural development and infrastructure activities, for example. It would potentially have some political implications as well, particularly from commission agents who would stand to lose from a greater proliferation of private sales yards that bypassed *mandis*. However, lowering tax levels may not necessarily reduce tax revenues by as much as feared, given that it could induce higher growth than without such tax reductions by increasing the number of participants and demand in the sector.

## **6.2 Strengthening Old and Creating New Institutions – “Getting Markets (and Other Institutions) Right”**

Operation of an active, competitive, private marketing system is essential to successful agricultural development in general and to accelerated transition to diversification in particular. Strengthening other existing institutions and creating new institutions is also important.

### ***6.2.1 Facilitate strengthening of private marketing through reforming the Agricultural Produce Marketing Committees (APMC) Act, abolishing the Essential Commodities Act, eliminating movement and storage controls.***

The key for greater private sector participation in marketing are policies that reduce *uncertainty*. At present, the public grain management system imposes significant amounts of risk on private sector participation by crowding out private activities and reducing the profitability of functions within the supply chain.

The model APMC Act tabled by the Government of India aims to improve the environment in which agricultural produce can be marketed, allowing for private market yards, direct sales and procurement between farmers and the private sector, promotion of contract farming and public-private partnerships, and rationalization of market fees and licensing requirements. State governments have made progress in adhering to a number of these components, including the re-definition of market yards to include private yards that have received a license from the state government and exemption of market fees for private entities that purchase wheat or rice for processing purposes.

Two main areas for reform are required. First, contract farming relationships need to be strengthened as per the conditions spelled out in the model APMC Act. This Act requires the strengthening of contract farming relations in a manner that protects both the interests of the farmer and buyer. In particular, the model Act strengthens the contract terms to protect the interests of both the buyer and seller by more clearly spelling out each party's obligations under the contract. Farmers are not allowed to renege on the contract simply if prices rise above the contracted price. Moreover, the model Act contract addresses issues of insurance, in case of crop failures, and formal remedies for arbitration, should any breach of contract be recorded, at a state government level. However, such reforms remain stalled. Indeed, the approach taken state governments to promote diversification through contract farming may work against such types of arrangements. Clear-cut (formal or otherwise) rules are required for contract relationships to evolve over time.

Second, while private sales yards have been allowed, it is not clear from the legislation whether direct sales between farmers and processors at the processor's gate (for example) are permissible or how easily licenses to establish private sales yards can be procured. More research on this is required, but the creation of transparent mechanisms to facilitate private sales yards is a crucial step to enable the unimpeded access of agribusiness to farmers, markets, and infrastructure to improve the volume and quality of transactions among high-value products.

Similar reforms that make the reforms of the Essential Commodities Act (ECA) permanent, including abolishing restrictions on private movement and storage, would also enhance stability in the grain sector for private sector actors.

Public operations, such as open-market sales, should be more predictable and transparent, so that the private sector can take these actions into account in planning its own operations.

The rationale for Government monopoly of either foodgrains imports or exports is clearly no longer valid. The experience of Bangladesh clearly demonstrates the value of opening imports and exports to the private sector.

### ***6.2.2. Establish a system of warehouse receipts, normalize grades and standards, and strengthen futures markets***

Four additional actions should also receive support. First, the system of warehouse receipts should fully recognized and encouraged. This will permit farmers as well as traders to responsibly hold stocks to utilize seasonal and spatial price advantages. Second, grades and standards should be normalized, strengthened, and enforced. Fair-average-quality (FAQ) is too loose a standard on which to base either a warehouse

receipt system or futures marketing. A system of enforceable grades and standards is essential to active participation in the international market. A system of enforceable grades and standards would greatly facilitate efficient and effective operation of the domestic market. Supermarkets and processors will develop their own systems of grades and standards which should set the standards for nationwide norms. Third, futures markets in all major commodities should be strengthened. This would be a powerful market-compatible means of stabilizing seasonal as well as year-to-year prices. Finally, it would be very useful to establish a price analysis and forecasting unit within the government to provide information, made available to all interested parties on a timely basis, on which to supplement private sources of information to facilitate planning.

### ***6.2.3 Promote agro-processing<sup>35</sup>***

Food processing acts as a catalyst in promoting the growth of HVCs but is in a nascent stage in India due to many problems faced by the industry. A draft integrated food law has been formulated by the government of India wherein all the activities of entire value-chain related to processing from sourcing of raw material to transportation, storage, grading, packaging, labeling, taxation etc, will be dealt by a single agency. Speeding up the implementation of this proposed act is crucial for the development of

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<sup>35</sup> In developing countries, public-private partnerships can harness the opportunities for smallholders and agri-businesses. But this is a new concept in India. Historically, due to the perceived presence of scale economies and demand externalities, management of grain sector, and provisions of services were entrusted to the government. Strict regulation and control measures on private infrastructure service providers were imposed apparently on the grounds of preventing monopolistic exploitation. However, because of the poor quality of publicly-provided infrastructure services and also due to the inefficient operations, the private provisions of these services are now being welcomed. This policy change is being argued to meet twin objectives: (i) bring in competitive forces and efficiency in the public enterprises, and (ii) ease the subsidy burden of the government.

An effective public-private partnership would immensely benefit smallholders and agri-businesses. Three successful case studies in selected developing countries are worth mentioning to illustrate the success of public-private partnership in promoting high-value agriculture (Anonymous 2005). First, Brazil's national agricultural research organization (EMBRAP), developed technology for small-scale processing of cashew nuts by working with an exporter and local producers. Second, for more than 30 years, the Chilean Institute partnered with a brewery to finance the breeding of barley varieties suited to Chile's climate. Third, Uruguayan farmers, millers, bakeries, and other stakeholders formed a partnership to improve the competitiveness of Uruguayan wheat. Drawing lessons from different success stories on public-private partnerships, government of Punjab in India is tying-up with Pepsi India and farmers to facilitate production, processing and marketing of orange juice. These examples suggest that partnerships facilitated the process of involving smallholders into HVCs. It is expected that public-private partnership would (i) allow pooling of resources and risks in investments to create mutual benefits, (ii) combine efficiencies of the private sector with the social equity aspects of public intervention, and (iii) create opportunities for knowledge sharing, joint learning, scale economies and cost sharing.

the food processing industry. Taxes on processed foods and packaging material need to be reduced to promote food processing industry.

There is 100 percent FDI allowed in food processing sector. But it has not received enthusiastic response from multi-national agri-business firms. Hostile regulations, plethora of laws, bureaucratic obstacles and high taxes are key deterrents for domestic and multi-national firms.

#### ***6.2.4 Facilitate credit and insurance***

Credit is an important requirement for the production of HVCs due to high initial investment, high input costs and, sometimes, long gestation periods. In the absence of formal credit, farmers have to rely on informal credit which charges exorbitant interest rates. All farmers including share-croppers, tenant farmers, and women should be eligible for loans. Alternatively, banks may consider crop loans to tenants on group-guarantee basis. Insurance premium on commercial crops should be reduced since high premiums detract farmers from taking insurance and thus are not eligible for loans. *Kissan* credit card scheme may also be promoted in less endowed regions which are emerging hub for HVCs. The number of regional rural bank (RRBs) branches should be increased and this should be accompanied by an increase in credit flow. The functioning of RRBs and Cooperatives need to be improved as they often suffer from political interference, lack of professionalism and end up as loss-making units.

Risk mitigation strategies are an important component to promote high-value commodities as they face more risk in production, markets and prices. HVCs are often pursued in rainfed areas that face vagaries of weather and biotic and abiotic stresses. Markets are often thin. An active crop insurance market, in which farmers paid private premiums to insure their crops against the vagaries of weather, disease, etc. would provide a type of safety net for farmers that is presently lacking.

#### ***6.2.5 Improve extension***

Access to information related to latest technologies, prices and availabilities of quality inputs are critical for promoting HVCs. It is suggested that the extension focus may be changed from food crops to HVCs, and also from production to entire value-chain. The government of India's agricultural extension policy framework, 2002, signaled an intension to focus on increasing farm household income through diversification. The goal is to make extension more market-driven, promote public-private partnerships and withdraw public extension where farmers are willing to pay. The demand for paid services in India is higher in non-food grain crops especially horticulture crops and oilseeds (World Bank 2005).

The relevance and effectiveness of the agricultural extension service has been increasingly compromised as a result of inability to adapt to changing needs. Linkage with research is weak, operating budgets are limited, and accountability is limited. The system is ill-suited to meet the demands of a market-driven and diversified agriculture. A partial answer may be to limit the responsibilities of the public sector system; focusing on recommending economic and balanced use of major nutrients might be one priority. A second answer may be to privatize certain responsibilities. A third response might be to actively encourage, perhaps even providing incentives, the private sector to increase their extension efforts, with a primary motivation to (responsibly) increase sales. The World Bank (2003) suggests redefining public-private roles in the extension services currently being provided and privatizing as appropriate. For example, they suggest that input-related services such as planting materials, fish fingerlings, and veterinary services should be privatized. With sophisticated farmers and a commercialized agriculture, there is little reason for the public sector to remain engaged in these activities, beyond regulatory oversight.

#### ***6.2.6 Reform land-lease laws and regulations***

Indian agriculture has been undergoing fragmentation of landholdings and is increasingly dominated by smallholders. However Punjab is an exception with an average landholding size of 4.03 ha as against the national average of 1.37 ha. Therefore the transition from cereal-based to high value commodities should be smallholder inclusive and help them participate and maximize the benefits. While smallholders can be part of the diversification process, larger holdings have advantages. Production risks can be spread over larger acreages. Larger production increases the bargaining power in negotiating sales of production.

Indian laws and regulations limit both sales and leasing of land. We think that both should be relaxed, but especially land lease laws and regulations should be liberalized. Properly carried out, land leasing can benefit both parties. By spreading risks of both production and increasing bargaining power in marketing, more responsive land-lease laws and regulations should facilitate diversification.

### **6.3 Increasing Investments in Public Goods – Infrastructure and Research**

Finally, the role of public goods – especially in infrastructure and research -- in promoting HVCs can not be over looked.

### ***6.3.1 Improve physical environment in which HVCs operate***

Appropriate infrastructure contributes in reducing the inefficiencies in handling and losses during post harvest management. It includes development of markets (specialized markets for fruits and vegetable, meat, fish etc), cold chains, refrigerated transport to capture distant markets, rapid transit facilities, and better storage. Cold chains provide opportunity for producers and processors to store their products and sell them to distant markets when local markets are not favorable, in addition to enhancing the shelf life of the produce. Treating the produce kept in the cold storage in par with the warehouse receipt<sup>36</sup> will greatly help the farmers to get the required finance.

The existence of physical and marketing infrastructure, such as roads, cold storage, and packing facilities would add value to produce, improve quality and farmer prices, and reduce losses in handling and transport. *The Economist* (June 3-9, 2006) reports that it takes eight days, including 32 hours waiting at checkpoints, inspection points, and toll booths, for a lorry to crawl (averaging 11 km per hour) the 2,150 km. from Kolkata to Mumbai. The current public marketing system is characterized by congestion in *mandis*, poor sanitary conditions and lack of market transparency. (World Bank, 2003) The condition of fruits and vegetables markets is especially poor. Support services like grading, standardization, and information systems have suffered and quality improvements have been lacking. The marketing system is such that the farmer has little incentive to improve the quality and cleanliness of produce. Improved infrastructure would assist in reducing price variability within seasons and open new markets (domestic and export). One area of good news is the rapid spread of cell phones, reportedly at a rate of five million per month, over India. Every trader and many farmers regularly use cell phones. Computers are also rapidly being adopted in markets throughout India, providing instant links on prices, quantities, qualities, etc.

Andhra Pradesh can take the natural advantage of having nine ports and four airports in the state. These ports and airports need to be upgraded in view of changing trade scenario and link them with road and rail. Similarly, Punjab needs to upgrade its airport and may promote more flights to Middle East, European countries and Central Asia to become a hub of export for neighboring states.

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<sup>36</sup> Warehouse receipts for food grains are negotiable instruments, which can be used to raise pledge loans at concessional facilities. The receipt of cold storages are not treated as warehouse receipts

Electrification will be necessary for storage and processing . A reliable and uninterrupted power supply mechanism can control substantial post harvest losses. This in turn will have a positive impact on the availability of these commodities and stabilize their prices. It is widely held that power sector reforms for rural supplies can boost up cold storage chain, agro processing in rural areas. Farmers are willing to pay a price provided they get regular quality supply.

### ***6.3.2 Strengthen agricultural research on high-value commodities***

One cannot underestimate the power of agricultural research. It was the key to the Green Revolution in wheat and rice. It also could be the key to transition to high-value commodities through fruits, vegetables, dairy and poultry. It is important to make a distinction between table variety and processable variety of fruits and vegetables. This requires advanced cultivation practices that can help farmers grow the right variety.

The proportion of agricultural sector domestic product going to research is similar to other states, but low even compared to all developing countries. (The World Bank, 2003) The allocation of research funds within the Punjab Agricultural University (PAU), which is the major research arm in the Punjab and which made major contributions to wheat and rice technologies, has been slow to respond to new demands for a diversified agriculture. The share going to horticulture, livestock, and post-harvest has either stagnated or decreased slightly. Research on marketing, policy, integrated pest and nutrient management, and organic farming has been especially weak. Although water is a critical input, a comprehensive research strategy for addressing water management has been lacking. Research is operated through a large number of schemes which spreads resources thinly.

The private sector could be a vital contributor to research. However, the Bank notes that large private agribusiness investors in high-value commodities in Punjab have largely imported their technologies from elsewhere and have depended little on PAU technologies. Given the heavy dependence on imported technologies until the PAU gets reoriented, modernizing quarantine practices becomes a priority for near-term, if not longer-term, success.

### ***6.3.3 Use of Information and Communications Technologies***

Lack of access to information about cultivation practices, post harvest technologies and markets is often cited as a major limitation in promoting high value agriculture. Both production and profitability of growing high value crops are adversely effected due to poor access to information and communications technology (ICT). In India the high cost of ICT infrastructure, local information contents coupled with illiteracy,

lack of skills to use it and awareness of the benefits coupled have been holding back major upscaling of these services. Despite these limitations, efforts are being put forth to enhance the quality and accessibility of ICTs much on lines of the ITC e-choupal initiative.

#### **6.4 The Bottom Line**

Indian agriculture has reached a point where it must make significant changes if it wants to move forward.

So long as:

- The Government continues to contract for wheat and rice at high, stable prices,
- The marketing system is geared to wheat and rice,
- Price subsidies for power and irrigation favor water-using crops, and
- The research system focuses on wheat and rice

all the incentives are stacked in favor of wheat and rice.

However, demand for wheat and rice is slowing perceptibly. Little additional land can be sown to wheat and rice. Yields of wheat and rice are stagnating. Thus, increases in incomes from wheat and rice are limited, even in the short-run. Add to this, the declining water table, increasing salinity, deteriorating soil nutrition, and increases in incomes are even more limited, if not reversing, in the longer-run.

Diversification could be the answer – but will require fundamental changes in incentives, institutions, and investments. If India does not rationalize incentives, create new institutions and reinvigorate old ones, and increase investments significantly, it will suffer declining income and employment and irreversible environmental degradation.

We understand that when change does not take place, there are reasons. We recognize that reforms can be hindered by the fact that important stakeholders as well as researchers can have rather different, and often opposing, views about essential facts, causal mechanisms, and appropriate policy solutions. (Birner, et al, 2006) For example, we recognize that not all parties accept that the falling water table is the direct result of subsidized electric power or even subsidized electric power leading to early sowing of paddy.<sup>37</sup> The popular perception is that high transactions costs for

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<sup>37</sup> Alternative policy options to reduce the amount of electricity consumed include:

- (1) promotion of energy-saving devices such as capacitors or more efficient motors, using (a) incentives or (b) regulators (Note: This would not necessarily reduce groundwater depletion.);

metering, necessary to enforce pricing reforms, would be prohibitive.<sup>38</sup> This dilemma calls for a concentrated effort to lay all the evidence on the table, debate it openly, identify differences, and then see if they can be reconciled. Open communication is especially vital to effective policy change.

We recognize that policies which, by themselves, seem inappropriate, when examined in the context of off-setting other policies, appear to be less inappropriate. For example, Indian policies – import restrictions, movement restrictions, levies – generally have suppressed foodgrains prices to respond to consumer concerns. Input subsidies have been justified, in the minds of some, as a means of providing profits. This policy combination has been described as “one foot on the brake and one foot on the gas peddle”. Another example is the justification for subsidies as benefiting the small and marginal farmers. In these cases, reforms would be difficult without offsetting changes in the other policies.

We also recognize that some policy changes may be more controversial than others. For example, unbundling of generation, transmission, and distribution may not be so controversial. However, privatization of the functions evidently is very controversial. Increasing fertilizer prices, without some offsetting gains, is also likely to be controversial. However, increasing power rates in return for guarantees of increased quality or increasing irrigation rates in return for more user control and higher operations and maintenance may be less controversial. And increasing surface irrigation to reduce groundwater needs or increasing research and extension would probably not be controversial but would face budget constraints. Finally, we recognize that some policies, for example, the fertilizer subsidy or the MSP, are national responsibilities while others, for example power or irrigation pricing, are state responsibilities. Putting together packages of these policies would involve working at several levels of government, with a wide range of interest groups, simultaneously.

The sequence in which activities are undertaken often becomes very important in the planning process. As with most approaches that seek to encompass a system in a holistic manner, the number of factors that have to be investigated in the agricultural sector are large indeed. Everything cannot be done everywhere at the same time.

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- (2) Further restrictions of the amount of electricity supplied to agriculture (rationing) by (a) simply reducing the hours of supply or (b) adjusting the supply better to crop needs;
  - (3) Promotion of less water-intensive crops using (a) restrictions or (b) incentives such as the promotion of crop diversification;
  - (4) promotion of water-saving practices in paddy cultivation;
  - (5) expanding and/or improving the efficiency of canal irrigation, as a means to reduce the need for groundwater irrigation.

Each of these options introduces issues which would have to be addressed. (Birner, et al, 2006)

<sup>38</sup> Technical experts do not foresee this as a major problem.

Resources – financial and human – are scarce. Necessary changes in some policies that are not possible immediately, may be possible after other changes have been undertaken.

The dilemma can be remedied by focusing on key activities. F.F. “Frosty” Hill, former Vice President of the Ford Foundation, recommended: “Search out the key log in the jam and attach it first. If the key log is immovable, waste not your efforts thereon but move to the second log. Remember not to dissipate all your energy on one log in the jam for there are others that also await your attention.”

Our package of solutions is large. It is, in our view, a set of first-best solutions. We have to admit that we do have priorities. Highest would be 1) reform of the public foodgrains marketing system<sup>39</sup> – particularly decoupling of MSP and procurement which, we presume, could leave ample profitability for wheat and rice producers while making HVC more competitive for returns -- and consequent strengthening of the private marketing system and 2) facilitating operation of new institutions and strengthening linkages of farmers to processors and retailers which, we presume, would unleash a wave of HVC value-added activity to satisfy rapidly growing demand. We place high priority on reforming subsidies but even higher priority on “getting the institutions right” before/simultaneously with “getting the prices right.”

India is clearly at a cross-road. All incentives are stacked in favor of wheat and rice. The situation is not yet at a crisis. Incomes are stagnating in the near-term. However, in the longer-term, changing demand and deteriorating environment will lead to progressively decreasing incomes. Keeping to the current course does not promise an attractive future.

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<sup>39</sup> Mainly the responsibility of the national government.

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