Re-energizing Agricultural Sector of Andhra Pradesh

From Food Security to Income Opportunities

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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 Government of Andhra Pradesh have been used extensively in this report.

Usual disclaimers apply.

Executive Summary

In recent years, Andhra Pradesh has attracted public attention on two fronts: (i) the boom in the Information Technology sector—between 1992–93 and 2001–02, the state witnessed an increase in the number of software companies from just 26 to 1200 and in the export of software from US$ 1 million to US$ 400 million; and (ii) suicides by farmers—between 2000 and 2005, a total number of 1,835 farmers committed suicide in the state. Such a contrasting performance is an indication of the widening economic inequities in the state—and growing stress in agriculture. Acute water deficiency due to successive droughts is adversely affecting agriculture in the state; on an average, in a cycle of five years, three are drought years of varied intensity. This has led to a decline in net irrigated area (by 14 percent between 2000–01 and 2004–05), net sown area (by 7 percent between 2000–01 and 2004–05), and production of the majority of crops (rice production has declined to below the level achieved ten years earlier).

The slump in agriculture, although accentuated in the current decade, had already begun in the 1990s itself. Average annual growth in agriculture was -1.96 percent between 2000 and 2005 as compared to +1.98 percent at the all-India level. During the 1980s, agricultural growth was higher (3.4 percent) than the national average (3.3 percent), but significantly fell in the 1990s (2.3 percent compared to the national average of 3.00 percent). The overall impact has been reflected in declining total factor productivity (TFP) of the crop sector—from 0.23 percent per annum increase during the 1980s to 0.17 percent per annum decrease during the 1990s.

The poor agricultural performance has led to increased rural indebtedness (in 2003, approximately 82 percent of households in the state were indebted compared to 48.6 percent at the all-India level), and failures to repay loans have compelled farmers to leave agriculture in search of livelihood opportunities and shifted rural poverty to urban areas (26.6 percent of the urban population is below the poverty line (BPL), compared to only 11 percent of the population in the rural areas).

These are alarming signals and imply that agriculture is in deep crisis. What are the options available to augment agricultural incomes and how can the poor improve their livelihoods?

Agriculture under Stress

Agriculture is still an important economic activity for over 70 percent of the total population in Andhra Pradesh. The state has the advantage of having nine ports (including India's largest major port at Visakhapatnam) and four airports (including

one international). Almost all the villages are electrified (compared to only 84 percent at the all-India level). However, the state has poor road, rail, and market connectivity as compared to many states in India. The state does not have superior natural resources for agriculture, especially in the Telangana and Rayalaseema regions, suffering from recurrent droughts, numerous pests, and poor soils. The state lags in technology adoption (only one-third of the total cereals area is under high-yielding varieties compared to nearly half at the all-India level). It has very low density of tractors (one-fourth of the all-India level) and low irrigated area (same as the all-India average of 40 percent of the net sown area), with a very low cropping intensity of 123 percent (compared to the all-India average of 134). The average size of holding is 1.37 ha, and about 81 percent of total landholders are smallholders who control 43 percent of the operational area. They cannot hope to make a decent living by growing traditional crops alone in tiny pieces of land, especially in view of the declining TFP in the crop sector.

The agricultural production environment is also deteriorating. There is high pressure on groundwater due to drought conditions and distorted policies, especially free power. As a result, groundwater has been increasingly exploited; 22 percent of *talukas* (blocks) are now characterized as dark zones. Rayalaseema region, where 35 percent *talukas* are overexploiting groundwater, is the worst affected. Efficiency of important canal irrigation projects is as low as 35 percent. And, about 11 percent of canal-irrigated area has become saline and waterlogged due to mismanagement, largely driven by low water rates. Similarly, subsidy to nitrogen is leading to imbalanced use relative to other nutrients (the nitrogen, phosphorus, and potash (NPK) ratio deviated to 6:2.4:1 in 1990, 10:2.9:1 in 1996–97, and 7:2.6:1 in 2003–04 as against the recommended level of 3:1.5:1). Micronutrient deficiency is becoming more critical (almost half of the soil samples in the state show zinc deficiency).

The Challenge for Traditional Crops

The major traditional crops (rice, coarse cereals, cotton, and groundnuts) have experienced declining trends in area (and consequently fall in production) during the period 2000–05. For example, rice production has decreased due to a steep fall in the irrigated area, down by 27 percent between 2000–01 and 2004–05, due to consecutive droughts and poor operation and maintenance (O&M) of the canals and distributaries. Though paddy yields in Andhra Pradesh are higher than the all-India average (4.8 tons per ha compared to 2.9 tons per ha for all-India; topped only by Punjab), the profitability is lower than in many low-yielding rice growing states. The C_2 (also A_2)

cost of rice production in Andhra Pradesh exceeds the cost in Punjab and neighboring rice-producing eastern states (namely Assam, Bihar, Orissa, and West Bengal), although Andhra has comparative advantage over neighboring southern states (namely Karnataka and Tamil Nadu). Often the C_2 cost of rice in Andhra Pradesh is higher than the minimum support price (MSP) announced by the government. Nevertheless, guaranteed procurement at a stable and increasing price provides a continuing incentive to grow rice.

Cotton is another important crop in the state. However, high pest incidence (especially bollworm) and indiscriminate use of pesticides are substantially reducing yields and increasing the cost of production (pesticides account for approximately 14 percent in operational cost). Estimated loss due to pests in cotton is in the range of 50–70 percent. Despite this, the state is the most efficient in cotton production with respect to C_2 cost as compared to other states.

Groundnut yields are also declining steeply due to drought and pest infestations. The crop is prone to a number of pests (yield loss ranges from a low of 15 percent to a high of 80 percent). Area and production of other foodgrain commodities, namely sorghum and millet, which are mandated crops of the International Crop Research Institute for Semi Arid Tropics (ICRISAT), which is located near Hyderabad, are declining due to low productivity and profitability. Incidentally, the per capita demand for sorghum and millets as food is also declining.

On the other hand, maize and pulses are showing positive trends. Maize is gaining as animal feed due to the remarkable growth of the poultry industry. Pulses find niches in dry land areas, and their short-duration varieties are yielding high dividends.

Rising Input Subsidy Syndrome

The traditional crop sector is facing the twin problems of water scarcity and pest infestation. High input subsidies (especially irrigation, power for groundwater, and fertilizer) are competing with other higher-return public investments in the agricultural sector. The input subsidies have grown at an annual rate of 9 percent, and were nearly 13 percent of the gross state domestic product (GSDP) in 2002–03. The largest share (56 percent) of the total input subsidy is accounted for by power. The irrigation subsidy is concentrated in the Coastal region (about 82 percent), while the highest share of the power subsidy goes to the Telangana region (about 57 percent).

High subsidies on irrigation and power encourage farmers to grow more water-intensive crops, such as rice and sugar cane. Water is being overused, resulting in

rising salinity in the Coastal region, and declining water table in the Telangana region. Surface irrigation is deteriorating due to lack of O&M. Similarly, the quality of power and other services is generally steeply declining.

Due to siphoning of resources from unabatedly growing input subsidies, public investment in agriculture has decelerated sharply to a growth rate of 1.4 percent per annum during the 1990s from 8.5 percent per annum during the 1980s.

Public Sector Domination in Grain Management

Public sector costs for grain management are growing rapidly and inefficiencies are increasing. The cost of procurement, stocking, and distribution has increased by 25 percent of MSP in the early 1980s to almost 50 percent in recent years, indicating a steep rise in the cost of procurement and stocking. Unfortunately, the Food Corporation of India (FCI) has not enjoyed economies of scale, and the subsidy burden (government cost) has been much higher than the consumer benefits.

The private sector performs better than the public sector in marketing. The price spread for the FCI increased from 23 percent in 1980–81 to more than 50 percent in 2003, while the marketing margin has not exceeded 20 percent for the private trade.

The state and Central public distribution systems (PDSs) are also incurring very high cost; the delivery costs of one rupee worth of rice under the public distribution scheme was Rs 6.37 and Rs 5.37 for the Andhra Rice Scheme and the Central PDS respectively.

Practices by the public sector—movement and storage restrictions on private trade, arbitrary purchases and sales at subsidized prices/costs, availability of unlimited credit at low rates—give the public sector an ‘unfair’ competitive edge against private sector marketing.

Agricultural Diversification: Promise for the Future

Diversification towards high-value commodities (HVCs) (such as fruits, vegetables, milk, meat, eggs, and fish) is one solution to overcome the stress in agriculture. Per capita demand for HVCs is increasing while per capita demand for cereals is declining significantly as a result of rising incomes, growing urbanization, and unfolding globalization. Estimates show that the per capita consumption of cereals even for the bottom 30 percent population declined by 10 percent over the period 1983 to 1999–2000; and the changes in the upper income group are even more profound. On the

other hand, the consumption of milk for the bottom 30 percent population increased by 30 percent, of vegetables by 50 percent, of meat, eggs, and fish by 100 percent and of fruits by 163 percent over the same period; although from a smaller base. The changes in the upper income groups were even larger. The global demand for high-value and processed commodities is also increasing; the share of high-value and processed commodities in agricultural exports from India went up from less than 20 percent in 1990–91 to more than one-third in 2003–04.

The production portfolio has diversified towards HVCs; the share of HVCs in the total value of agricultural output increased from 29 percent in TE 1982–83 to 50.3 percent in TE 2002–03. Amongst Indian states, Andhra Pradesh leads in the production of eggs, meat, and fish. Poultry is booming with more than 11 percent annual growth in broiler production. Fruits (mangoes, grapes, guavas, and papaya) are finding niches in rainfed and water-scarce areas, where watershed programs are operational. Similarly, buffalo milk, small ruminants (for meat), and shrimp are emerging as important income- and employment-augmenting opportunities, and mitigating risk. High-value commodities are produced more extensively around the urban centers than the hinterlands because of better road networks and easier access to markets. Across regions, HVCs are flourishing more in the Coastal and Telangana regions than the Rayalaseema region. Processing of HVCs is also showing rising trends: during the 1990s, processing of dairy products grew at an annual rate of 4.9 percent, bakery products at 4.2 percent, and fish preservation at 3.9 percent, compared to only 1.43 percent for grain milling.

Various studies suggest that fruits and vegetables can be as much as four times more profitable than coarse cereals in the rainfed areas. Shrimp farming, which grew rapidly in the state, yields as much as 8–13 times higher returns than rice and groundnuts.

As compared to cereals, the production of HVCs absorbs more labor (about a quarter more in irrigated areas and three times more in rainfed areas) and is thus smallholder-friendly. These HVCs are important for women who account for about 50 percent of the labor force engaged in vegetable production and about 41 percent in livestock.[1]

These commodities are also environment-friendly; with the exception of shrimp farming, HVCs require less water and have higher water productivity than rice and sugar cane.

[1] But rising wages may be a deterrent to the growth of HVCs.

Agriculture Sector Reform

To reinvigorate the agricultural sector, Andhra Pradesh needs to focus on (i) water and fertilizer; (ii) drought- and pest-resistance technologies and practices; (iii) risk mitigation; and (iv) agricultural diversification. Our recommendations for each of these are outlined below.

Water (including Power) and Fertilizer

Subsidies contribute to 'getting prices wrong', encouraging unsound environmental results and competing with investments to promote other commodities that can augment the income of the smallholders. These results undermine the economic performance of farmers using services and of the institutions supplying the services. Improving the situation requires a comprehensive approach that would include institutional changes, technological interventions, and price reforms. The objective should be to ensure quality and timely delivery at affordable prices. The following are recommended.

Institutions

- Strengthening existing water users' associations (WUAs) to involve them in allocation decisions and in O&M of the canal network[2]
- Promoting electricity user groups to improve services and minimize theft
- Giving more autonomy to the Transmission Corporation of Andhra Pradesh Ltd. (APTRANSCO) by delegating powers for making it self-sustaining and viable[3]
- Rejuvenating the extension services and developing a network of soil testing facilities to improve fertilizer use efficiency, promote balanced nutrient application, and encourage bio-fertilizers.

Pricing

- Revising canal water rates to at least meet O&M expenses.[4]
- Targeting electricity subsidy to smallholders, and raising prices to recover at least the supply cost from medium and large farmers by reintroducing meters

[2] Andhra Pradesh has been among the leading states in putting canals under 'water user associations'.
[3] Andhra has been among the leading states in unbundling electricity components. It now needs to take the next steps in moving toward a more efficient and effective system.
[4] Andhra Pradesh has been among the leading states in charging higher rates on new projects funded by international financial institutions.

using pre-paid cards to (i) reduce the magnitude of subsidy, and (ii) provide positive incentives to water-efficient crops.

- Increasing prices of nitrogen to bring nutrient prices into proper economic balance and to cut the subsidy burden[5]

Technologies and Practices

- Making fuller use of biotechnology, taking into account bio-safety concerns, to develop more water-efficient, stress-resistant crops that respond better to threats of drought and pests.
- Promoting watershed development programs to conserve and harvest rainwater for maximizing productivity and profitability.
- Promoting water-saving devices such as micro-irrigation and drip and sprinkler irrigation systems
- Introducing a statewide campaign to promote integrated pest management (IPM).
- Popularizing appropriate Bt cotton cultivars, safeguarding bio-safety concerns.[6]
- Developing and disseminating varieties and practices to enhance the quality of traditional crops to fetch higher prices from *niche markets,* that is, make them HVCs.[7]
- Promoting pulses in rice-fallow and rainfed production systems to increase production and improve soil health.[8]

Risk Mitigation/Market Reform

The public sector may have a constructive role in grain management (especially rice) but it needs to redefine activities and carry them out on 'level playing field' with the private sector:

[5] The fertilizer response ratio of rice production in Andhra Pradesh is high (5.44) compared to other states in India. Therefore, any policy that raises prices may adversely affect the production unless appropriate technological support is provided to compensate.
[6] Bt cotton is expected to reduce the use of pesticides, bring down the cost of production, and increase yield levels. However, the positive impact of Bt cotton in the state is yet to be proven as has been realized in other states such as Gujarat and Maharashtra.
[7] For example, confectionary groundnuts, quality-protein maize, maize for poultry feed and ethanol, and sorghum for beer have potential in the state to augment incomes.
[8] Saving nitrogenous fertilizers in rice crop by disseminating the high-yielding and pest-resistance varieties of black gram, green gram, lentil, chickpea, and pigeonpea.

- Amending the Essential Commodities Act (ECA) and Agricultural Produce and Marketing Committee (APMC) Act to free movement and storage of agricultural commodities from surplus to deficit regions and the encourage active participation of the private sector.
- Improving efficiency of FCI and the state government in grain management, especially rice.
- Promoting innovative initiatives such as futures markets and warehouse receipts, to minimize the price risk.
- Evolving insurance mechanisms to overcome the risk in production due to drought or pest attacks.[9]

Diversification

Incremental gains in raising the profitability of traditional crops, by themselves, will not be enough. Farmers in Andhra Pradesh could benefit from the growing demand for high-value and processed commodities in the domestic and global markets. The real challenge to promote diversification is to connect farmers, especially smallholders, with processors, retailers, and exporters. There are some successful examples emerging in the state on contract farming. The success of poultry and gherkins is a result of strong farmer–industry linkages through contract farming. Gooseberry, grapes, and oil palm provide other success stories. Retail chains and supermarkets are emerging in the state and some of these are connecting with the farmers through contract farming. The following are recommended:

- Amending the APMC Act for direct marketing with the farmers and abolishing the ECA will help agri-business to connect smallholders with the market, promote contract farming and encourage agri-business for processing, export, and/or retail chains.
- Facilitating financial support for developing infrastructure and different activities in the value chain and reducing taxes and policy hurdles can help to build up the confidence of agri-business to invest in developing infrastructure (such as cold storage, packaging, roads, etc.) for promoting processing, encouraging exports, and developing supermarkets and retail chains through contract farming or farmers' cooperatives.

[9] Perhaps in the initial stages, the government may share a part of the premium to demonstrate the advantages of insurance schemes.

- Providing incentives (such as tax holidays or preferential credit) to the private sector to promote agro-processing in low and medium rainfall areas.[10]
- Upgrading facilities at airports and ports, and linking them with good roads and rail network to facilitate exports.[11]

Our Vision

If the state follows what has been proposed above and improves incentives, strengthens institutions, and develops infrastructure, the future Andhra Pradesh is expected to be characterized as follows:

- Rice production concentrated in the Coastal region, utilizing surface irrigation, and HVCs concentrated in the Rayalaseema and Telangana regions.
- Production centers of traditional crops with high quality for niche markets (such as confectionery groundnut, quality protein maize, high ethanol content maize and sorghum, and superior rice).
- Large production centers for poultry and maize, dairy, livestock meat, fisheries, fruits and vegetables.
- Hubs of processed commodities, for example mangoes for juice and pulp; grapes for juice and wine; maize for livestock feed and fuel; sorghum for livestock feed and fodder, fuel and beer; tomatoes for ketchup or sauce; poultry for meat and egg powder to the Gulf countries and the EU.
- Centers for export of mangoes, grapes, gherkins, mango pulp, chilies, meat, eggs, aqua-products to the Gulf countries, EU, and the Central Asian countries.
- Greater private sector participation in developing infrastructure (like cold storage, refrigerated vans), and agri-business by offering incentives and reducing bureaucratic hurdles.
- Well-organized retail network spread across the state and strong farm–firm linkages through contract farming.

[10] For example, there is considerable scope for processing of sorghum for beer, maize for poultry feed or ethanol, grapes for juice and wine, mangoes for juice and pulp, tomatoes for ketchup or sauce, etc.

[11] The state can take advantage of its having four airports (Hyderabad, Tirupati, Vijayawada, and Visakhapatnam). Hyderabad has direct connectivity with Middle East and Singapore. Other airports are connected with several important cities in the country. Similarly, the state has nine ports (including India's largest major port at Visakhapatnam), which give additional advantage to the state for promoting exports.

- Improved use of scarce water resources by adopting water-saving technologies and commodities.

With these developments, we envision a strong and vibrant agriculture in the state with higher farm incomes, lesser risk, more jobs opportunities, and better environment.

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Acronyms

AEZ	Agri-Export Zone
APL	Above the poverty line
APMC	Agricultural Produce and Marketing Committee
APRLP	Andhra Pradesh Rural Livelihood Project
APSCSCL	Andhra Pradesh State Civil Supplies Corporation Ltd.
APTRANSCO	Transmission Corporation of Andhra Pradesh Ltd.
ASCI	Administrative Staff College of India
ATMA	Agriculture Technology Management Agency
BOOT	Build–Operate–Own–Transfer
BPL	Below the poverty line
CACP	Commission on Agricultural Costs and Prices
CIBA	Central Institute of Brackishwater Aquaculture
CIFTI	Confederation of Indian Food Trade and Industry
CIP	Central Issue Price
CMIE	Centre for Monitoring Indian Economy
CRRID	Centre for Research in Rural and Industrial Development
CSO	Central Statistical Organisation
CST	Central Sales Tax
DISCOM	Distribution Companies
ECA	Essential Commodities Act
EMBRAPA	Brazilian Agricultural Research Corporation
EU	European Union
EuroGAP	European Good Agricultural Practices
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	FAO Statistical Database
FAQ	Fair Average Quality

FCI	Food Corporation of India
FDI	Foreign Direct Investment
FPS	Fair price shop
GCA	gross cropped area
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GSDP	Gross State Domestic Product
Ha	hectare/s
HACCP	Hazard Analysis and Critical Control Point
HVC	High-Value Commodity
IASRI	Indian Agricultural Statistics Research Institute
ICDS	Integrated Child Development Scheme
ICRISAT	International Crop Research Institute for Semi Arid Tropics
INM	Integrated Nutrient Management
IPM	Integrated Pest Management
ITC	Indian Tobacco Company Limited
IWMI	International Water Management Institute
KV	Kilovolt
MCX	Multi Commodity Exchange
MOFPI	Ministry of Food Processing Industries
MSP	Minimum Support Price
MU	Million unit/s
NABARD	National Bank of Agriculture and Rural Development
NCDEX	National Commodity and Derivatives Exchange Limited
NCMSL	National Collateral Management Services Ltd
NGO	non-governmental organization
NMCE	National Multi Commodity Exchange
NPK	Nitrogen, Phosphorous, and Potash

NSS	National Sample Survey
NSSO	National Sample Survey Organisation
O&M	Operations and Maintenance
OLS	Ordinary Least Squares
PDS	Public Distribution System
PPP	Public–Private Partnership
PPPAC	Public–Private Partnership Appraisal Committee
Re	Indian Rupee
Rs	Indian Rupees
SBI	State Bank of India
SGRY	Sampoorna Grameen Rojgar Yojana
SNP	Supplementary Nutrition Programme
SPS	Sanitary and phyto-sanitary
SPV	Special Purpose Vehicle
SURE	Seemingly Unrelated Regression Equation
T&D	Transmission and Distribution
TE	Triennium ending
TFP	Total Factor Productivity
TPDS	Targeted Public Distribution System
UK	United Kingdom
UN	United Nations
WPI	Wholesale price index
WTO	World Trade Organization
WUA	Water Users' Association

Chapter 1
Introduction and Motivation for the Report

1.1 Characteristics of Andhra Pradesh

The state of Andhra Pradesh is the fourth largest state in India, bounded on the north by the states of Maharashtra and Chhattisgarh, on the east by the Bay of Bengal, on the west by Karnataka state, and on the south by Tamil Nadu and Karnataka states (see Map 1.1). In 2001, the state's population was 75.7 million, the fifth largest in the country. Approximately 7.4 percent of the country's population lives in the state. (Appendix Table A2.1 gives selected key indicators for Andhra Pradesh.)

Andhra Pradesh has attained the status of a foodgrain surplus state [the state contributes about 20 percent of rice in the Central pool for the Public Distribution System (PDS)]; yet, approximately 12 million people (15.8 percent of total population) were below the poverty line (BPL) in 1999–2000. Rural indebtedness is increasing—approximately 82 percent of households in the state were indebted, compared to 48.6 percent at the all-India level in 2003 (NSSO 2005)—and the numbers of loan defaulters is rising, compelling farmers to commit suicides (between 2000 and 2005, a total number of 1,855 farmers committed suicides in the state) or to leave agriculture, leading to distress among the farming community, large-scale rural–urban migration, and decline in net sown area (by 7 percent between 2000–01 and 2004–05). These are alarming signals, and clearly imply that agriculture is in deep crisis.

Agriculture is still an important economic activity for over 70 percent of the total population in the state. The state has a rich coastal farming region with good irrigation. Andhra Pradesh also has the advantage of having nine ports (including India's largest major port at Visakhapatnam) and four airports (including one international airport). Almost all the villages are electrified, as compared to only 84 percent at the all-India level. However, the state has lagged in technology adoption (only one-third of the total cereals area is under high-yielding varieties compared to nearly half at the all-India level). It has very low density of tractors (one-fourth of the all-India level) and irrigation (40.7 percent of net sown area as compared to more than 90 percent in Punjab), with a cropping intensity of 123 percent (compared to the all-India average of 134 percent). It has poor road, rail, and market connectivity compared to many states in India.

1.1.1 Unfavorable Agro-Climatic Conditions

The state of Andhra Pradesh is adversely placed with respect to rainfall and soils. It has a hot and humid tropical climate that varies from semi-arid to sub-humid, with an average rainfall of about 900 mm as against the national average of about 1,150 mm. The state is dominated by red soils (less fertile), covering about 65 percent of area, followed by black soils (medium fertile, 25 percent) and alluvial soils (most fertile, 10 percent) as against 80 percent of black and alluvial soils at the all-India level.

The state is divided into 23 districts. Based on rainfall and soil, the districts [1] fall under three popularly known regions (Map 1.2):

- Coastal region: Srikakulam, Vizianagaram, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasam, and Nellore.
- Rayalaseema region: Anantapur, Chittoor, Kadapa, and Kurnool.
- Telangana region: Mahbubnagar, Medak, Nizamabad, Adilabad, Karimnagar, Warangal, Khammam, Nalgonda, Ranga Reddy, and Hyderabad.

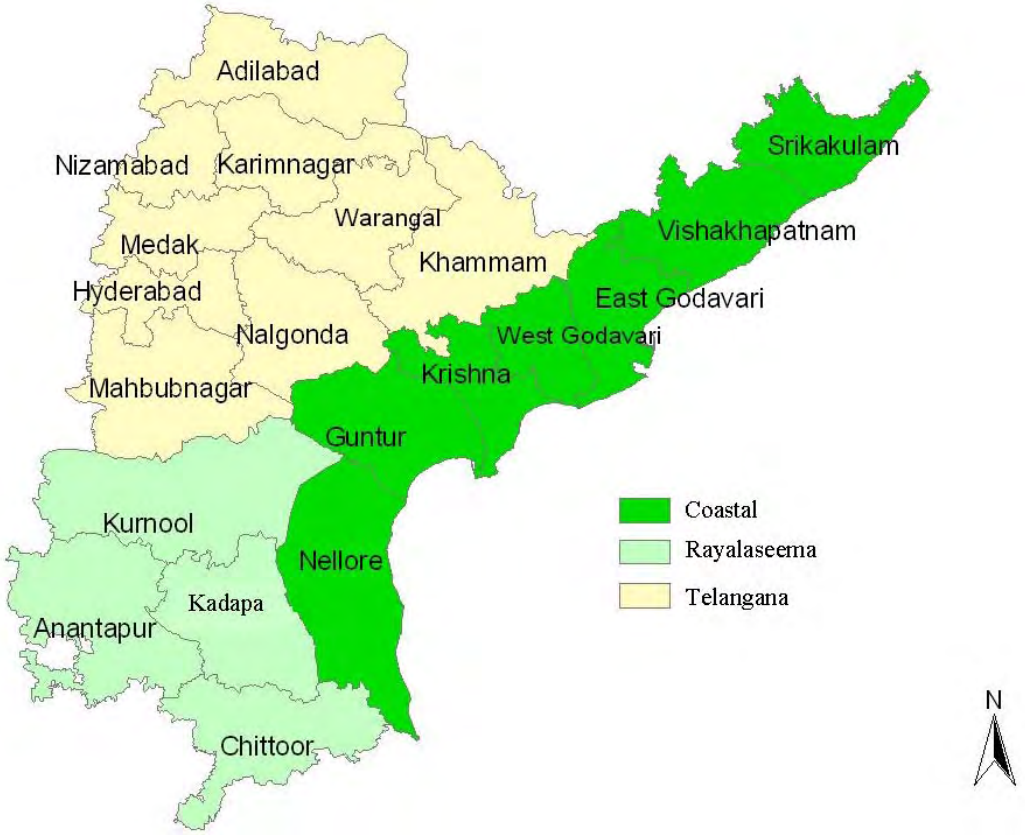
These regions have high heterogeneity with respect to soil, rainfall, and production patterns. The average annual rainfall is lowest (650 mm) in Rayalaseema region and highest in the Coastal region (1,050 mm). Coastal Andhra is also the most fertile of the three regions in terms of soils and irrigation potential and has favorable conditions for growing irrigated crops. Rayalaseema (in the rain-shadow area) and several districts of Telangana region are particularly drought-prone.

[1] District names as per Government of Andhra Pradesh, *Statistical Abstract of Andhra Pradesh 2005*.

Map 1.1: Location of Andhra Pradesh State in India

Source: www.mapsofindia.com, accessed February 10, 2006.

Map 1.2: Agro-Climatic Regions and Districts in Andhra Pradesh



Note: Map shows parent district/s for the following: Ranga Reddy district, formed in 1978–79 from the district of Hyderabad; Prakasam district, formed in 1974–75 from the districts of Guntur, Nellore, and Kurnool; and Vizianagaram, created in 1979–80 from the districts of Srikakulum and Visakhapatnam.
Source: ICRISAT.

1.1.2 Successive Droughts

Several parts of the state are afflicted by drought at irregular intervals. In the period 2001–02 to 2004–05, only 2003–04 was a normal year, while 2001–02 and 2004–05 (rainfall 19 percent below normal) received deficient rainfall and 2002–03 (rainfall 35 percent below normal) was a severe drought year. Overall, there was 15 percent deficiency in rainfall during the period 2001–02 to 2004–05. The successive droughts adversely affect the availability of water and result in growing shortages for drinking as well as for irrigation.

The cumulative effect of drought is reflected in declining area and production of important crops. Successive crop failures and falling income has led to greater indebtedness in the state; 82 percent of the households in Andhra Pradesh were indebted in 2003, compared to 48.6 percent at the all-India level (Rath 2005). The

socio-economic impact has been severe—large-scale rural–urban migration, increasing number of agricultural laborers, the highest incidence of child labor,[2] and the state attaining the dubious distinction of having the highest number of farmers' suicides in the country.[3]

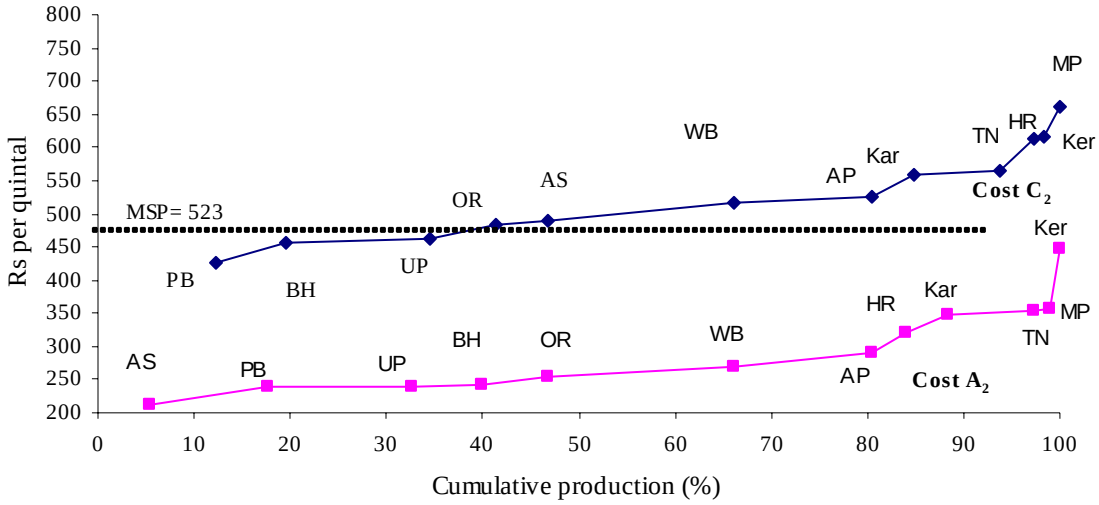
1.1.3 Disappointing Agricultural Performance

Agricultural growth, which used to be little higher (3.4 percent) than the national average (3.3 percent) during the 1980s, significantly slumped in the 1990s (2.3 percent compared to the national average of 3 percent). An especially serious decline in agriculture was observed during the period 2000–01 to 2004–05—the average annual growth in agriculture was -1.96 percent between 2000 and 2005 as compared to +1.98 percent at the all-India level.

The crop sector is dominated by foodgrains, which account for about 63 percent of the total cropped area (12.52 million ha) during 2004–05 (Government of Andhra Pradesh 2005b). However, the area under foodgrains is gradually declining in most parts of the state, except in the rice-dominated areas. Rice is the most important crop of the state, occupying about 24 percent of total cropped area, and contributing 19.1 percent in the total value of crop output in the triennium ending (TE) 2002–03.[4] Rice area has declined from 4.3 million ha in 1998–99 to 2.9 million ha in 2003–04 depending upon the rainfall. Due to consecutive droughts, rice production declined to 9.6 million tons in 2004–05 from 11.9 million tons in 1998–99. Rice irrigated-area has fallen by 27 percent between 2000–01 and 2004–05. Though rice yields in Andhra Pradesh are still higher than the all-India average, the profitability is lower than in many neighboring rice-growing states due to rising costs. The C_2 cost[5] of rice production exceeds both that in many other major rice-growing states and the minimum support price (MSP), which suggests that the state does not have comparative advantage in rice production (Figure 1.1). The per capita demand for rice declined by six percent during the decade of the 1990s.

[2] Twenty-five percent of the children of rural areas in the age group of 10–14 years are engaged as workers as against 9.3 percent at the all-India level (NSSO 2000a).
[3] During the five-year period between 2000 and 2005, a total of 1,835 suicides by farmers were reported in the state.
[4] The state accounted for only 6.83 percent area of the total rice area in the country in 2002–03.
[5] The CACP uses C_1, C_2, and C_3 cost concepts in its calculations, where C_1 cost refers to all paid up costs plus imputed value of family labor, C_2 cost refers to C_1 plus rental value of land, and C_3 cost provides remuneration to farmers at the C_2 cost plus 10 percent of C_2 cost to account for the managerial input of the farmer.

Figure 1.1: Cumulative Production (percent) and C_2 and A_2 Costs: Paddy, TE 2002–03



Note: AP; Andhra Pradesh; AS; Assam; BH: Bihar; HR: Haryana; Kar: Karnataka; Ker: Kerala; MP: Madhya Pradesh; OR Orissa; Pb: Punjab; TN: Tamil Nadu; UP: Uttar Pradesh.
Source: Government of India, *Reports of the Commission for Agricultural Costs and Prices*, various years.

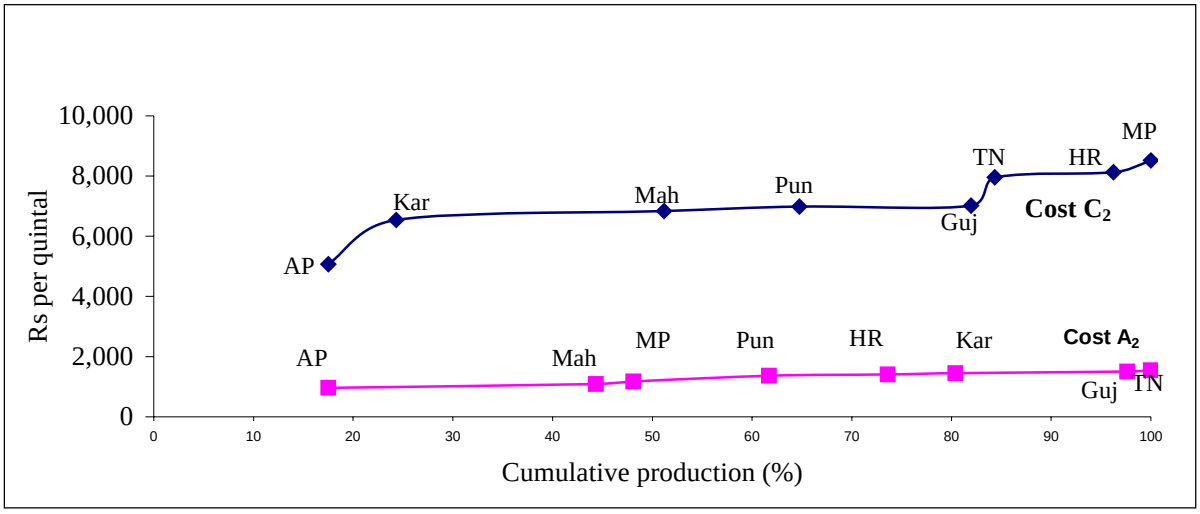
Other important crops of the state are coarse cereals (namely sorghum, pearl millet, and maize), cotton, and groundnut. There was a noticeable decline in the area under sorghum, pearl millet, and groundnut between 1980–81 and 2004–05 and a modest increase in the area under maize and cotton (Table 1.1). Maize is emerging as an important source of poultry feed and livestock fodder in the state. Cotton has been facing serious problems of high incidence of pest infestation and indiscriminate use of pesticide. These are substantially reducing yields and increasing the cost of production (pesticides account for approximately 14 percent of the operational cost). Estimated losses due to pests in cotton range between 50 and 70 percent of production. Despite this, the state has been more efficient in cotton production compared to other major cotton producing states (Figure 1.2). However, the high incidence of pests and use of pesticides may make Andhra Pradesh less competitive in cotton production than other states.

Table 1.1: Area, Production, and Yield of Important Crops in Andhra Pradesh, 1982–83 to 2003–04

	Area ('000 ha)			Production ('000 tons)			Yield (kg per ha)		
	TE 1982–83	TE 1992–93	TE 2003–04	TE 1982–83	TE 1992–93	TE 2003–04	TE 1982–83	TE 1992–93	TE 2003–04
Rice	3,689.6	3,858.7	3,207.3	7,516.9	9,230.9	9,223.2	2,037	2,393.7	2,861
Sorghum	2,128.1	1,102.9	637	1,314.3	808.5	661.2	616.7	734.3	1,037
Pearl millet	516.3	198.1	105.7	347.6	143.8	92.2	668.3	727.3	835
Maize	328.4	316.2	558.5	700.4	712.3	1,807.2	2,133.7	2,249.3	3,221
Pigeonpea	238.6	332.7	457.5	49.7	89.3	185.6	208	268	405
Total pulses	1,444.7	1,621.7	2,035	488.7	742.4	1,146.1	338	457.3	555.3
Groundnut	1,419.8	2,415.8	1,551.2	1,143.7	2,127.8	1,019	801	880.7	652.3
Total oilseeds	1,944.3	3,199	2,434.3	1,243.7	2,448.3	1,494.8	636.3	766	612.7
Cotton	445.1	722.2	916	592.3	1,185.3	1,617.5	225.3	280.7	301.3
Sugar cane	160.5	249.4	219.9	12,540.5	13,295.7	16,179.7	77,903.3	54,038	73,708.7
Chilies	164.8	224.9	232.7	168.5	326.5	599.1	1,020	1,454.7	2,549.7
Turmeric	24.9	47.1	64.1	73.5	153.2	302.9	2,995.3	3,249	4,706
Tobacco	202.2	181.9	125.8	203.5	226.7	177.3	1,006.7	1,245	1,410

Note: TE 2003–04 for chilies should be read as TE 2002–03; Production figure for cotton is in '000 bales of 170 kg each.
Source: Calculations based on data from CMIE (2005).

Figure 1.2: Cumulative Production (percent) and C_2 and A_2 Costs: Cotton, TE 2002–03



Note: AP; Andhra Pradesh; Guj: Gujarat; HR: Haryana; Kar: Karnataka; Mah: Maharashtra; MP: Madhya Pradesh; Pb: Punjab; TN: Tamil Nadu.
Source: Government of India, *Reports of the Commission for Agricultural Costs and Prices*, various years.

Table 1.2 shows the performance of area, production, and yield of important crops in the state. By and large, the agricultural performance in the state was much better during the 1980s than the 1990s, and severely deteriorated in recent years. The production performance of the majority of crops was depressed between 2000–01 and 2004–05 due mainly to the occurrence of successive droughts.

Table 1.2: Annual Compound Growth Rates of Area, Production, and Yield of Selected Crops in Andhra Pradesh, 1980–81 to 2004–05

(percent)

	Area			Production			Yield		
	1980–81 to 1989–90	1990–91 to 1999–2000	2000–01 to 2004–05	1980–81 to 1989–90	1990–91 to 1999–2000	2000–01 to 2004–05	1980–81 to 1989–90	1990–91 to 1999–2000	2000–01 to 2004–05
Rice	0.5	0.6	-8.5	2.5	1.7	-7.6	2	1	1
Sorghum	-5.5	-5.3	-5.9	-5.3	-5.7	-0.4	0.2	-0.5	5.8
Pearl millet	-8.3	-7.1	-5.1	-9.1	-5.1	-5	-0.8	2.2	0.1
Maize	-1.4	4.1	10	-2.7	9.7	9.6	-1.4	5.4	-0.4
Chick pea	0	10.1	20.6	4.3	10	11.2	4.3	-0.1	-7.8
Pigeonpea	4.9	2.3	0.8	4.2	5.4	1.5	-0.6	3	0.6
Total pulses	0.6	-0.1	-0.2	5.1	0.3	0	4.5	0.4	-0.2
Groundnut	5.8	-3.3	-1.5	8	-5.6	-6.5	2	-2.3	-5.1
Total oilseeds	4.8	-2.6	1.9	7.6	-4.9	-2.5	2.6	-2.4	-4.4
Cotton	4.3	6.3	-8.8	1.3	3.8	-1.6	-2.8	-2.4	7.8
Sugar cane	1.3	-1.1	-3.1	-1.9	3.1	-6.7	-3.1	4.2	-3.7
Chilies	4	0.8	1.4	10.6	5.8	9.2	6.3	5	7.6
Turmeric	7.2	2.6	-12.3	11.1	8.5	-13.1	3.7	5.7	-0.9
Tobacco	-4.1	0.6	31.4	-2	-0.6	22.4	2.2	-1.1	-6.9

Note: Compound growth rates for the latest years for cotton, sugar cane, chilies, and tobacco range from 2000–01 to 2003–04 and that of turmeric range from 2000–01 to 2002–03 due to unavailability of data.
Source: Calculations based on data from CMIE (2005) and www.indiastat.com, accessed March 20, 2006.

1.1.4. Declining Total Factor Productivity

The total factor productivity (TFP) growth rates of food and non-food grains in the state have been showing declining trends. Chandrasekhara Rao (2005) estimated that the annual growth of TFP declined from 0.23 percent during the 1980s to -0.17 percent during the 1990s due to intensive use of inputs such as fertilizer, pesticides, and also expenditure on hired labor, especially in cotton.

1.1.5. Deteriorating Production Environment

The agricultural production environment has been also deteriorating. There is high pressure on groundwater due to drought conditions and defective policies, especially free power. As a result groundwater has been increasingly exploited; 22 percent of *talukas* (blocks) are now characterized as dark zones, i.e. areas in which the groundwater has been severely exploited. Rayalaseema region faces a particularly severe problem, where about 35 percent *talukas* are excessively over-exploiting groundwater.

Irrigation efficiency of important canal irrigation projects is as low as 35 percent. About 11 percent of canal-irrigated area has become saline due to mismanagement, largely driven by low water rates (Government of Andhra Pradesh 2003).

Similarly, the nutrients are misallocated, resulting in distorted balance among nitrogen, phosphorous, and potash (NPK). Nitrogen is being used exceedingly more than other nutrients (the NPK ratio deviated from 6:2.4:1 in 1990 to 10:2.9:1 in 1996–97 and 7:2.6:1 in 2003–04 as against the recommended level of 3:1.5:1). Micronutrient deficiency is also becoming critical (almost half of the soil samples in the state show zinc deficiency) (Vashishtha 2006).

1.1.6 Predominance of Smallholders

Marginal and small landholders are the predominant landholders in the agriculture sector in the state. In 2000–01, there were about 8.6 million marginal and small landholders (about 81 percent of the total number of holdings) in the state (Table 1.3). However, they controlled only about 42.8 percent of the total area.[6] In contrast, there were only 82,000 (<1 percent of total landholdings) large landholders (>10 ha), which operated about 1.26 million ha (about 8.8 percent) in 2000–01. The average size of landholding of smallholders declined from 0.75 ha in 1980–81 to 0.72 ha in 2000–01, while the average holding size shrunk from 1.87 ha to 1.35 ha, showing signs of fragmentation as seen in other states.

[6] In 1980–81, the smallholders constituted about 73 percent of total landholdings and controlled 30 percent of the operated area.

Table 1.3: Number and Area of Operational Holdings: Andhra Pradesh, 2000–01

Size of operational holdings	Number of holdings ('000 nos.)	Operational area ('000 ha)	Distribution of holdings and area (percent)	
			Holdings	Operational area
Marginal (<1 ha)	6,328	2,919	59.5	20.3
Small (1–2 ha)	2,270	3,240	21.3	22.5
Semi-medium (2–4 ha)	1,396	3,738	13.1	26
Medium and large (>4 ha)	643	4,479	6	31.2
All holdings	10,637	14,276	100	100

Source: Indiastat website www.indiastat.com, accessed on June 5, 2006.

1.2 Motivation for the Report

The agriculture sector in Andhra Pradesh is under distress. The agricultural production environment is deteriorating, TFP is decelerating, and successive droughts have worsened the agriculture prospects. The more serious problem, however, is the dominance of smallholders, whose number is growing, thereby reducing the size of landholdings. The traditional crops may not make the smallholders viable in the long run unless the performance of these crops is improved. While commercial crops can make agriculture viable the evidence shows that intensification is leading to more distress due to high input use and great risk and uncertainty.

The agricultural sector in Andhra Pradesh is clearly at a crossroad, confronted with inherent problems and emerging opportunities in the domestic and global markets. On the supply side, severe recurrent droughts and numerous pests are leading to a host of problems such as rising costs of production, declining farm profits, and deteriorating natural resources. On an average, in a cycle of five-years, three are drought years of varied intensity, leading to decreases in net irrigated area (by 14 percent between 2000–01 and 2004–05), net sown area (by 7 percent between 2000–01 and 2004–05), and production of major crops (Government of Andhra Pradesh, *Statistical Abstract of Andhra Pradesh*, various years). For example, rice production has declined to about 9.6 million tons in 2004–05, below the level achieved ten years earlier.

Rising input subsidies and declining investments are leading to fatigue in technological change, deceleration in the productivity growth of major crops, and fall in TFP (Rao and Dev 2003). The growing number of loan defaulters, rural–urban migration, suicides by farmers, and deteriorating agricultural environment are its testimony. The challenge is to mitigate risk, raise farm incomes, and generate

employment opportunities by improving incentives, strengthening institutions, and developing infrastructure.

Rising incomes, urbanization, and globalization have resulted in the unfolding of new opportunities. These are inducing higher demand for high-value commodities (HVCs) (such as fruits, vegetables, milk, meat, poultry, and fish) in both domestic and global markets.

The question then is whether, and how, can Andhra Pradesh position itself to overcome the inherent problems and take advantage of the unfolding opportunities by linking the farm sector with agri-business and global markets. And, if yes, how far can it succeed, and if not, what are the driving forces that retard the transformation of agriculture.

This study attempts to identify growth-promoting options for re-energizing Andhra Pradesh agriculture.[7] More specifically, the study aims to examine: (i) how the state is responding to emerging opportunities in traditional commodities and the high-value sector; (ii) what factors promote or obstruct the harnessing of opportunities by the state; (iii) the manner in which 'input-subsidy' and 'food-subsidy' regimes are influencing the expansion of high-value agriculture; and (iv) the reform options that may be initiated to improve feasibility of traditional crops, promote high-value agriculture, and accelerate agricultural growth.

The study is organized into four chapters. This chapter has provided a brief background to the state and an overview of the agricultural performance during the last two decades or so. Chapter 2 provides detailed analyses on agricultural diversification towards HVCs, the rise of the agro-processing sector, and the emergence of organized retailing. Chapter 3 analyzes three key constraints that obstruct agricultural diversification, namely dominance of smallholders, rising subsidies in agriculture (especially fertilizer, power, and irrigation), and inefficiencies in grain management. The last chapter provides a road map that proposes possible reform options for accelerating agricultural growth and sharing its benefits with the smallholders.

[7] For the ailing agriculture sector, the Government of Andhra Pradesh prepared a document, *Andhra Pradesh—Vision 2020*, and through this, embarked on a road map to make Andhra Pradesh the foremost state in the country in terms of growth, equity, and quality of life. It envisioned Andhra Pradesh as having a strong and vibrant agriculture sector by achieving an average annual growth rate of 6 percent over the period till 2020 from a mere 2.6 percent during 1980–2000 (Government of Andhra Pradesh 1999).

Appendix Table A1.1: Key Indicators of Andhra Pradesh vis-à-vis All India, 2001–02

	Andhra Pradesh	India
Demographic		
Population, 2001 (million)	75.5	1,022.97
Population density (No. per sq. km)	277	312.92
Urban population (percent)	27.3	27.8
Rural population (percent)	72.7	72.2
Male literacy (percent) (2001)	70.3	75.3
Female literacy (percent) (2001)	50.4	53.7
Agrarian structure/farm size* (2000–01)		
Average size of landholding (ha)	1.35	1.37
No of small landholders (percent)	80.83	81.1
Technological		
Net area sown as percent of geographical area	38.7	46
Irrigated area (percent to net sown area, 2000–01)	40.7	39.1
Area under high-yielding varieties (percent to total cropped area)	33	45.87
Fertilizer consumption (kg per ha of gross cropped area)	150.09	91.51
Tractor density (per '000 ha of NCA)	5.5	21.84
Diesel and electric pumpset density (per '000 ha of NCA)	121	
Villages electrified (2002–03)	99.9	83.8
Share of electricity consumption for agriculture (percent)	41.19	24.88
Cropping intensity (percent)	123	134
Average normal rainfall (mm)	874	792
Infrastructure		
Road density (km per sq. km of geographical area, 1998–99)	0.65	0.81
Railway route length (km per '000 sq. km)	18.89	19.22
No. of wholesale assembling and regulated markets (2000)	675	7,127

Source: Government of Andhra Pradesh, *Statistical Abstract of Andhra Pradesh 2005*; Government of India (2005c); Indiastat website www.indiaagristat.com, accessed March 10, 2006.

Chapter 2

Agricultural Diversification: Promising Future

2.1 Changing Consumption Pattern

The Indian consumer is diversifying his/her food basket in favor of HVCs. Per capita consumption of cereals declined by about 5 percent and of pulses by 17 percent during 1990–2000. On the other hand, consumption of fruits, vegetables, milk, eggs, and fish increased remarkably (Table 2.1). Even the poor are consuming more of HVCs; consumption of milk by persons living below the poverty line increased by 30 percent, of vegetables by 50 percent, of fruits by 162.5 percent, and of meat, eggs, and fish by 100 percent during the period 1983 to 1999–2000. On the other hand, their per capita consumption for cereals declined by 10 percent during the same period (Table 2.2). For the higher income group, the change was much larger than for the low-income consumers.

Table 2.1: Annual Per Capita Consumption of Food Commodities: All-India, 1980–2000

(kg)

Food commodities	1980	1990	2000	Percent change 1980–1990	Percent change 1990–2000
Wheat	45.7	54	56.1	18.2	3.9
Rice	67.5	78.5	73.8	16.3	-6
Other cereals	36.4	31.6	26.5	-13.2	-16.1
Total cereals	*149.6*	*164.1*	*156.4*	*9.7*	*-4.7*
Pulses	12.5	14	11.6	12	-17.1
Roots and tubers	4.9	4.6	5.4	-6.1	17.4
Edible oil	5.3	6.6	7.9	24.5	19.7
Sugar	19.9	22.8	25.2	14.6	10.5
Vegetables	48.4	53.5	60.4	10.5	12.9
Fruits	25.7	28.0	38.8	8.9	38.6
Milk	40.4	54.9	66.2	36	20.6
Meat	3.7	4.5	4.5	21.6	0
Eggs	0.7	1.2	1.5	66.7	25
Fish	3.1	3.9	5.4	25.8	38.5

Source: Kumar et al. (2006).

Table 2.2: Annual Per Capita Consumption of Food Commodities by Different Income Classes: All-India, 1983–2000

(kg)

Food commodities	Bottom income group			Upper income group		
	1983	1999–2000	Percent change	1983	1999–2000	Percent change
Rice	66.5	75.6	-13.7	94.4	85.8	-9.1
Wheat	43.6	44.9	-3	71	59.9	-15.6
Coarse cereals	37	11.9	-67.8	28.8	9	-68.7
Total cereals	*147.1*	*132.4*	*-10*	*194.3*	*154.6*	*-20.4*
Pulses	7.6	6.9	-9.2	17.7	16.6	-6.2
Edible oils	2.6	4.6	76.9	7.3	13.7	87.67
Vegetables	36	53.9	49.7	65.2	90.8	39.3
Fruits	1.6	4.2	162.5	6.4	18.2	184.4
Milk	15.7	20.5	30.6	89.7	117.2	30.7
Meat, eggs, and fish	1.9	3.8	100	4.8	10.6	120.8
Sugar	6.4	6.6	3.1	18.7	18.8	0.5

Note: Bottom income group: Below poverty line; Upper income group: Above 150 percent of poverty line

Source: Calculations based on data from Government of India, *National Sample Survey*, various years.

While the transformation in consumption is taking place in both rural and urban areas the magnitude is higher in the urban areas. Kumar and Mruthyunjaya (2002) have shown that the share of HVCs in the total food increased from 31 percent in 1983 to 39 percent in 1999–2000 in the rural areas, and from 41 percent to 50 percent over the same period in the urban areas. Annual per person consumption of fruits and vegetables was 114.7 kg in urban areas compared to 93.9 kg in rural areas. The corresponding values for milk were 90.7 kg and 63.3 kg, and those of meat, eggs, and fish were 9.5 kg and 6.7 kg in 1999–2000.

The food basket is likely to continue to diversify in favor of HVCs. Projections reveal that the demand for meat, eggs, and fish would increase by more than 100 percent and those of fruits, vegetables, and milk by approximately 80 percent between 2000 and 2025. The corresponding increase in the demand for cereals would be only 29 percent (Kumar et al. 2006). Such a change is taking place not only in India but also worldwide (Dolan and Sorby 2002). Generally, four reasons are ascribed for the changing consumption pattern: (i) rising per capita income; (ii) increasing urbanization; (iii) globalization; and (iv) better market integration due to improved infrastructure. Per capita income in Andhra Pradesh grew at an annual rate of 4.1

percent during the 1990s, close to the all-India average growth. The Indian economy is expected to grow at 8–10 percent in the next five years.

The urban population in India is increasing at an annual rate of 3 percent. There are projections that by the end of 2030, 41 percent of India's population will live in urban areas (United Nations 2002).

Globalization of agriculture under the World Trade Organization (WTO) regime is also becoming an important driving force for altering the consumption basket as it is responsible for changing diets and food preferences that no longer conform to local habits (Pingali and Khawaja 2004).

Growing concern for dietary health is attributed as an important determinant for the shift in the consumption pattern. Pingali and Khawaja (2004) also attribute the changing consumption pattern in urban areas to the growing number of urban middle class, increased female participation in the workforce, and higher disposable income to spend on food consumption outside of the home.

2.2 Export of High-value Commodities

The demand for HVCs is rapidly increasing in developed and many developing countries. If India meets the quality standards for HVCs it can become an important hub for supplying the commodities. Trade liberalization and domestic market reforms during the 1990s promoted the export of HVCs. The share of agriculture in total export from India has declined—from 30.7 percent in 1980–81 to 19.4 percent in 1990–91 and 10.2 percent in 2004–05.[1] However, the share of HVCs in agricultural exports has shown an increase—from 18.8 percent in 1980–81 to 24.2 percent in 1990–91 and 34.7 percent in 2000–01.[2]

Andhra Pradesh is an important exporter of HVCs, both for domestic (inter-state) and international markets. Horticulture, dairy, poultry, rice, and fisheries account for nearly 60 percent of total domestic (inter-state) exports. Similarly, fish, horticulture, dairy, and poultry account for roughly 40 percent of the value of the state's total international exports, for which the major destinations are Australia, Bangladesh, European Union (EU), Japan, United Kingdom (UK), United States of America, and the United Arab Emirates (World Bank 2005b). Andhra Pradesh is in an advantageous position to export because of its numerous and convenient ports and airports.

[1] Calculated using data from Government of India, *Economic Survey*, various years.
[2] It dipped to 29.4 percent in 2004–05 due to non-compliance of sanitary and phyto-sanitary measures, particularly in fish and fish products.

2.3 Agricultural Diversification

Andhra Pradesh is positively responding to the changing scenario. A gradual and silent transformation which is moving agriculture away from subsistence to commercial agriculture is underway. During the 1980s, the shift was away from a cereal-based system towards commercial commodities, such as oilseeds, cotton, and sugar cane (Subrahmanyam and Sekhar 2003) and the state achieved around 3.4 percent annual growth rate in agriculture. During the 1990s, the transformation continued but was towards HVCs (such as fruits, vegetables, milk, meat, poultry, and fish). During the 1990s, the crop sector performed badly due to consecutive droughts and decelerating crop yields (Chandrasekhara Rao 2005), but HVCs rescued the agriculture sector somewhat. During the period 1998–99 to 2003–04, while the growth in the crop sector was negative (-3.8 percent), the overall annual growth in the agricultural sector in the state was 1.5 percent due to more than 10 percent growth in the livestock and fisheries sectors. Within the crop sector, fruits and vegetables (3 percent per annum) and floriculture (21 percent per annum) grew impressively compared to the traditional foodgrains (rice, sorghum, and millet) and commercial crops (sugar cane, cotton, and groundnuts) (Government of Andhra Pradesh 2004).

2.3.1 Nature and Speed of Agricultural Diversification

In Andhra Pradesh, the share of HVCs in the total value of agricultural output increased from 29.1 percent in TE 1982–83 to 33.1 percent in TE 1992–93and accelerated to 50.3 percent in TE 2002–03 (at 1993–94 constant prices). In particular, the livestock (including poultry, meat, and dairy) and fisheries sectors are coming up in a big way; the share of these commodities in the value of agricultural output increased from 17.7 percent in TE 1982–83 to 24.5 percent in TE 1992–93 and 40.7 percent in TE 2002–03. Horticultural crops (including floriculture) are also flourishing—their scale (at 1993–94 prices) expanded from Rs 16.5 billion in TE 1982–83 to Rs 28.4 billion in TE 2002–03. [3]

In contrast, the importance of foodgrains and commercial crops is gradually declining (Table 2.3). The area of the majority of foodgrains crops is declining (exceptions being maize and pulses), and productivity is stagnant or falling, leading to a fall in production (Table 2.4).

[3] All figures in this paragraph are calculated using data from Government of India, *National Accounts Statistics*, various years.

Table 2.3: Percentage Value of Output of Selected Commodities (at 1993–94 prices): Andhra Pradesh, TE 1982–83 to TE 2002–03

Commodities	TE 1982–83	TE 1992–93	TE 2002–03
Paddy	29.1	25.8	19.1
*Coarse cereals**	*5.3*	*2.7*	*2.3*
Pulses	3.2	3.5	3.7
Oilseeds	8.9	13.1	6.9
Total sugar	5.2	4.2	3.3
Cotton	3.5	4.9	4.3
Chilies	2	2.9	3
Turmeric	0.7	0.9	1.2
Tobacco	2.3	1.9	0.8
Fruits and vegetables	*11.3*	*8.7*	*9.6*
Milk	8.9	9.5	12.9
Meat	4.3	7.1	12.1
Eggs	1.2	1.5	3.6
Other livestock	Neg.	2.6	2.1
Total livestock	*14.5*	*20.7*	*30.7*
Fish	*3.3*	*3.8*	*10*
*HVCs***	*29.1*	*33.1*	*50.3*
Total value (Rs million)	145,827	202,421	296,334

Note: ***** Coarse cereals include jowar, bajra, barley, maize, and ragi; ** HVCs include fruits, vegetables, fish, and livestock; Neg.: negligible.
Source: Central Statistical Organisation (CSO) website http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=nad07_1990_2003&type=NSS), accessed August 19, 2006, except for figures for fish for all years, which were obtained from unpublished CSO sources.

Table 2.4: Change (percent of gross cropped area) in Cropping Pattern: Andhra Pradesh, 1969–71 to 2003–04

Crops	1969–71	1980–82	1991–93	1999–2001	2003–04
Rice	25.6	29.1	28.7	30.7	24.1
Sorghum	19.5	16.4	8.2	5.2	5.2
Pearl millet	4.3	4.1	1.3	0.9	1.1
Maize	2	2.6	2.4	3.6	5.8
Finger millet	2.3	1.9	1.1	0.7	0.6
Coarse cereals	*28.1*	*25*	*13*	*10.4*	*12.7*
Chick pea	0.6	0.4	0.6	1.6	3.4
Pigeonpea	1.5	1.9	2.5	3.5	4.2
Other pulses	8.7	9.0	9.4	8.8	10.1
Total pulses	*10.8*	*11.3*	*12.5*	*13.9*	*17.7*
Groundnut	11.8	11.2	18.6	13.6	12.1
Sesamum	2	1.3	1.4	1.2	1.3

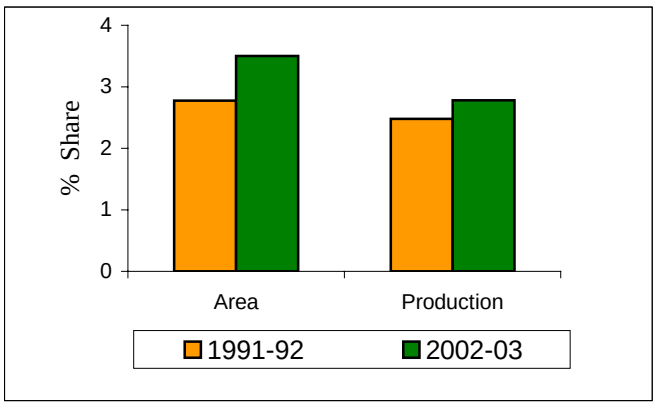
Total oilseeds	16.3	15.1	25	19.3	21.5
Sugar cane	1	1.3	1.4	3	1.7
Cotton	2.5	3.2	5.8	8.1	6.8
Total condiments and spices	2.9	2.6	2.8	2.9	0.4
Tobacco	1.7	1.5	1	0.8	1.1
Total commercial crops*	24.4	23.7	36	34.1	33.6
Fruits	1.5	1.9	3.4	4.6	5.1
Vegetables	0.4	0.7	1.2	1.7	1.5

Note: * Commercial crops include oilseeds, sugar cane, cotton, chilies, turmeric, and tobacco.
Source: Government of Andhra Pradesh, *Statistical Abstract of Andhra Pradesh*, various years.

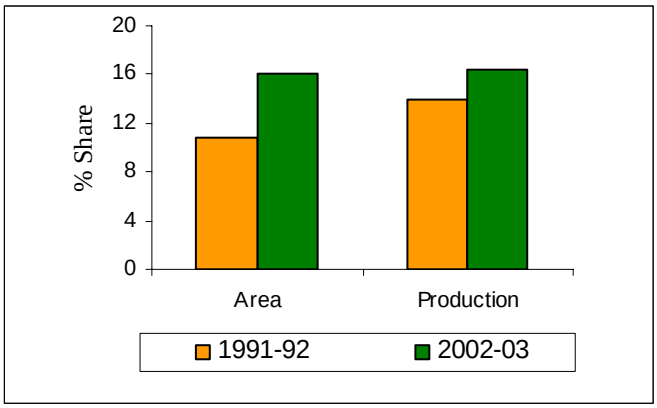
Andhra Pradesh agriculture has responded well to the changing scenario in HVCs (Figure 2.1). For fish, the share of Andhra Pradesh in all-India production increased significantly both for inland and marine fish. The share of poultry meat production (not reflected in Figure 2.1) to all-India production increased significantly—from around 17 percent in 1982 to 25 percent in 1998. Similarly, the state's shares of area and production of fruits and vegetables also increased between 1991–92 and 2002–03.

Figure 2.1: Share of High-value Commodities (percent to All India): Andhra Pradesh, 1990–91 to 2002–03

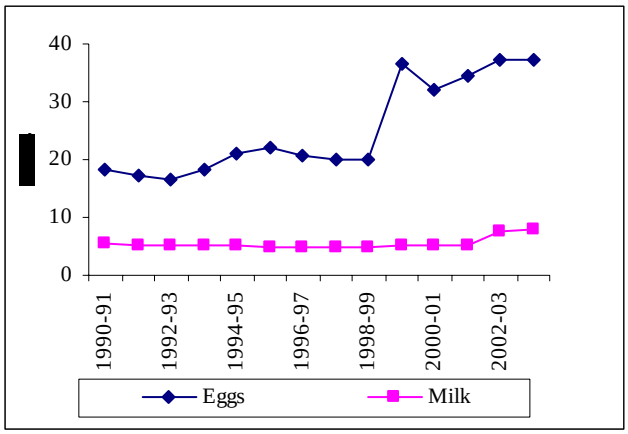
Vegetables: Area and Production



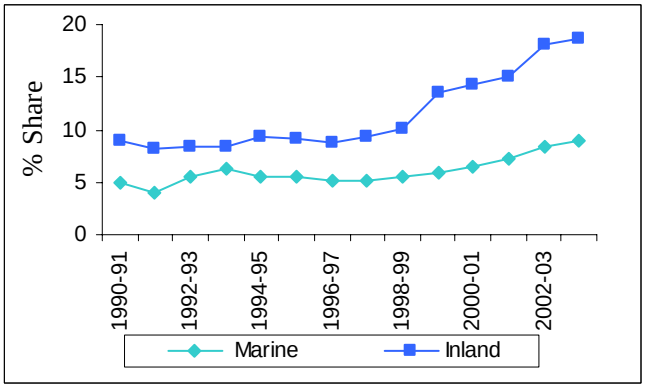
Fruits: Area and Production



Eggs and Milk: Production



Fish: Production



Source: Indiastat website www.indiastat.com, accessed July 6, 2006.

2.3.1.1 Spatial Analysis of High-value Commodities

Vegetable production is concentrated close to the demand centers and the area under vegetables is highest in urban and urban surrounded districts.[4] In contrast, the bulk of the area under fruit cultivation is concentrated in the north coastal districts and scanty rainfall region. Fruits have specific niches based on agro-climatic or soil characteristics. However, fruit cultivation is gradually spreading to non-traditional areas due to availability of improved varieties. While milk production is important in all districts of the state with a few exceptions, the share of milk production is little higher in urban and urban surrounded districts. The share of poultry production in total value of production is highest in Hyderabad and surrounding districts.

(i) Horticulture crops

While Andhra Pradesh accounts for 16.4 percent of fruit production and 2.8 percent of vegetable production in India, its share for some fruits and vegetables ranges from 24 percent to more than 50 percent of the all-India production (Table 2.5). Fruit production in the state increased from 4,766 thousand tons in 1992–93 to 7,404.8 thousand tons in 2002–03—an annual growth rate of 3 percent. The increase in production was mainly due to rapid expansion of area, which increased at an annual rate of 5.3 percent during the same period. Production of fruits is likely to increase

[4] Districts with urban population more than 1.3 billion were classified as urban and all neighboring districts around the urban district as urban surrounded districts.

even more when new orchards reach their high-bearing stage and old orchards are rejuvenated.

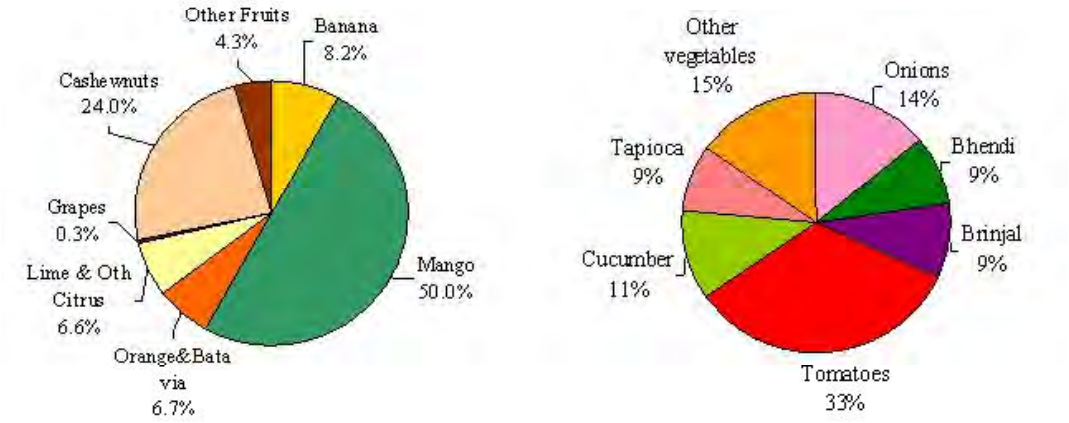
Table 2.5: Area and Production of Major Fruits and Vegetables: Andhra Pradesh, 2001–02

Fruits/Vegetables	Area	Production	Share to all-India (percent)	
	('000 ha)	('000 tons)	Area	Production
Mango	341.2	2,445.8	21.7	24.4
Banana	50.5	1,111.2	11.7	8.9
Grapes	1.5	29.4	3	2.4
Mousambi	85.1	647.6	67.3	53.5
Lemon	40.7	488.1	25.2	34.5
Citrus fruits	82.4	1,113.8	16.6	25.3
Cashew nuts	161.8	88.4	20.9	18.8
Fruits and nuts*	609.5	7,404.8	16.1	16.4
Onion	31.8	509.2	7.0	10.5
Sweet potato	1.9	38.9	1.4	3.4
Brinjal	20.5	410	4.1	4.9
Tapioca	17.7	353.9	7.1	5.2
Tomato	74.4	744.1	16.2	10
Vegetables and tubers*	213.3	2,357.9	3.5	2.8

Note: * Figures are for year 2002–03.
Source: CMIE (2005).

Among fruits, while mango is the dominant crop, accounting for about 50 percent of the area (Figure 2.2), in recent years papaya and lemons are also gaining importance. The area under papaya increased at an annual rate of about 30 percent during 1990–91 to 2000–01. Such a speedy adoption of papaya was due to (i) fast growing demand for it in urban areas; (ii) its short gestation period, and (iii) the crop giving high, early, and sustained income. Lemon is another crop that is modestly spreading in the state—its area increased at an annual growth rate of 5.3 percent during the 1990s. Cultivation of grapes is also catching up in Andhra Pradesh due to promising export opportunities and infrastructure facilities provided under the Agricultural Export Zone (Parthasarathy Rao et al. 2007).

Figure 2.2: Area of Major Fruit and Vegetable Crops: Andhra Pradesh, TE 2000–01



Source: Government of Andhra Pradesh (2001).

The district-wise shares of area and production of major fruits and vegetables are shown in Appendix Tables A2.1 and A2.2, respectively. There is considerable regional specialization in the production of selected fruits, especially papaya, grapes, orange, and cashew. Vegetable production is more widespread but tomato, onion, and tapioca are concentrated in a few districts.

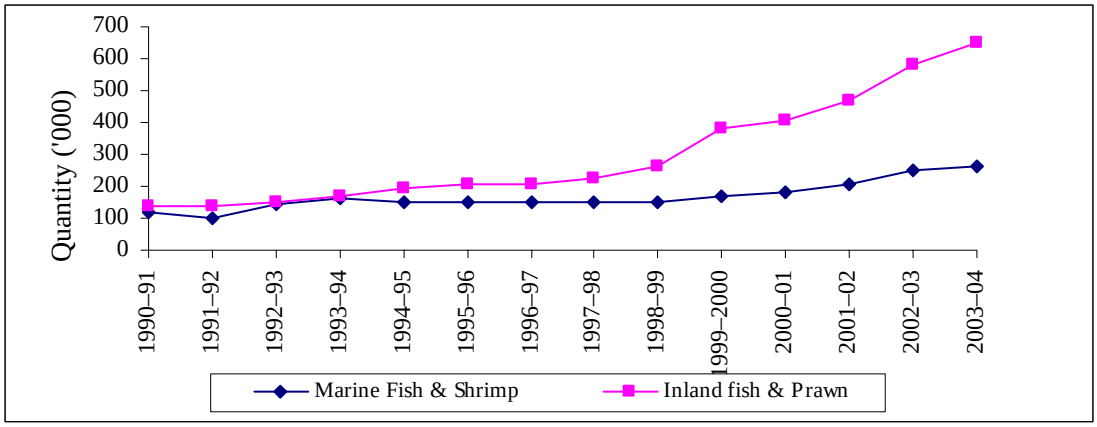
(ii) Fisheries

The fisheries industry in Andhra Pradesh ranks first amongst all states in the country in coastal aquaculture and freshwater prawn production and second in inland fish production. In 2002, the state produced 200 thousand tons of marine fish and 580 thousand tons of inland fish, accounting for 8 percent and 18 percent of the all-India production, respectively. The sector is providing direct and indirect employment to over 1.4 million fishermen and is an important source of foreign exchange (Government of Andhra Pradesh 2002). The state contributed about Rs 25 billion by way of marine product exports, and nearly 40 percent of the total marine product exports from the country in 2003–04.[5] Japan and the United States of America are among the major export markets.

[5] The Kolleru lake area in West Godavari and Krishna districts is a major point of fish exports to the eastern and north-eastern states in India.

Between 1993 and 2003, fish production increased at an annual growth rate of 9.5 percent. Within the fisheries sector, inland fish production grew much faster (14 percent annually) compared to marine fish (4 percent annually) (Figure 2.3).The comparable figures at the all-India level are 5.6 percent for inland fish and 0.7 percent for marine fish. The spatial distribution of production is shown in Appendix Table A2.3.

Figure 2.3: Trend in Fish Production: Andhra Pradesh, 1990–91 to 2003–04



Source: Government of Andhra Pradesh (2004).

(iii) Dairy

Andhra Pradesh is the fifth largest milk producing state in the country; producing 7.6 million tons of milk in 2005–06 (7.9 percent of all-India production). Between 1990–91 and 2005–06 milk production in the state grew by 7 percent per annum compared to 4 percent at the all-India level. Per capita availability of milk in the state increased substantially from 121 grams per day in 1991 to 231 grams per day in 2002.[6] The rapid increase in milk production came as a result of faster growth of buffalo population. Buffalo milk accounted for 70 percent of total milk production in the state during 2002. Although milk production activity is well distributed across the districts in the state, it is relatively more pertinent in coastal and a few South Telangana districts. The spatial distribution of milk production can be seen in Appendix Table A2.4.

[6] The all-India average availability of milk in 2002 was 230 grams per day.

(iv) Poultry

Andhra Pradesh is known as the capital of the poultry industry in India. Between 1992 and 1999, the broiler production grew at 11.3 percent per annum. Poultry now accounts for more than 50 percent of the total meat production in the state (Appendix Table A2.4). Egg production too grew impressively (14 percent per annum between 1982 and 2002 as against 12 percent at the all-India level). In 2002, the state produced 14,862 million eggs accounting for 20 percent of the all-India production. The annual per capita availability of eggs in the state increased from 64 in 1993 to 151 in 2001—the comparable figures at the all-India level are 27 and 36.[7] Poultry meat and egg production is expanding more rapidly in urban and peri-urban areas than in the hinterlands. Among regions, districts belonging to Telangana dominate poultry meat production.

The state is a major exporter of eggs to neighboring states such as Tamil Nadu, Maharashtra, Karnataka, and Madhya Pradesh. The state also accounts for one-fourth of eggs exported internationally from India (60 million of the 220 million exported in 2001), mainly to the Gulf countries. A small quantity of egg powder is also exported to the Gulf countries. The state exports poultry meat mainly to the East, South, and Middle Asian countries.

2.3.2 Benefits of High-value Commodities

There are many benefits in diversifying agriculture in favor of HVCs. These include higher returns, more employment opportunities, and lesser use of scarce resources, particularly water.

2.3.2.1 Profitability

Based on the unit cost of production, for a number of major crops grown in Andhra Pradesh, the state does not compete successfully with other states (Table 2.6). Among grains, only for maize, green gram, and black gram does the state have lower unit costs of production and higher yields than other states. However, Andhra Pradesh does not have comparative advantage in the production of other crops such as groundnuts and sugar cane. Returns over C_2 cost for the majority of crops show a very disappointing picture (Table 2.7).

[7] Data collected from Directorate of Animal Husbandry, Government of Andhra Pradesh, Hyderabad.

Table 2.6: Unit Cost of Production of Selected Crops in Important States in India: 2002–03

	Paddy	Sorghum	Groundnut	Maize	Cotton	Sugar cane*
C_2 per quintal						
Andhra Pradesh	543.71	844.7	1,797.67	591.97	1,617.76	73.89
Punjab	498.12	–	–	–	2,447.74	–
Bihar	484.08	–	–	–	–	–
Maharashtra	–	528.57	2,013.15	–	2,365.52	64.44
Gujarat	–	–	1,501.62	–	1,954.3	–
Uttar Pradesh	528.88	–	–	1,170.29	–	64.36
Karnataka	603.57	845.34	2,006.34	573.7	1,987.79	51.08
Madhya Pradesh	690.26	718.68	–	818.63	3,015.02	–
A_2 per quintal						
Andhra Pradesh	294.88	459.67	1,131.65	327.58	822.12	42.44
Punjab	296.21	–	–	–	1,459.48	–
Bihar	264.74	–	–	–	–	–
Maharashtra	–	324.34	1,342.77	–	1,617.42	41.42
Gujarat	–	–	926.46	–	1,080.98	–
Uttar Pradesh	282.97	–	–	299.17	–	30.18
Karnataka	376.77	533.36	1,370.75	369.95	1,159.43	27.88
Madhya Pradesh	314.63	371.17	–	422.5	1,615.95	–

Note: * Figures are for 2001–02; Blank spaces (–): Not available.
Source: Government of India (2005), *Reports of the Commission for Agricultural Costs and Prices; for the Crops Sown during 2004–05 Season*.

Table 2.7: Returns over C_2 Cost for Selected Crops: Andhra Pradesh, 1999–2000 to 2002–03

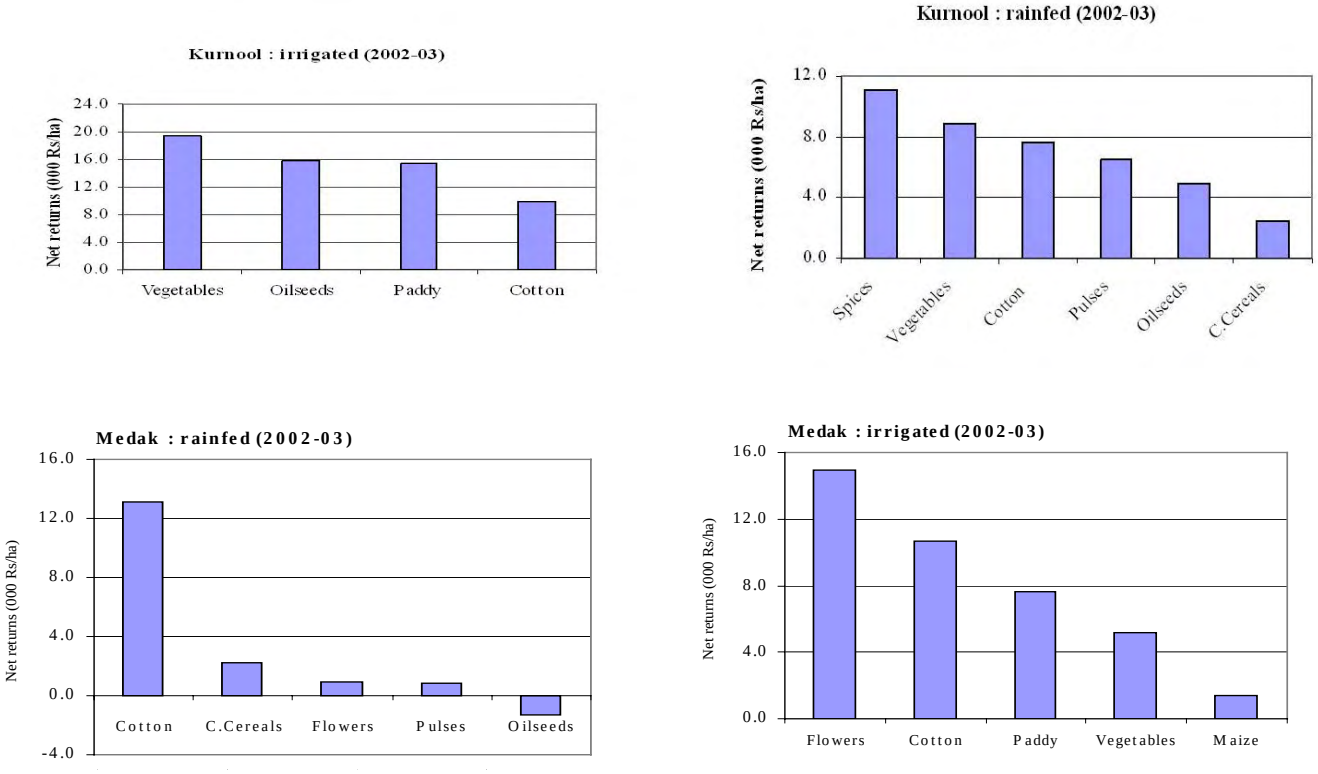
(in Rs)

	1999–2000	2000–01	2001–02	2002–03
Paddy	-388	187	-390	-681
Sorghum	-3,866	-2,884	-5,152	-3,741
Maize	-2,329	-864	334	-2,864
Pigeonpea	-2,878	-4,333	-2,980	-875
Green gram	-1,490	-3,021	-3,316	-3,097
Black gram	-593	-282	459	3,060
Groundnut*	-4,266	-336	-2,709	-3,005
Cotton#	-2,413	-1,031	-935	1,364

Note: # J-34 variety; * in shell
Source: Author's calculation (MSP-C_2)*yield (quintal per ha) based on data from Government of India, *Reports of the Commission for Agricultural Costs and Prices,* various years.

Crops such as flowers and vegetables have been more profitable than other traditional crops in Andhra Pradesh (see Figure 2.4 for Medak and Kurnool districts). Andhra Pradesh has the advantage of having higher yields of major fruits (namely mango and lemon) and vegetables (namely onion, brinjal, and sweet potato) compared to the all-India average (Table 2.8).

Figure 2.4: Net Returns for Selected Crops in Sample Households: Andhra Pradesh, 2002–03



Source: ICRISAT (2003).

Table 2.8: Comparison of Yield of Major Fruits and Vegetables: Andhra Pradesh and All India, 2000–01

(tons per ha)

Crops	Andhra Pradesh	All India
Fruits		
Mango	8	6.7
Cashew nuts	0.6	0.6
Banana	25.1	33.5
Lemons	12	8.4
Grapes	19.6	23.4
All fruits	11.2	11.7
Vegetables		

Tomato	10	15.9
Onion	18.4	10.5
Brinjal	20	16.3
Tapioca	7.7	26.7
Sweet potato	13.4	8.8
All vegetables	12.6	15

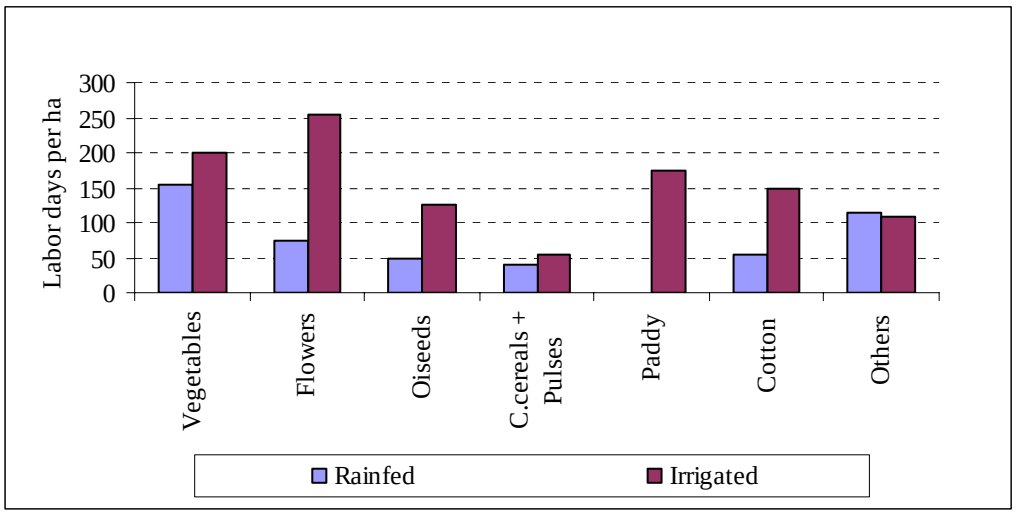
Source: CMIE (2002).

For shrimp farming, up to 8–13 times higher returns were reported than paddy and groundnut crops, depending on the variety (Ratna Reddy et al. 2004). Tiger prawn is the most remunerative shrimp, followed by scampi.

2.3.2.2 Employment

In general, HVCs are labor-intensive in the entire supply chain from production till they reach the consumers. Labor requirement per unit of output or per unit of land is found to be higher for vegetables, fruits, and flowers (Joshi et al. 2003; Deshingkar et al. 2003), as is also confirmed by the data on labor days collected from the districts of Medak, Kurnool, Nalgonda, and Mahbubnagar (Figure 2.5). On an average, for rain-fed crops labor use is highest for vegetables (156 labor days per ha) followed by flowers, cotton and oilseeds. For irrigated crops, labor use is highest for flowers (264 labor days per ha), followed by vegetables, paddy, cotton, and oilseeds. Shrimp farming is another avenue for generating employment opportunities and increasing income of fishermen. A study conducted by CIBA (1996) reported that in Nellore district of Andhra Pradesh, employment increased by 2–15 percent after the establishment of shrimp farms, with a corresponding increase of 6–22 percent in incomes of farm laborers. According to the Fisheries Commissioner of Andhra Pradesh, scientific shrimp farming generates maximum employment opportunities—650 man-days per ha per annum as against 225 man-days per ha per annum through other agricultural operations.

Figure 2.5: Labor Use (days per ha) for Selected Crops in Sample Households, Andhra Pradesh, 2002–03



Source: ICRISAT (2003).

An important factor in the transition of agriculture is the participation of women in cultivation of HVCs. About half of the total workforce engaged in the production of vegetables and flowers in Andhra Pradesh is comprised of women (Table 2.9). The corresponding figures for fruits and livestock production are 40 and 41 percent, respectively. At the all-India level, more than 70 percent of the total workforce engaged in livestock production comprised of women. In Punjab, women constituted as high as 93 percent of the total workforce engaged in livestock production (NSSO 2000a). Promoting HVCs in Andhra Pradesh will open new avenues to women workers, whose participation in greater numbers in the workforce engaged in HVCs would lead to their being empowered in rural areas.

However, on the flip side, higher wages (male or female) could be a deterrent for cultivation of HVCs in labor-scarce regions in the state. Other factors that may go against HVCs despite high net returns are long gestation period for some species of HVCs and high per ha cost of production for vegetables, fruits, and flowers as compared to the traditional crops. For example, the gestation period for fruits varies between two and seven years. The availability of institutional credit from formal sources would be essential for the success of HVCs, particularly for smallholders.

Table 2.9: Participation of Women (percent of all workers) in Various Agricultural Activities: Andhra Pradesh and All India, 1999–2000

Crop group	Andhra Pradesh	All-India
Cereals and pulses	47.2	37.1
Commercial crops	49.3	41.8
Vegetables*	50.3	45.1
Fruits	39.8	40
Livestock	41.1	71.7
Forestry	46.6	49.5
Fishing	19.7	12.5
Other activities	51.4	40
Total agriculture	47	39.8

Note: * Includes vegetables and seeds of horticultural commodities.
Source: NSSO (2000b), Schedule 10.

2.3.2.3 Sustainable Use of Natural Resources

The agricultural sector in the state is facing three problems related to water, namely (i) declining water table due to excessive digging of new wells; (ii) waterlogging and soil salinity due to mismanagement of surface irrigation; and (iii) land degradation due to aquaculture.

The irrigated area increased very slowly in the state from 35 percent in the early 1980s to 42 percent in 2000, with the expansion coming largely from groundwater irrigation[8] (bore wells). The shift to groundwater has led to over-exploitation of groundwater and depletion of the water table in several areas. As production from dry lands has become highly uncertain, farmers have sought to evade the risk of drought by digging new wells / borewells at an exorbitantly high cost and at a considerable risk of failure. To cite an example from the Andhra Pradesh Rural Livelihood Project (APRLP) in Mahbubnagar district, as many as 200 attempts[9] were made to dig bore wells but the success rate was only 42 percent (Rao 2004).

Another problem is waterlogging and soil salinity in surface-irrigated areas mainly concentrated by rice and sugar cane cultivation. Approximately 150,000 ha in the state are affected by these twin problems. Since water rates are low, farmers invariably cultivate high-water-requirement crops such as rice and sugar cane, without proper drainage, which causes salt build-up in the soil and rise in the water table

[8] The share of groundwater in total irrigated area increased from 21 percent in the early 1980s to 42 percent in 2000, while that of surface irrigation declined, both for tank and canal irrigation.
[9] The cost of digging the wells was as high as Rs 2.74 million.

(Government of Andhra Pradesh 2003). The adverse effects of these problems are declining productivity of important crops and resources, and falling farm incomes. Alternative production systems with less water requirement would minimize these land and water related problems.

HVCs can play an important role in reducing environment-related problems. In Andhra Pradesh, water requirement (hours per ha) is highest for blue-water crops[10] such as paddy and sugar cane (Shiferaw et al. 2003). In contrast, for other crops such as flowers, vegetables, cotton, and chickpeas, water requirement is lower. The water productivity is highest with low-water-demand HVCs, while it is lowest for high-water-demand crops such as paddy and sugar cane. Paddy, which occupies about a quarter of the irrigated area in Medak, uses more than 60 percent of the water (Table 2.10).

Table 2.10: Farmers' Irrigation Decisions and Water Productivity Relationships, Medak District: Andhra Pradesh, 2002–03

Crops	Percentage of total area irrigated	Intensity of water use (hours per ha)	Net returns ('000 Rs per ha)	Net water productivity (Rs per hour)	Actual irrigation (hours)	Percentage of total water applied
Cotton	3.66	26.19	10.23	391	0.473	0.49
Flowers	13.74	71.96	26.45	368	4.875	5.01
Chickpea	8.61	21.24	7.2	339	0.902	0.93
Vegetables	30.49	76.92	13.41	174	11.562	11.88
Turmeric	10.15	94.38	15.59	165	4.723	4.85
Maize	2.02	56.61	9.03	160	0.563	0.58
Paddy	22.72	530.96	11.07	21	59.473	61.13
Sugar cane	1.47	1,541.94	22.58	15	11.143	11.45
Total	100	-	-	-	97.29	100

Source: Shiferaw et al. (2003).

Although shrimp farming has raised incomes substantially, it has led to many environment-related problems;[11] there are reports that lands around the shrimp ponds have become unsuitable for growing other crops and have been abandoned (Aquaculture Authority 2001). As a consequence, livestock production has been adversely affected due to shortage of fodder and water. To overcome the problems

[10] Blue-water crops refer to water-intensive crops.
[11] See Section 3.2.3.3.

arising due to expansion of aquaculture, the Supreme Court of India had to intervene and deliver a judgment for compliance that restricts aquaculture production.[12]

2.3.3 Drivers of Agricultural Diversification

Earlier studies have shown that expansion of HVCs is a demand-driven phenomenon (Pingali and Rosegrant 1995; Dorjee et al. 2002; Joshi et al. 2004). Important factors responsible for pushing the demand for HVCs are rise in income, increasing urbanization, and changing food preferences (Parthasarathy Rao et al. 2004; Pingali and Khawaja 2004).

To examine the relationship between HVCs and demand- and supply-side factors, multivariate analysis[13] was carried out, with models based on Ordinary Least Squares (OLS), Tobit,[14] and Seemingly Unrelated Regression Equation (SURE) techniques following Zellner (1962). Simple correlation between different variables was also computed and are given in Appendix Table A2.5.

The results reveal that urbanization, rainfed area covered under watershed programs, and districts with larger share of smallholders positively and significantly influenced the production of HVCs (Table 2.11). Individual commodities were influenced by different variables. For example, fruit production is positively associated with agro-processing industry and negatively with farm wages. Rainfall positively influenced fruit production, while irrigation had a negative relationship. In fact, fruits find niches in high rainfall regions but away from districts having intensive agricultural systems with high irrigated area. Availability of the agro-processing industry is another factor driving fruit production (Table 2.12). 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 production implying that these are grown in all types of agro-climatic situations.

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[12] In response to a petition filed against unsustainable shrimp farming, the Supreme Court of India passed a landmark judgment (judgment dated December 11, 1996 in S. Jagannath vs. Union of India and Others).

[13] For estimating the coefficients in different models, the dependent variables were defined as the shares of HVCs in total value of agricultural production and include: (i) share of all HVCs; (ii) share of fruits; (iii) share of vegetables; (iv) share of milk (cattle and buffalo separately); (v) share of ruminant meat; and (vi) share of mono-gastric meat. The independent variables included a set of demand-side and supply-side factors.

[14] The modified version of the 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 1995). 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.

Table 2.11: Factors determining Diversification: All HVCs, Model Results, 1999–2001

Variables	Estimated elasticities	t-ratio
URBAN	0.16	2.56**
SMFARM	0.85	2.23***
WSCOV	0.19	3.80***
WAGEM	-0.46	-1.04
POVERTY	-0.09	-1.02
CONSTANT		0.9
R- Squared	0.58	

Note: URBAN: Urban; SMFARM: Small and marginal farms; WSCOV: Unirrigated land covered by watershed programs; WAGEM: Wages (field labor, male, Rs per day); POVERTY: Poverty; CONSTANT: constant;
***, **, and * refers to significant at 1, 5, and 10 percent probability levels respectively.
Source: Parthasarathy Rao et al. (2007).

Table 2.12: Factors determining Diversification: Fruits and Vegetables, Model Results, 1999–2001

Variables	Fruits				Vegetables			
	OLS		SURE		OLS		SURE	
	elasticity	t-ratio	elasticity	t-ratio	elasticity	t-ratio	elasticity	t-ratio
CONSTANT		2.27		3.47		2.66		2.58
URBAN	-0.7	-3.11	-0.9	-3.11	0.7	3.69	1	3.46
WAGEM	-1.5	-1.64	-3.1	-3.75	-4.1	-2.8	-3.5	-3.09
TERMLN	0.4	1.37	0	-0.35				
FVCOLPR	0.5	5.93	0.6	6.65	0.1	1.17	-0.1	-0.77
POVERTY	-0.7	-2.78	-1	-2.59	0	-0.01	0.3	0.78
NRAIN	1.3	1.65	1.7	2.35	-0.4	-0.58	-0.2	-0.26
IRRI	-0.6	-2.28	-1	-2.73	-0.3	-1.17	-0.2	-0.44
No. of observations	20		20		20		20	

Note: CONSTANT: Constant; URBAN: Urban; WAGEM: Wages (field labor, male, Rs per day); TERMLN: Agriculture term loans (plant and horticulture sector) per hectare; FVCOLPR: Fruit/vegetable processing industries and cold storage units (number); POVERTY: Poverty; NRAIN: Normal rainfall (cm); IRRI: Irrigated area [percent of gross cropped area (GCA)].
Source: Parthasarathy Rao et al. (2007).

Milk production is scattered across different zones of the state (Table 2.13). However, watershed programs, which contribute to improved fodder production, have significant bearing on cattle milk production [15] (Subrahmanyam et al. 2006). Availability of credit

[15] In the watershed village, dairy activity expanded over time compared to the surrounding villages without a watershed program.

for agri-allied sectors also positively influenced milk production. Cattle milk production is concentrated more in districts having relatively higher proportion of poor. Surprisingly, none of the variables significantly explain buffalo milk production.

Table 2.13: Factors determining Diversification: Milk, Model Results, 1999–2001

Variables	Cattle				Buffalo			
	OLS		SURE		OLS		SURE	
	elasticity	t-ratio	Elasticity	t-ratio	elasticity	t-ratio	elasticity	t-ratio
CONSTANT		-1.79		-2.27		5.93		4.3
URBAN	-0.1	-0.4	-0.1	-0.71	-0.1	-1.06	0	-0.27
ROADD	1.3	1.76	1.1	1.91	-0.7	-2.69	-0.4	-1.45
WSCOV	0.6	4	0.7	5.61	0	0.34	-0.1	-1.29
CREDIT	0.2	1.53	0.3	2.03	0.1	2.18	0.1	1.21
POVERTY	0.7	2.37	0.7	2.7	-0.3	-1.67	-0.1	-0.9
No. of observations	20		20		20		20	

Note: CONSTANT: constant; URBAN: Urban; ROADD: Road density; WSCOV: Unirrigated land covered by watershed programs; CREDIT: Credit to agriculture and allied activities (Rs per ha); POVERTY: Poverty.
Source: Parthasarathy Rao et al. (2007).

Ruminant meat (bovine, sheep, and goat) is significantly associated with the availability of grasses from common grazing lands, and production is concentrated in districts having a large proportion of poor. Consequently, ruminant meat is negatively associated with intensive agriculture (i.e., irrigated agriculture). Availability of credit is negatively associated with ruminant meat production, implying that production is concentrated in districts with lower access to credit (Table 2.14).

Table 2.14: Factors determining Diversification: Ruminant and Poultry, Pig Meat, and Eggs Model Results, 1999–2001

Variables	Ruminant				Poultry, pig meat, and eggs			
	OLS		SURE		OLS		SURE	
	elasticity	t-ratio	elasticity	t-ratio	elasticity	t-ratio	elasticity	t-ratio
CONSTANT		2.58		2.18		-2.09		-2.71
URBAN	-0.2	-2	-0.1	-0.62	1.1	7.89	1.2	7.26
CPR	0.5	2.45	0.3	2.94				
POVERTY	0.1	1.16	0.3	1.83	0.2	1.16	0.3	1.35
CREDIT	-0.2	-2.84	-0.3	-3.29	-0.4	-4.87	-0.6	-4.97
NRAIN	0	-0.1	0.1	0.49	0.4	0.66	0.6	1.27
IRRI	-0.6	-3.29	-0.4	-2.6	-0.4	-1.68	-0.1	-0.61
ROADD					1.2	1.79	1	1.86
WAGEM					-0.1	-0.07	0.3	0.41
IMPPOU					0.7	3.58	0.6	3.32
No. of observations	20		20		20		20	

Note: CONSTANT: Constant; URBAN: Urban; CPR: Common property rights; POVERTY: Poverty; CREDIT: Credit to agriculture and allied activities (Rs per ha); NRAIN: Normal rainfall (cm); IRRI: Irrigated area (percent of gross cropped area); ROADD: Road density; WAGEM: Wages (field labor, male, Rs per day); IMPPOU: Improved poultry.
Source: Parthasarathy Rao et al. (2007).

Poultry and pig meat are largely driven by urbanization and infrastructure variables such as roads. Credit shows a significant but negative influence on production of poultry and pig meat. This is puzzling and difficult to explain. One possible explanation for production of pig meat may be that it is concentrated in less-endowed regions, while much of the credit is flowing to the better-endowed regions. For poultry production, the possible reason may be growing popularity of contract farming, where producers directly get inputs from the firm and do not opt for organized credit.

In summary, urbanization from the demand side is an important driver for production of HVCs, with the exception of fruits and milk—the latter, because production is scattered due to agro-climatic factors. From the supply side, processing industry, farm wages, credit, and agro-climatic factors are important drivers. Roads were an important driving force for poultry production.

2.4 Institutional Changes

2.4.1 Rise of Agrofood-processing Sector

The agrofood-processing industry is a sunrise sector with vast untapped potential. In India, only 2.2 percent of fruits and vegetables, 6 percent of poultry meat, 8 percent of marine products, 21 percent of buffalo meat, and 35 percent of milk is processed (Government of India 2005b). In contrast, 70 percent of fruits and vegetables are processed in Brazil and USA, 78 percent in Philippines, 83 percent in Malaysia, and 30 percent in Thailand (Kaul 1997). Food processing not only contributes to the value chain but also promotes rural–urban linkages, rural industrialization, and employment opportunities (Shivkumar et al. 1999).

Within India, Andhra Pradesh is a relatively important food processing state with 40 percent of the factories in the manufacturing sector in 1999–2000 falling under the agro-food processing industries category, accounting for 10 percent of the total fixed capital (Mahendra Dev and Chandrashekhara Rao 2004). The comparable figures at the all-India level are 17 percent and 4.5 percent. The agro-food processing industry contributed 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 in 1997–98 (Table 2.15). Within India, Andhra Pradesh ranks second next only to Maharashtra, with 10 percent share of total value added from food processing industry in the country in 1999–2000.

Table 2.15: Share of Food Products in Output, Employment and Net Value Added in Total Manufacturing Sector: Andhra Pradesh

(in percent)

Year	Output	Employment	Net value added
1980–81	20.93	13.42	24.76
1986–87	14.89	13.97	23.6
1991–92	16.15	19.41	26.18
1994–95	16.61	15.11	25.54
1997–98	17.82	18.28	27.36

Source: Chakravarty (2003).

In 1999–2000, there were 5,350 food manufacturing industries in the organized sector with an investment of Rs 12.1 billion (Mahendra Dev and Chandrasekhara Rao

2004).[16] Of these, the largest numbers of units were in grain milling accounting for about 67 percent of the total units, followed by edible nuts, bakery products, and dairy products (Table 2.16). Canning and preservation of fruits industries are still at infancy. Despite this, grain milling contributes only 23 percent of the net value added in the food industry, compared to 25 percent from HVCs.

Table 2.16: Growth Rates of Food Processing Enterprises: Andhra Pradesh

NIC '87 code	Item	Raw material intensity (percent)	Number of enterprises 1999–2000	Net value added (1999–2000) (Rs million)	Growth rate of units (percent)	
					1984–85 to 1990–91	1991–92 to 1999–2000
201	Manufacture of dairy products	79	94	183.2	-0.45	4.91*
202	Canning and preservation of fruits	66	54	47.4	10.4*	0.58
203	Processing, canning and preserving of fish, crustaceans and similar foods	79	31	345.2	-0.96	3.91
204	Grain milling	91	3,566	1,022.3	5.63*	1.43*
205	Manufacture of bakery products	79	110	44.8	4.80	4.27*
206	Manufacturing and refining of sugar	69	–	800.4	2.07	-1.44
207	Production of indigenous sugar, boora, khandasari, gur etc from sugar cane, palm juice etc.	76	–	–	-20.3*	-1.52
209	Manufacture of cocoa products and sugar confectionery (including sweets)	72	24	103.5	22.7*	1.59
210+	Manufacture of hydrogenated vegetable oils and vanaspati ghee etc.	89	–	48.4	3.46	-4.05

[16] At the all-India level too, within the food category, grain milling dominates with 44 percent share of industries, edible oils and sugar account for 23 percent, while other foods category, including HVCs, account for 33 percent of the factories. In terms of net value added, however, the other foods category accounts for 49 percent of total net value added and 43 percent of employment in the food category compared to grain milling, which contributes only 7 percent to value addition and 20 percent to employment.

211	Manufacture of vegetable oils and fats (other than hydrogenated)	86	–	219.6	8.73*	2.25*
215	Processing of edible nuts	89	448	261.6	62.1*	5.1*
216+	Manufacture of ice	46	–	6.9	-15.4	0.18
217	Manufacture of prepared animal and bird feed	–	70	79.4	–	–
218	Manufacture of starch	–	24	42.6	–	–
219	Manufacture of food products not elsewhere classified	–	–	168.1	–	–
	All food products	–	5,350	4,361.2	–	–

Source: Mahendra Dev and Chandrashekhara Rao (2004).

For the state as a whole, the annual growth rate of the food industry was around 5 percent during the 1980s but declined steeply to around 1.3 percent during the 1990s. The decline in the growth rate can be attributed to the slowing down of the growth of grain milling, processing of edible nuts, and vegetable oils and fats industries. These industries grew rapidly in the 1980s but reached a saturation point by the mid-1990s. During the 1990s, industries related to HVCs such as dairy products, fishing, and feed manufacture (for dairy and poultry industry) grew faster, reflecting their rising importance. This is also reflected in the faster growth rates in net value added in industries such as processing of edible nuts and in industries related to HVCs such as fruits and fish processing, feed industry, ice creams, etc. However, since these sectors are growing from a low base, their growth is not reflected in the overall growth of the food processing industry.

2.4.1.1 Processing of Fruits and Vegetables

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 most important fruits and vegetables for processing. Most of the food processing units in the state are small-scale industrial units.[17] Only a few medium-

[17] An industrial undertaking is considered to be a small-scale industrial undertaking if the investment in fixed assets in plant and machinery does not exceed Rs 10 million. This criterion is in force with effect from December 21, 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).

scale units are equipped with facilities for fruit processing and assertive packaging.[18] At present, only fruit pulps of tomato and mango, juices, canned fruits, jams, pickles and squashes are manufactured. Frozen fruits, pulps, dehydrated and freeze dried vegetables, fruit powders, fruit juice concentrates, and canned mushrooms are recent additions.

There is ample scope for growth in processing of fruits such as mango, grapes, papaya, guava, pomegranate, banana, etc., and vegetables such as gherkins, tomato, peas, tapioca, etc. The state has started exporting a small quantity of processed fruits and vegetables. (Boxes 2.1 and 2.2 provide more information about processing of mango pulp and tomato, respectively.)

[18] The fruit processing units in the state are concentrated mainly in Chittoor district where the raw material is available.

Box 2.1: Processing of Mango Pulp in Andhra Pradesh

Chittoor district of Andhra Pradesh is an important source for export of mango pulp in the country. The value of mango pulp exports from India increased from a low of Rs 267.5 million in 1991 to a high of Rs 2,638.5 million during 2000–01. In 2000–01, Andhra Pradesh accounted for a third of these exports. The state, however, processes only 1.8 percent of its mango production (0.4 million tons out of 2.4 million tons production) and exported about 40 percent (0.17 million tons) of the mango pulp production in 2000–01 (Government of Andhra Pradesh 2001). Different technologies are adopted for making mango pulp. While mango jelly making is carried out in cottage industries under traditional technology with minimal capital investment, mango canning involves considerable capital outlay. There are reports that the net margin realized by the farmer was 21 percent if mango was sold to processing units compared to 4.6 percent if sold to traditional consumers (NABARD 2001). The macro impact of mango processing was also considerable with value addition of Rs 650 million from 400 jelly units and 33 canning units.

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.

Besides non-compliance of Hazard Analysis and Critical Control Point (HACCP), non-availability of suitable pulp varieties is the main problem in promoting mango processing and exports. Since compliance of HACCP is costly, the mango pulp processors (exporters) are targeting low price markets (e.g. Gulf countries) where HACCP is yet to be enforced.

Box 2.2: Tomato Processing in Andhra Pradesh

Tomato is the leading vegetable crop grown in the state. Out of the total production of tomato, about 70 percent goes for table consumption, and only 13 percent is processed, while 17 percent is wasted in the entire supply chain. There is scope for increased processing since the tomato market is highly volatile and sometimes devastating for tomato growers. The short-term solution is to transport tomatoes to distant and deficit markets. The long-term solution would be processing and making a variety of products for different consumers. For processing purposes, varieties characterized by high yields and more pulp, uniform maturity, and rich in total soluble salts are required. Growing selected varieties under contract farming is an option that can promote processing and value-addition.

2.4.1.2 Processing of Livestock Products

Cows and buffaloes are not reared for meat in India. The slaughter laws also 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 of 20–25 percent of the produce, the by-products are often lost at the production point.

The poultry industry is one of the fastest growing in the country. However, only one percent of egg production is processed into egg powder while processed poultry accounts for less than five percent of meat production. Andhra Pradesh has two egg plants that produce whole egg, yolk, and albumen powder. A four percent processing tax is levied on poultry products in the state in addition to the usual sales tax on poultry feed (Delgado et al. 2003). High taxes increase the cost of production, making the units uncompetitive in the export market. Restrictions on domestic sales also need to be addressed to make the units viable. This industry needs to be given a boost as the state has surplus egg production.

2.4.1.3 Processing of Marine Products

Shrimps account for about 70 percent in the total value of marine products' exports from India during 2001–02. However, the unit value realization remains low due to the high compliance cost of SPS measures. Japan (31 percent), United States (24 percent),

and EU (19 percent) account for 74 percent of the value of India's marine product exports. These countries are prescribing stringent measures under the guise of the WTO, and exports would be adversely affected if the prescribed norms are not adhered.

The quality of produce is important because processed marine products differ widely and deteriorate rapidly in tropical conditions. 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.

In the short run, the government needs to take steps for enacting an Aquaculture Seed Quality Control Act, establishing disease diagnostic centers, popularizing alternative species that would reduce the cost of production and are in tune with the emerging demands, conducting farmer awareness camps, levying power and water charges to aquaculture at par with the agricultural sector, and enacting comprehensive legislation for inland fisheries conservation, development, and exploitation.

In the long run, however, the Government of Andhra Pradesh should formulate a comprehensive policy for the development of the fisheries sector aimed at improving both production and quality through better regulation, improved infrastructure, and modernized technology (Parthasarathy Rao et al. 2007).

2.4.1.4 Food Processing Policy in Andhra Pradesh

The Government of India is providing a number of incentives to promote agro-processing. To synchronize with national policies, the state government evolved a Food Processing Policy in 2005.[19] The main objectives of the policy are to: (i) develop food parks and Agri-Export Zones (AEZs); (ii) harmonize various policies related to agriculture, horticulture, cooperatives, etc.; (iii) upgrade technology rapidly;

[19] The various incentives and concessions under the policy include the following: (i) additional 10 percent on the subsidy given by the Government of India to the food processing industry; (ii) government is providing electricity at subsidized rate of Rs 1.75 per unit for a period of five years for newly established units; (iii) refund of 50 percent of the stamp duty on land registration etc.; (iv) 50 percent subsidy on mechanized primary processing equipment for grading, sorting, packing, washing etc.; 25 percent subsidy on dryers; 25 percent airfreight subsidy on actual airfreight incurred for export of perishables; and a 5 percent interest subsidy on working capital loans up to Rs 200,000; (v) sales tax on inputs, other than fuel, used by the food processing industry shall be adjusted against the tax payable, on the sales of the finished products; (vi) market cess exempted from all food processing industries. However, the government will collect development cess of 0.5 percent on the turnover of the value of finished product for exports and the amount will be utilized for improving the infrastructure for the food processing industry.

(iv) establish linkages between research, farmers, and industry; (v) create markets for processed foods; (vi) develop a futures market; and (vii) increase use of information technology. The ultimate goal is to give clearance under a single window, and simplify all procedures for inspection, pollution control, etc., leading to a zero inspection regime. Already, the Government of Andhra Pradesh has developed five AEZs to promote export (Table 2.17).

Table 2.17: Agri-Export Zones (AEZs) in Andhra Pradesh

Name of AEZ	Districts covered	Fruits/Products	Estimated cost (Rs million)
AEZ Vijayawada	Krishna	Mangoes	180
AEZ Hyderabad	Ranga Reddy, Mahbubnagar, and Medak	Grapes and mangoes	570
AEZ Gherkins	Ranga Reddy, Mahbubnagar, Medak, Karimnagar, Warangal, Nalgonda, and Anantapur	Gherkins	200
AEZ Chittoor	Chittoor	Mango pulp and vegetables	110
AEZ Chillies	Guntur	Chilies	—

Source: Government of Andhra Pradesh (2005).

The policy will cover the horticulture, agriculture, animal husbandry, fisheries, and agro-food processing industries. In addition, it would cover allied industries such as cold storage units, refrigerated transportation vehicles, food packaging, canning and bottling industries, and the food additives and preservatives industry. Food parks are being set up for: processing of poultry products, coarse grains, and spices in Telangana districts; rice products, marine, and horticulture products in coastal Andhra; and vegetable and spice products in Rayalaseema region.

2.4.1.5 Constraints in Food Processing

The food processing industry in the state is plagued by a number of bottlenecks on the supply side. These include: (i) non-availability of raw materials in adequate quantity and of right quality; (ii) small size of the units and obsolete technology leading to diseconomies of scale, regulations, and policy hurdles; (iii) 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 different production and marketing processes.

The tax levels on the processed foods in India are one of the highest (21–23 percent) in the world[20] (Government of India 2005a). Comparative tax burdens are 10 percent in the Philippines, Indonesia, and Malaysia, 14–15 percent in the Netherlands and UK, and 17 percent in China and Ireland (CIFTI 2002). High taxes add to the cost and impact on the prices and, consequently, on the demand for processed foods.

Similarly, the cost of packaging, ranging from 10 to 64 percent of production costs, is another major constraint facing the sector. It adds 30–70 percent to the cost of the processed food product. Good and low cost packaging is essential to cut down prices of processed commodities and prevent losses.

Besides high taxes and packaging costs, the regulatory overhang with more than 12 Union ministries and corresponding state ministries, and plethora of laws governing the food industry are suppressing the growth of agro-processing sector the regulatory overhangs with several ministries and government departments also restrict entry of private sector.[21]

The above-mentioned constraints restrict foreign direct investment (FDI) in food processing. Though 100 percent FDI is allowed in the food processing sector by the Government of India, the response to this liberal policy initiative is lukewarm only. It is disappointing to note that of the total FDI in India only 4 percent was for the food processing sector by March 2006. The actual FDI by March 2006 was only about 28 percent of the approved (Rs 98 billion) amount for food processing (Srinivas 2006).

2.4.2 Rise of Retail Chains

The current marketing network of HVCs is thin and fragmented; therefore, farmers have difficulty in taking advantage of the emerging opportunities. Experiences from many developing countries reveal that supermarkets and organized retail food chains have the potential to improve market efficiency and integrate producers with the

[20] For instance, there is Central Sales Tax (CST) on food products, state sales tax, octroi, mandi and entry tax, and customs duty levied at various levels.

[21] There are about 17 laws governing the food industry. In addition, there are separate laws relating to weights and measurements, packaging, adulteration, etc. These laws are administered and implemented by different departments and/or ministries. Besides rules and regulations framed by the Central government, there are a number of regulations that come under the purview of the state government. For instance, while excise duty is imposed by the Central government, sales tax, etc. are imposed by the state governments. Processors face a stiff challenge to meet all the regulations.

markets. The evolution of supermarkets and organized retail chains in the food sector in India is slow but is growing fast. The US$ 215 billion retail industry is expected to grow at the rate of 30–35 percent over the next few years. Organized retail is worth US$ 7.5 billion and is expected to grow to US$ 22 billion by 2010 (India Brand Equity Foundation 2007). 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, particularly vegetables and fruits is taking off. The Indian food industry is worth US$ 6.1 billion growing at the rate of 9 percent. Traditional markets are making space for new format stores, hypermarkets and supermarkets. A Mckinsey (2000) study shows that supermarkets comprise of only 2 percent of the organized food retail in India and therefore these enterprises can take advantage of the untapped opportunities. The Indian retail sector is a big attraction for both domestic and foreign players, all poised to invest heavily in end-to-end supply chain activities

Lessons can be drawn from the rapidly growing organized retail sector in many developing countries. The lead was taken by the Latin American countries, where the share of supermarkets increased to 50–60 percent of national food retail in 2000. The average food retail share in the South-east Asian countries is 33 percent while it is 63 percent in the East Asian countries. The share of super markets in the Chinese urban food market increased to 48 percent in 2001. Important reasons for their fast expansion in these regions were: (i) rapid urbanization; (ii) rise in income growth; (iii) improvement in domestic infrastructure; (iv) women entering the away-from-home workforce, thus enhancing their opportunity cost; and (v) acquisition of refrigerators by consumers (Reardon et al. 2003). All these factors are consistent with the growing Indian economy; and Andhra Pradesh can take advantage of the emerging opportunities.

In Andhra Pradesh, the twin cities of Hyderabad and Secunderabad are attracting private sector initiatives to establish supermarkets (or hypermarkets) and retail chains. Food World of the RPG group was the first to set up a hypermarket in Hyderabad. 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, Nilgiris, Food Bazar, Subhiksha, and Spencers.[22] Reliance Fresh started its operations in fruits and vegetable retail in November 2006 and has opened 35 stores across the state. The Indian Tobacco Company Limited

[22] In January 2007,Trinethra had 83 retail stores spread across important cities in Andhra Pradesh, namely Hyderabad, Secunderabad, Vizag, Vijaywada, Guntur, and Rajahmundry.

(ITC) has entered this segment in early 2007 through Choupal Fresh stores on the lines of its e-Choupal model.

2.4.3 Implications of Consolidation in Agro-Processing and Retail Chains

Promoting agro-processing and organized retailing in food commodities would be advantageous in that it would: (i) reduce post-harvest losses; (ii) improve marketing efficiency; (iii) strengthen market integration; and (iv) minimize wastage and overheads. Due to small marketable surplus and high transaction costs, smallholders are deprived of taking advantage of economies of scale. Agro-processing and retail chains would interface producers with agri-business (agro-processors or retain chain), and reduce their transactions costs and increase smallholders' share in the consumers' rupee. In developing countries, there is evidence that consumers pay 3–4 times the farm-gate prices for fresh produce (*The Economic Times* 2003). Almost 60–80 percent of the price paid by the consumers goes to commission agents and wholesalers to cover transportation, loading, unloading, storage, wastage, overheads, profits, etc. In organized retail markets, consumers pay only 1.5 to 2 times the farm-gate prices for basic food (*The Economic Times* 2003). Integrating smallholders in the market chain, cutting marketing costs, reducing wastages, and enhancing consumers' satisfaction are the key factors for the success of retail food chains and agro-processing.

2.4.4 Emergence of Innovative Institutional Arrangements

To overcome constraints, producers need to be connected with markets and agri-business. This requires innovative institutional arrangements to eliminate intermediaries and improve the product quality. Andhra Pradesh initiated the concept of *Raythu Bazar*,[23] where farmers directly sell their produce to the consumers at selected markets in the state. In such markets, producers' share in consumers' rupee was in the range of 82–90 percent, compared to 40–56 percent for the sale of similar produce in the traditional supply chain. However, problems related to economies of scale, price volatility, and high transport cost still persist in such arrangements.

To overcome such problems and involve farmers in HVCs, alternative institutional arrangements are emerging through vertical coordination. Among different forms of

[23] On an average, every week 20–25 thousand tons of vegetables are sold through these markets. The annual turnover of vegetables is estimated at 1.1 million tons, valued roughly at Rs 60 million. The government has estimated that farmers participating in the *Raythu Bazar* gain an annual additional income of approximately Rs 25,000 per farmer, totaling to about Rs 1 billion in the state as a whole. As of 2006, there were 107 *Raythu Bazars* in the state, of which 33 had permanent structures.

marketing arrangements, contract farming is silently emerging in India, including in Andhra Pradesh. In Andhra Pradesh, contract farming is in a nascent stage and only a small proportion of area and few commodities are covered under contract farming (about 50 thousand ha).[24] The state, however, is famous for successful contract farming in the poultry sector. There is a wide array of possible contract farming models. These vary with the nature of the firm and the commodity, and are formal as well informal. They also vary from only-procurement to entire value chain from production to procurement, processing, retail, and/or export. We have analyzed three successful models of contract farming in the state: (i) gherkins for exports; (ii) grapes for exports and domestic markets; and (iii) broilers for domestic markets. It is expected that these case studies would provide some insights on the functioning of the contract farming in the state and draw lessons for up-scaling to other agricultural commodities.

2.4.4.1 Case Study 1: Gherkins for Export

Gherkins are a non-traditional crop for Andhra Pradesh. The crop has a huge international market and a small but growing domestic market. Roughly 60–70 percent of the produce in India is exported to Russia, with the other destinations being America, Australia, and Europe. Global Green[25] exports about 2,000 containers (14.5 tons per container) per annum. The company has six years of experience.[26] The company has adopted contract farming model for procuring the produce from farmers. It is providing technical guidance and inputs (seeds, fertilizers and pesticides) to farmers on credit and the farmers, in turn, are supplying quality produce to the company.[27] The firm also provides extension services such as technical guidance on agronomic practices, appropriate use of fertilizers and pesticides, and effective management to augment productivity and reduce unit cost of production to become

[24] Palm oil occupies the largest area (38,000 ha) under contract farming followed by cocoa (8,500 ha) and gherkins (3,500 ha), and to some extent gooseberry.
[25] Global Green and Capricon Foods Ltd. are the major players in exporting gherkins.
[26] The company has two processing plants—one at Zaheerabad and another at Bangalore. The capacity of the plant located at Zaheerabad is 50 tons per day, and at Bangalore it is 30 tons per day. In Andhra Pradesh, the company has four production centers/growing regions that feed the processing plant in the state. These are located in Gadwal and Jedcherla mandal in Mahbubnagar district, Siddipet mandal in Medak district, and Vikarabad mandal in Ranga Reddy district. In Siddipet, the company has a facilitator, Mahindra Shublabh, who procures the produce on behalf of Global Green. This type of contract farming is also called as an intermediary model.
[27] The contracting firms generally supply seeds, fertilizers, and pesticides to the farmers on credit and recover the loan at the time of the final payment to the farmers. If the crop fails before harvest, the company encourages farmers to take up another crop of gherkin and extend the repayment period of the first crop by adjusting to the returns realized in the next crop.

more competitive in the global market. The prices of different grades are decided before sowing and often kept uniform throughout the year. The produce is procured at collection centers, packed in plastic crates, and transported to the processing unit at the cost of company. All precautions are taken to adhere to the non-tariff barriers (specially the traceability in the final product) prescribed by the importing countries.

Motivation for Contract Farming

The entire gherkins production is under contract farming for exports. The net profit from gherkins production was about Rs 35,000 per ha per crop in the 2004–05 crop-season. The net returns from other vegetable crops were lower (ranging between Rs 6,800 per ha and Rs 20,200 per ha) compared to gherkins (Parthasarathy Rao et al. 2007). Higher returns from gherkins production and its assured market through contract farming have induced farmers to gradually shift towards its production.

The other 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 especially suited for women [about 250–300 days per hectare (ha) per crop]; and (iii) reducing rural–urban migration due to availability of wage employment during the off-season. Since the crop is labor-intensive, it very well suits smallholders. Besides, the crop starts bearing fruit early,[28] and hence yields quick returns over the costs incurred. Thus, the smallholders are more inclined for its cultivation than large farmers. This is verified from our sample, which shows that smallholders account for 47 percent of total gherkins-producing farmers.[29]

2.4.4.2 Case Study 2: Broiler Production Contract[30]

Vertical coordination is very strong and successful in broiler production in Andhra Pradesh. High risk in broiler production due to outbreak of diseases and fluctuating prices had led to the closure of several small-scale broiler farms. To check the closure of broiler farms, Venkateshwara Hatcheries Limited, a leading poultry integrator based in Hyderabad, came up with a contract-farming scheme that has operated in

[28] Harvesting of gherkins starts after 35 days of sowing and continues for the next 30 days. Two to three crops may be grown in a year.
[29] The composition of medium and large farmers among the gherkins-producing farmers was 30 percent and 23 percent, respectively.
[30] This section has been drawn heavily from Birthal et al. (2005) and Ramaswami et al. (2005).

Andhra Pradesh and a few other southern and western states of the country since the mid-1990s.

Motivation for Contract Farming

Under the agreement the integrating firm supplies chicks, medicines, and feed to the farmers, such supplies constituting 75 percent of the total cost of broiler production. The firm also provides technical guidance, communication, and transportation for acquiring inputs. The broiler producers provide land with the 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 with the farmers any profits arising from an increase in market prices. The firm also shares mortality risk of 5 percent. A premium of 25 percent is paid on the price if the feed-conversion ratio is higher than some stipulated average. Thus the firm is bearing the market risk while the producer is bearing the production risk. This type of risk-sharing mechanism protects farmers, especially the smallholders, under volatile market conditions. Ramaswami et al. (2005) have estimated that contract farming in the broiler industry could shift about 88 percent of risk from the farmer to the processor. Such a risk-sharing mechanism helps the smallholders in improving their management strategies. The contract farmers made 13 percent higher profit compared to non-contract farmers in broiler production (Table 2.18).

Table 2.18: Costs and Profits in Broiler Production under Contract and Non-Contract Farming, 2001–02[*]

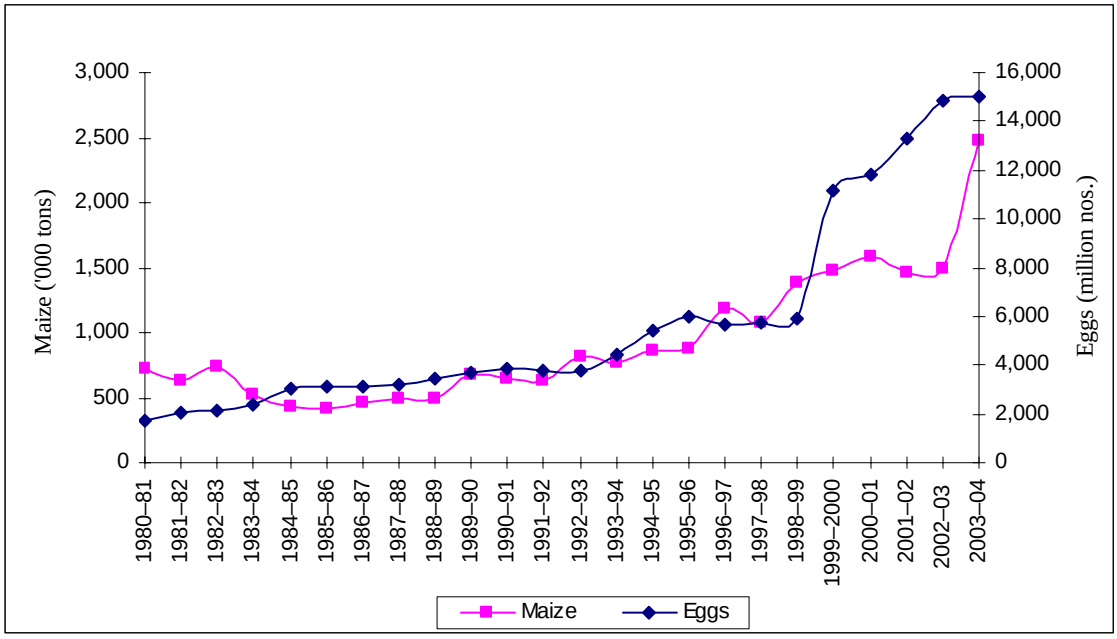
(Rs per ton)

Item	Production cost	Transaction cost	Total cost	Net profit
Non-contract producer	27,322	90	27,412	2,003
Contract producer[**]	808	38	846	2,255

* Sample size is 25 contract farmers and 25 non-contract farmers
** Firm supplies free chicks, medicines, and feed to farmers
Source: Birthal et al. (2005).

The growing poultry industry in the state as a result of contract farming has induced the production of maize (especially for feed), which has dramatically increased in the state (Figure 2.6).

Figure 2.6: Production of Maize and Eggs: Andhra Pradesh



Source: Indiastat website www.indiastat.com, accessed June 5, 2006.

2.4.4.3 Case Study 3: Grape Contract for Export

Grape is one of the largest traded fruits in the world. The European market is the largest market with annual trading of about 1.1 million tons (Naik 2004). The Indian grape industry has found a niche of 30 days (April 15 to May 15) for export. During this period, there is no competition for Indian grapes from other countries; the 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 regions. The hot-tropical region[31] accounts for about 70 percent of the total grape production in the country (Shikhamany 2001). About 1,675 ha is under grape in Andhra Pradesh, which was 3.5 percent of the all-India grape area during

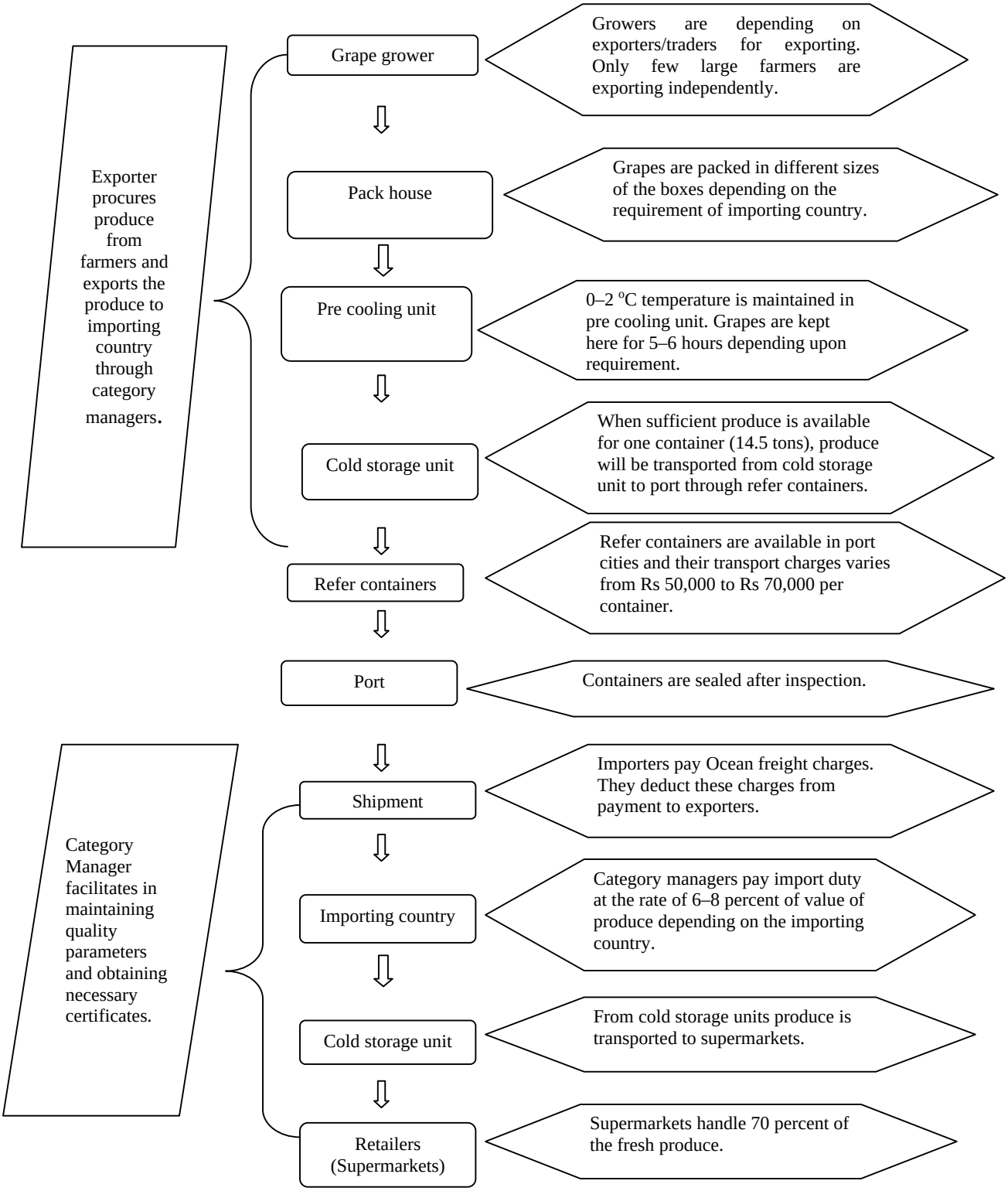
[31] Andhra Pradesh, Maharashtra, and northern Karnataka constitute hot-tropical climate.

2000–01 (CMIE 2002). Grape production in the state is largely concentrated in the southern Telangana region (including Ranga Reddy, Medak, Anantapur, and Mahbubnagar districts), with 85 percent of the total area concentrated around a 75 km radius of the twin cities of Secunderabad and Hyderabad.

Sam Agritech is the leading exporter and has been adopting contract-farming model since 2002.[32] Its exports have grown from two containers (14.5 tons per container) in 2002 to 30 containers in 2005. The firm is exporting grapes through 'category managers' who have direct tie-ups with the supermarkets in the EU and UK. Detailed information on the processes involved from grape production to the supermarket in the importing country is given in Figure 2.7.

[32] The firm selects farmers based on the condition of the orchard and background of farmers. During the 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 acquainting themselves of the technical know-how and export procedures. The selection process starts after winter pruning in the month of September. The company has contract agreement with 10 farmers during 2005. The contract agreement is formal and written down, and usually lasts for a period of three years.

Figure 2.7: Flow Chart of Processes Involved in the Export of Grapes



Source: Parthasarathy Rao et al. (2007).

To meet the required standards for exports, growers have to adopt appropriate agronomic practices, perform certain mechanical practices,[33] and follow the right post-harvest management[34] 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 the domestic market (such as color, size, packaging, bunch weight, sugar acid, etc.). Thompson seedless, Tas-A-Ganesh, Crimson seedless, and Anab-E- Shahi varieties are grown in the state for export purpose.

Motivation for Contract Farming

Contract farmers producing for export received 55 percent higher net returns from grape production compared to those producing for domestic markets (Table 2.19). Though the unit cost of production of contract farmers for export markets was higher (33 percent) than for the domestic market, better prices (approximately 61 percent higher) offset these higher costs and generated higher dividends. The grape yields of the contract farmers were lower to maintain quality for export purpose. The cost of production for the export market is higher due to following of better management practices as well as incurring additional post-harvest costs towards packaging, pre-cooling, and cold storage. The contract farmers also have to follow the recommended practices to get the European Good Agricultural Practices (EuroGAP) certificate, which costs 10 percent more than the routine cultural practices.

Table 2.19: 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 per kg	9.28	6.28	32.65
Yield	Tons per ha	25	30	(-) 20
Prices received by	Rs per	31 (20–40)	12	61.29

[33] For example, the pre-harvest practices involve the use of shade nets, which are used to protect the fruit from sunlight to meet the color specifications.

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

farmers	kg				
Gross returns	Rs kg	per	21.96	12	45.35
Net returns	Rs kg	per	12.68	5.75	54.65

Note: Prices received vary from market to market. For example, prices received by the farmer for the UK market is Rs 40 per kg, for Europe it is Rs 33 per kg, and for the Gulf countries Rs 20 per kg.
Source: Based on data collected from grape growers (contract and non-contract) in the state.

Farmers' share in the prices paid by consumers in the importing countries ranges from 33 percent in the UK to 37.5 percent in the EU. The share of exporter and category manager is 18–19 percent in the entire supply chain, with the rest going to meet the transportation and packaging cost (Parthasarathy Rao et al. 2007). Besides higher returns, the contract producers also benefit from improved genetic stock and management practices. From the smallholders' perspective, the arrangement provides opportunity to share the global prices, and take advantage of liberalization and globalization, which otherwise was not possible.

2.4.5 Lessons Drawn from Innovative Marketing Institutions

Innovative institutions in the form of either *Raythu Bazar* or contract farming are compressing the supply chain and improving marketing efficiency, and thereby encouraging participation of smallholders. The concept of *Raythu Bazar* is good, but it primarily benefits the farmers near urban centers. However, the farmers through contract farming can benefit immensely even away from the urban centers, and can take advantage of growing international markets. The benefits include access to markets, technology, and credit, hence increased income and higher employment opportunities. In the case of contract farming in gherkins and grapes, it was found that the farmers, particularly smallholders were linked with the global markets. In the absence of contract farming it would have not been possible for smallholders to take up production of gherkins or grapes for export purpose. These high-value crops require considerable knowledge of technology and SPS compliance to meet the standards of the importing countries. This is possible through emerging innovative institutional arrangements by involving a number of smallholders and sharing benefits with them.

Appendix Table A2.1: Distribution of Fruits across Districts: Andhra Pradesh, TE 2000–01

District	Mango		Cashew		Banana		Orange and bativa		Papaya		Grapes		Total fresh fruits	
	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
	(percent to state area and production)													
Guntur	–	–	–	–	17.5	17.3	9	8.6	4.9	3.6	–	–	–	–
Karimnagar	–	–	–	–	–	–	7.3	7.3	–	–	–	–	–	–
Anantapur	–	–	–	–	–	–	23.3	34.6	48.4	49	4.3	4.3	–	–
Kurnool	–	–	–	–	5	5	–	–	3.9	3.5	–	–	–	–
Medak	–	–	–	–	–	–	–	–	–	–	1.5	1.5	–	–
West Godavari	6.5	6.7	29.2	29.4	14.6	14.4	–	–	–	–	–	–	6.6	6.8
Nellore	–	–	–	–	–	–	8.1	9	3.2	2	–	–	8.6	9.1
Khammam	10.3	10.7	–	–	–	–	–	–	–	–	–	–	7.3	5.3
Krishna	19.9	20.3	–	–	2.9	3	–	–	–	–	–	–	13.5	10.1
Nalgonda	–	–	–	–	–	–	31.5	19.9	–	–	–	–	6.4	4.0
East Godavari	6.1	6.5	22.2	22.2	22.1	20.5	–	–	–	–	–	–	6.6	7.6
Srikakulam	7.6	7.8	15.5	15.2	7.9	7.4	–	–	–	–	–	–	–	–
Kadapa	5.2	5.5	–	–	9.4	11.7	–	–	32.1	33.9	–	–	7.1	10.9
Mahbubnagar	–	–	–	–	–	–	–	–	–	–	4.6	4.6	–	–
Chittoor	14.1	14.7	–	–	–	–	–	–	–	–	2.4	2.4	9.3	7.1
Visakhapatnam	10.4	10.7	24.3	24.3	10.7	10.5	–	–	–	–	–	–	11.4	10.2
Hyderabad	–	–	–	–	–	–	–	–	–	–	86.3	86.3	–	–
*Andhra Pradesh**	*315*	*2,424.8*	*149.6*	*86.9*	*43.9*	*1,047.8*	*61.3*	*618.8*	*5.5*	*546.6*	*1.5*	*31*	*490.8*	*5,445.4*

Note: *Area in ‘000 ha and production in ‘000 tons; Blank spaces (–) refer to data not available.
Source: Horticulture Department, Government of Andhra Pradesh.

Appendix Table A2.2: Distribution of Vegetables across Districts: Andhra Pradesh, TE 2000–01

District	Tomato		Onion		Brinjal		Tapioca		Sweet Potato		Total vegetables	
	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
	(percent to state area and production)											
Guntur	5	5	–	–	9.3	9.3	–	–	17.1	17.1	8.2	8
Karimnagar	–	–	–	–	–	–	–	–	–	–	–	–
Anantapur	–	–	5	4.9	4.7	4.7	–	–	–	–	–	–
Kurnool	31.5	31.5	32.7	30.7	–	–	–	–	4.3	4.3	19.7	15.8
Medak	–	–	11	12.3	–	–	–	–	–	–	4.8	5
West Godavari	–	–	–	–	5.7	5.7	–	–	–	–	–	–
Nellore	–	–	–	–	–	–	–	–	23.1	23.1	–	–
Khammam	–	–	–	–	–	–	–	–	–	–	–	–
Krishna	–	–	–	–	–	–	–	–	–	–	–	–
Nalgonda	–	–	–	–	–	–	–	–	–	–	–	–
East Godavari	–	–	–	–	10.5	10.5	94.9	94.9	–	–	11.4	16.5
Srikakulam	–	–	-	-	8.2	8.2	1.6	1.6	4	4	–	–
Kadapa	–	–	9.6	8.5	–	–	–	–	–	–	–	–
Mahbubnagar	6.4	6.4	9.2	8.6	5.2	5.2	–	–	–	–	4.8	4.7
Chittoor	13.1	13.1	–	–	7.8	7.8	–	–	8.9	8.9	6.6	6.2
Visakhapatnam	–	–	–	–	11.1	11.1	3.1	3.1	23.8	23.8	6.1	5.7
Hyderabad	15.4	15.4	8.6	8.6	9.9	9.9	-	-	4.8	4.8	10.6	9.8
*Andhra Pradesh**	*76.5*	*764.7*	*31.1*	*522.8*	*21.5*	*430.3*	*19.1*	*381.8*	*2.0*	*39.3*	*234.4*	*2,862.3*

Note: *Area in ‘000 ha and production in ‘000 tons; Blank spaces (–) refer to data not available.
Source: Horticulture Department, Government of Andhra Pradesh.

Appendix Table A2.3: Growth in Inland and Marine Fish Production: District-wise, Andhra Pradesh

District	Inland fish		Marine	
	Production ('000 tons) (1999–2001)	Growth (percent) (1993–2001)	Production ('000 tons) (1999–2001)	Growth (percent) (1993–2001)
Nizamabad	12.7	9.7	–	–
Warangal	11	-0.9	–	–
Adilabad	13.1	26.5	–	–
Guntur	13.2	18.7	18.6	-10.6
Karimnagar	13.9	4.7	–	–
Anantapur	3.8	-8.9	–	–
Kurnool	10.7	33.3	–	–
Medak	10.3	0.5	–	–
West Godavari	95.1	24.7	3.2	27
Nellore	31.3	2.7	49.6	-0.6
Khammam	14.6	34.5	–	–
Krishna	91.7	56.2	11.9	10.4
Nalgonda	36.2	19.4	–	–
East Godavari	17.5	42.9	27.6	12
Srikakulam	5.7	-9.6	32.2	17.6
Kadapa	2.3	-11.4	–	–
Mahbubnagar	18.7	6.8	–	–
Chittoor	2.7	-21.3	–	–
Visakhapatnam	7.9	-14.5	40.1	11.2
Hyderabad	7.2	22.9	–	–
Andhra Pradesh	*419.6*	*13.9*	*183.2*	*4.3*

Note: Blank spaces (–) refer to Not Applicable
Source: Commissionerate of Fisheries, Government of Andhra Pradesh.

Appendix Table A2.4: District-wise Milk, Meat, and Egg Production: Andhra Pradesh, 2002

District	Milk		Meat				Eggs (million nos.)
	Total ('000 tons)	Buffalo (percent)	Total ('000 tons)	Large ruminant (percent)	Small ruminant (percent)	Pig and poultry (percent)	
Nizamabad	136	69.3	10	7.9	30.2	61.9	181.2
Warangal	158	76	14	4.8	21.5	73.7	532.9
Adilabad	168	56.3	5	16.9	50.6	32.5	172.9
Guntur	668	97.4	22	2.5	38.5	59	1,462.3
Karimnagar	328	69.8	18	6.4	40.2	53.4	360
Anantapur	192	59.9	12	5.5	31.9	62.6	235.3
Kurnool	403	75.7	14	20.6	33	46.4	222
Medak	206	66.6	49	51.4	41.3	7.2	422.3
West Godavari	446	84.2	12	7.9	21.8	70.3	1,426.8
Nellore	339	87	17	10.2	23.9	65.9	428.1
Khammam	308	71.9	7	12.1	32.5	55.4	193
Krishna	486	81.8	24	5.3	30.7	63.9	832.6
Nalgonda	262	68.9	19	4.4	16.2	79.4	584.6
East Godavari	483	73.6	13	4.2	20	75.8	1,089.4
Srikakulam	277	35.1	9	0.9	30.4	68.7	269.1
Kadapa	136	87	9	7.2	28.2	64.6	266
Mahbubnagar	436	68.5	35	2.5	19.1	78.4	863.9
Chittoor	535	17.3	23	1.6	15.1	83.3	1,214.6
Visakhapatnam	403	62.9	18	0.4	16.9	82.7	686
Hyderabad	213	61.6	69	38.4	38.1	23.5	3,419.4
Andhra Pradesh	*6,582*	*69.3*	*398*	*17*	*30*	*53*	*14,862.2*

Source: Directorate of Animal Husbandry, Government of Andhra Pradesh.

Appendix Table A2.5: Correlation between HVCs and Selected Indicators: Andhra Pradesh, 2001

Variables	HVCs	Fruits	Vegetables	Milk	Ruminant meat	Pigs, poultry, and eggs	Livestock*	Commercial crops**	Paddy
	(Percent to total value of production)								
	Correlation coefficients								
Urban (percent)	0.5	-0.02	0.59	0.05	-0.21	0.73	0.56	-0.18	-0.35
Population density (No. per sq. km of area)	0.49	0.06	0.45	0.02	-0.45	0.71	0.51	-0.54	0.11
Literacy (rural female percent)	0.1	0.48	-0.21	-0.13	-0.72	-0.16	-0.26	-0.37	0.52
Marginal farms (percent)	0.25	0.33	-0.16	-0.1	-0.64	0.24	0.07	-0.55	0.43
Farm size (ha)	-0.25	-0.33	0.19	0.09	0.63	-0.25	-0.08	0.56	-0.42
Poverty (percent)	-0.05	-0.19	0.10	0.22	0.53	-0.09	0.08	0.59	-0.52
Human Development Index	0.25	0.13	0.15	-0.08	-0.63	0.37	0.18	-0.29	0.11
Income (Rs per capita per annum)	0.29	0.25	0.1	-0.02	-0.57	0.28	0.14	-0.22	-0.01
Wages (Field labor male, Rs per day)	-0.21	0.09	-0.63	-0.26	-0.31	-0.11	-0.23	-0.13	0.47
Wages (Field labor female, Rs per day)	0.13	0.33	-0.33	-0.04	-0.45	0.03	-0.05	-0.01	0.15
Crop credit (Rs per NCA)	-0.18	0.21	-0.27	-0.2	-0.72	-0.28	-0.39	-0.31	0.65
Allied activities (agricultural) credit (Rs per ha)	0.26	0.33	0.08	0.19	-0.68	0.05	0.03	-0.49	0.34
Crop and allied activities credit	-0.08	0.21	-0.17	-0.15	-0.74	-0.16	-0.27	-0.38	0.62

(Rs per ha)									
Road density (Km per sq. km of area)	0.25	0.21	-0.17	0.05	-0.46	0.29	0.19	-0.54	0.48
Market density (No. per sq. km of area)	0.18	0.27	-0.09	-0.21	-0.39	0.2	0.02	-0.48	0.46
Irrigation (percent)	-0.27	0.12	-0.46	-0.36	-0.59	-0.2	-0.37	-0.28	0.78
Tractors density (No. per '000 ha)	-0.05	0.16	-0.3	-0.02	-0.57	-0.1	-0.15	-0.32	0.61
Fertilizer consumption (Kg per ha)	-0.19	-0.09	-0.16	-0.25	-0.61	0.06	-0.13	-0.43	0.77
Area under HYV (percent)	-0.29	-0.01	-0.38	-0.31	-0.68	-0.11	-0.29	-0.53	0.82
Unirrigated land covered by watershed programs (percent)	0.54	0.05	0.41	0.42	0.45	0.49	0.6	0.05	-0.61
Normal rainfall (mm.)	0	0.38	-0.46	-0.13	-0.54	-0.17	-0.25	-0.52	0.54
Crossbred animals (percent)	0.41	0.41	0.08	0.24	-0.29	0.13	0.16	-0.06	-0.13
Common property (percent)	-0.15	-0.60	0.03	-0.05	0.41	0.40	0.35	0.08	0.11
Feed availability (tons per LSU)	-0.21	0.08	-0.19	-0.11	-0.70	-0.25	-0.32	-0.32	0.62
Fruits and vegetables units (no.)	0.39	0.29	0.14	0.35	-0.22	0.14	0.22	0.05	-0.25
Fruits and vegetables and cold storage	0.54	0.42	0.18	0.25	-0.45	0.34	0.31	-0.06	-0.24

units (no.)									
Livestock, fruits and vegetables, and cold storage units (no.)	0.67	0.42	0.43	0.36	-0.46	0.43	0.42	-0.24	-0.27
Paddy and flour mills (no.)	-0.26	-0.16	-0.38	-0.2	-0.11	-0.02	-0.11	-0.34	0.76

Note: Sample size = 23 observations.
*All livestock products
**Commercial crops include oilseeds, sugar cane, cotton, chilies, turmeric, and tobacco.
LSU = Livestock units
Source: Parthasarathy Rao et al. (2007).

Chapter 3

Constraints Faced By Agriculture

The agriculture sector, both in Andhra Pradesh and in the country, is faced with numerous constraints for the growth of both traditional crops and HVCs. Besides drought, important constraints include dominance of smallholders, rising subsidies (that restrict investment in agriculture), and outdated grain management policies (constraining diversification). This chapter provides a brief discussion of these constraints and their impacts

3.1 Predominance of Smallholders

Small landholders have been predominant in Andhra Pradesh agriculture in the past, and the trend is likely to continue in the future as well. This is largely due to the imposition of land ceilings and lack of non-farm income opportunities. The number of small landholders continues to grow unabated, with serious implications on their viability and agricultural growth. There were about 8.6 million smallholders (<2 ha) in the state, comprising about 81 percent of the total farm households and commanding roughly 43 percent of the total operated area in 2000–01. The average size of landholding of smallholders was a mere 0.72 ha in 2000–01. The viability and sustainability of such tiny landholdings by growing foodgrains is doubtful, particularly in view of the on-going process of market liberalization and globalization.

To augment their income the smallholders need to shift from a foodgrain-based system to high-value agriculture (Pingali and Rosegrant 1995; Ryan and Spencer 2001; Barghouti et al. 2004; Joshi et al. 2003). However, several constraints prohibit smallholders from diversifying towards HVCs.

3.1.1 Food Security Syndrome

The foremost desire of the smallholders is to be self-sufficient in foodgrain production. Farmers do not take full advantage of the commercialization and specialization opportunities as they are willing to maintain household food security from the production of their own crops (von Braun 1995). This is perhaps due to the risk in access to foodgrain markets as well as available market opportunities for HVCs, for which markets are thinly distributed. Access to markets is a pre-requisite for the effective participation of smallholders in income-augmenting opportunities.

3.1.2 High Transactions Costs

The transactions costs of smallholders are very high due to the meager marketable surplus. Though the smallholders have many advantages, especially abundant family labor, their scale of operations poses major constraints in shifting their production portfolio towards HVCs. The transactions cost for smallholders for vegetable production and marketing was much higher (by 46–55 percent) than for large farmers (Joshi et al. 2006). Though the smallholders are more cost-effective in vegetable production, higher transactions costs reduce their comparative advantage.

3.1.3 Production and Market Risk

A shift from traditional (for example, cereal-based) to non-traditional crops (HVCs) may lead to higher production (variable, cash) costs, hence more income is at risk in the event of crop failure (Simmons et al. 2005). Crop failure due to disease or insect infestation or change in weather adversely affects vegetable production, thus threatening food security of smallholders. The coefficient of variation of vegetables on small farms is higher (63 percent) as compared to large farms (56 percent) (Joshi et al. 2006). The prices of HVCs are also highly volatile and fluctuate with seasons. In particular, prices of fruits and vegetable are very sensitive to supply. Data from Azadpur Mandi (one of the largest vegetable markets in Asia) showed a very high coefficient of variation (66 percent) in the vegetable prices. However, in the case of wheat and rice prices, stabilization is assured by government intervention (Parthasarathy Rao et al. 2007).

3.1.4 Inefficient Supply Chain

The traditional supply chains in HVCs are inefficient, unorganized, and disintegrated. Intermediaries exploit producers who do not have bargaining power due to limited produce. Farmers' share in the consumers' rupee varies in the range of 40–56 percent in the case of vegetables and 28–42 percent for fruits, depending upon the supply channel and the crop (Parthasarathy Rao et al. 2007).

3.1.5 Non-Availability of Credit

Most of the HVCs require large amounts of capital for initial investments to acquire new assets, seek information for new technology, and adopt different components of the technology. The existing credit supply system for smallholders is weak though the

government is taking initiatives to step up rural credit. Often, farmers have to rely on the informal credit sector, which has a high cost of credit (Ramachandra Rao and Tripathi 2001) and from which as much as 40 percent of credit needs in rural India are met.

3.1.6 Food Safety and Quality Issue

While HVCs are perishable, in the modern supply chain, when farmers are linked with the supermarkets or retail chains, quality assumes critical importance. Similarly, in the global market, farmers have to meet the quality standards as per the sanitary and phyto-sanitary measures, which include good agronomic practices and quality processing, packaging, transporting, and labeling. Failure to maintain quality standards as per the SPS measures increases the likelihood of the commodity being rejected in the global market. Smallholders are particularly handicapped as they lack information about food safety related issues unless they are linked with agri-business.

3.2 Growing Input Subsidies

One of the major problems confronting Andhra Pradesh agriculture is the mammoth amount of input subsidies that are leading to inefficiencies, obstructing investment and impeding agricultural growth. Fertilizer, irrigation, and power are the major components that are receiving subsidies to meet multiple objectives (for example, protect farmers and/or industry). Of these, fertilizer subsidy is controlled by the Central government, while irrigation and power subsidies are under the purview of the state governments. The structural reforms of 1991 were followed up by Andhra Pradesh since the mid-1990s to address the distortions in agricultural input prices.[1] Unfortunately, over the years, these subsidies have come to be used more for political mileage rather than economic gains, and are thus difficult to withdraw.

3.2.1 Nature and Extent of Subsidies

To estimate the subsidy on fertilizer, irrigation, and the power sector, we used the approach of Gulati and Narayanan (2003). Broadly, the fertilizer subsidy is measured as the difference between import parity price and the price actually paid for the

[1] Pricing of fertilizer was made more market determined with the withdrawal of the retention price mechanism from phosphatic and potassium fertilizers; however, subsidies continued in nitrogenous fertilizers. Similarly, the Electricity Act 2003 has shifted the responsibility of power sector reforms primarily to the state governments.

fertilizer by the farmer multiplied by the total consumption of fertilizers.[2] Irrigation and power subsidies are measured as implicit payments made by the state government to the service providers. While the irrigation subsidy is wholly provided as budgetary support, the power subsidy to agriculture is partly financed through cross-subsidization. The irrigation subsidy is measured as the excess of operation and maintenance (O&M) expenses over receipts from the farmers as canal irrigation charges.[3] The power subsidy is estimated as the difference between the average cost of production per unit and the average revenue realized per unit, multiplied by agricultural power consumption.[4]

3.2.1.1 Extent of Subsidy

The total expenditure incurred on major input subsidies, consisting of power, fertilizer, and irrigation, was estimated at Rs 44.31 billion, in current prices, during 2002–03. At constant prices (1993–94), the estimates reveal a marked increase in the expenditure on agricultural input subsidies from Rs 5.5 billion during 1983–84 to Rs 25.9 billion in 2002–03, registering a compound growth rate of about 8.8 percent per annum. The rate of growth of input subsidies has decelerated in the 1990s in comparison to the 1980s, declining from 15.9 percent per annum during the period 1981–82 to 1990–91 to 4.80 percent during the period 1991–92 to 2002–03.

During 2002–03, the total expenditure on fertilizers, electricity, and irrigation subsidies represented 12.9 percent and 2.7 percent of the agricultural and aggregate GSDP, respectively. Rising subsidies can be attributed to two components: (i) expansion in usage, and (ii) increase in the rate. The rise in irrigation subsidy was dominated by the increase in the rate during the 1990s. Fertilizer subsidy registered

[2] The import parity price was worked out by adding c.i.f. price, pool handling expenses, and dealer's margin, as suggested by Gulati and Narayanan (2003).

[3] In fact, a broader definition of irrigation subsidy should add one percent of cumulative irrigation investment at historical cost, which needs to be recovered along with the O&M expenses (Planning Commission 1996). However, due to data constraints, this has not been attempted in this paper. Since our focus is on how the benefits of irrigation subsidy are being shared by different farm groups and regions, the omission of one percent of cumulative irrigation at historical cost would not make a difference to the distribution pattern of irrigation subsidy. Rao (2005) has measured irrigation subsidy in three different ways: (i) O&M subsidy + 6 per cent of the cumulative irrigation investments at historical cost; (ii) O&M subsidy + 1 per cent of the cumulative irrigation investments at historical cost; and (iii) O&M subsidy.

[4] Power subsidy was computed as the (i) difference between average cost of production per unit and the average revenue realized per unit multiplied by agricultural power consumption as estimated by APTRANSCO; (ii) difference between the cost to serve agriculture and average revenue realized per unit multiplied by agricultural power consumption as estimated by APTRANSCO; and (iii) difference between the cost to serve agriculture and average revenue realized per unit multiplied by power consumption as estimated by the Federation of Farmers' Associations, Andhra Pradesh.

the highest increase among all the input subsidies considered (Table 3.1 and Appendix Table A3.1).

Table 3.1: Annual Compound Growth Rates of Subsidy on Fertilizer, Irrigation, and Power in Andhra Pradesh, 1981–82 to 2002–03

(in percent)

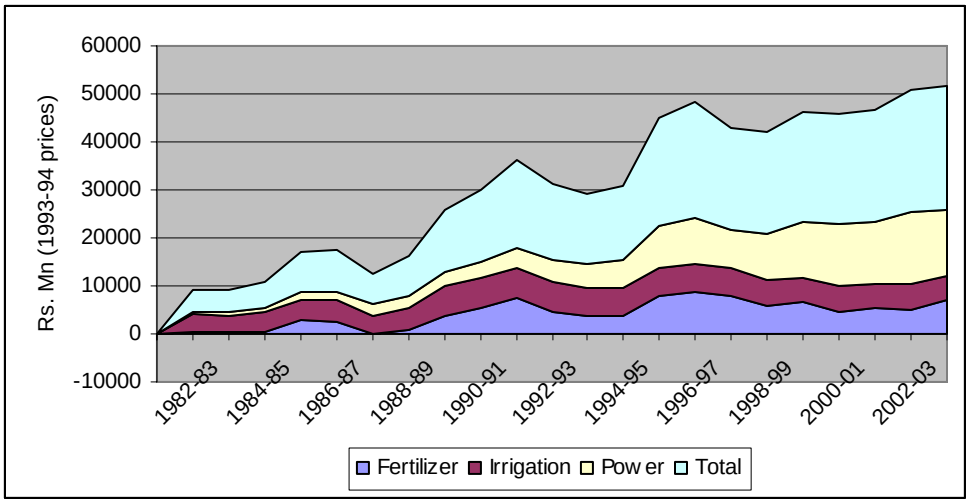
Period	Fertilizer	Irrigation	Power	All Inputs
1981–82 to 1990–91	30.67	7.26	25.65	15.86
1991–92 to 2002–03	2.13	-1.82	11.1	4.8
1991–92 to 1995–96	23.23	-1.88	21.85	13.99
1995–96 to 2002–03	-5.27	-2.02	8.61	1.94
1981–82 to 2002–03	17.79	1.67	16.39	8.76

Source: Vashishtha (2006).

3.2.1.2 Composition of Subsidy

Figure 3.1 shows the changing composition of input subsidies. While irrigation accounted for over 76 percent of the total input subsidy in TE 1983–84, its share declined to around 21 percent during TE 2002–03, primarily due to an absolute decline in the gross canal irrigated area (from 2.2 million ha in 1994–95 to 1.5 million ha in 2003–04). In sharp contrast, the power subsidy for groundwater irrigation increased substantially from less than 15 percent to around 56 percent over the same period. Expenditure on power subsidy recorded a growth rate of around 16 percent per annum between 1981–82 and 2002–03.

Figure 3.1 Changing Composition of Input Subsidy: Andhra Pradesh, 1980–81 to 2002–03



Source: Rao (2005).

The share of fertilizer subsidy increased till the mid-1990s but declined afterwards due to persistent drought conditions.[5] The changing composition of input subsidies points to increased efficiency losses in the economy.

Power Subsidy

The power subsidy increased rapidly from an estimated Rs 743 million in TE 1983–84 to about Rs 13.96 billion in TE 2002–03[6] (in constant 1993–94 prices). This is attributable to low financial recovery and increasing number of energized electric pumpsets. The share of agriculture in total electricity consumption was 40 percent in 2001–02 but the share in revenue was only 4.8 percent. The number of electric pumpsets in the state increased from 664,000 in 1987 to 1.12 million in 1999. The share of electrical pumpsets in total pumpsets (electric and diesel) increased from 75.5 percent in 1987 to about 89 percent in 1999. The gross irrigated area from tubewells

[5] During the period 2001–02 to 2004–05, only the year 2003–04 was a near normal year in terms of rainfall. While 2001–02 and 2004–05 were deficient rainfall years, 2002–03 was a severe drought year. Overall, there was a 15 percent deficiency in rainfall during the last four years (Rao 2005).

[6] As per the Andhra Pradesh State Electricity Board, the power consumption in agriculture increased from 6,972 million units (MU) in 1991–92 to 10,301 MU in 2001–02 to 10,998 MU in 2003–04 (Government of Andhra Pradesh, *Statistical Abstract of Andhra Pradesh*, various years).

increased from 22 percent in 1998–99 to 35.6 percent in 2003–04; the area expanded from 1.3 million ha to 1.7 million ha during the same period.

Power subsidy to agriculture has become an issue of serious concern in the state's economy, especially after the re-introduction of free power to farmers in 2004. Under flat rate the marginal cost of using an additional unit of power and water for crop production is zero. In this situation, farmers tend to overuse electricity and overexploit groundwater. Farmers are willing to pay higher tariff provided the quality, delivery, and reliability of power supply are ensured (World Bank 2003). Though the tariff is low for every farmer, smallholders disproportionately share the burden of low-quality and unreliable power supply because they spend a greater share of their income to install electric pumps than large farmers. Since smallholders cannot afford alternative sources such as diesel pumps, they are subject to higher production uncertainty than the large farmers.

Irrigation Subsidy

Expenditure on irrigation subsidy increased from Rs 3,731 million in TE 1983–84 to Rs 5,177 million in TE 2002–03 (at 1993–94 constant prices). During this period, irrigation subsidies increased by 38 percent but gross surface irrigated area declined by about 15 percent—from 1.73 million ha in TE 1982–83 to 1.4 million ha in TE 2002–03. The share of surface irrigated area in gross irrigated area also declined from 37.5 percent in 1998–99 to 31.6 percent in 2003–04, while gross irrigation by other sources [7] declined from 40.4 percent to 32.8 percent during the same period. The rising subsidy is due to low water rates (not revised since July 1997), low financial recovery (30–40 percent), and low ratio of receipt to working expenses (about 13 percent) (Vashishtha 2006).

The irrigation sector is characterized by several disquieting features: falling public investment, low canal water use efficiency (25–40 percent as comparable to an achievable level of 65 percent), poor maintenance of distributaries and watercourses due to low recovery from beneficiaries, and poor governance of the irrigation system (inequitable distribution to tail-enders). [8]

Fertilizer Subsidy

[7] Other sources include tanks, wells other than tubewells, and others.
[8] During the early 1980s, the spread of high-yielding varieties associated with a rapid rise in paddy yields was confined to some of the coastal areas of Andhra Pradesh where surface irrigation was available.

The budgetary subsidy contains components of subsidy going to different agents such as farmers, the fertilizer industry, and the feedstock-supplying companies. At the all-India level, farmers' share in total fertilizer subsidy showed a consistent decline, from 90 percent in 1998–99 to 57 percent in 2002–03. Thus, the fertilizer industry has been a major (if not the main) benefactor of the subsidy. The share of Andhra Pradesh in all-India fertilizer subsidy markedly increased from about 3 percent in 1980–81 to about 13 percent in 2003–04. The fertilizer subsidy in Andhra Pradesh increased sharply from Rs 428 million in TE 1983–84 to Rs 6,840 million in TE 2003–04 (at 1993–94 constant prices); registering an annual average growth rate of about 5 percent. The fertilizer consumption in the state has increased from 110.4 kg per ha in 1991–92 to 150 kg per ha in 2003–04. Smallholders use more fertilizer (190.33 kg per ha) than the large farmers (96.4 kg per ha).

The fertilizer response ratio of paddy (kg of grain for one kg of fertilizer) is about 5.44, which is lower than the national level (6.38) but much higher than ratio in Punjab (3), another important food surplus state (IASRI 2001).[9] Any withdrawal of subsidy on fertilizer, without any technological intervention or shift in production portfolio, would negatively affect farmers and paddy production in Andhra Pradesh.

3.2.2 Distribution of Subsidies

Across regions: Table 3.2 shows the inter-regional variations in subsidies in the use of agricultural inputs in Andhra Pradesh. About 45 percent of the total subsidy in TE 2002–03 was enjoyed by the Telangana region, which accounted for about 35 percent of the gross cropped area (GCA). On the other hand, Coastal Andhra Pradesh and Rayalaseema accounted for about 42 percent and 23 percent of the gross cropped area while their shares in the total subsidy were approximately 36 percent and 19 percent, respectively.

[9] Therefore, in the context of efficiency, an important policy implication of the response ratio is that fertilizer subsidy contributes higher benefits to farmers in Andhra Pradesh than in Punjab.

Table 3.2: Distribution of Irrigated and Gross Cropped Area and Subsidy on Fertilizer, Irrigation, and Power across Regions: Andhra Pradesh, 2002–03

Region	Gross cropped area (percent)	Surface irrigated area (percent)	Groundwater irrigated area (percent)	Subsidy (percent)			
				Fertilizer	Irrigation	Power	Total
Coastal	42.1	81.3	29.5	46.28	81.3	20.8	36.27
Rayalaseema	22.5	6.7	21.2	15.85	6.7	22.6	18.54
Telangana	35.4	12	49.3	37.87	12	56.6	45.19

Source: Rao (2005).

The bulk of fertilizer and irrigation subsidies are received by the Coastal region, which is characterized as intensive-agriculture with high input uses. Fertilizer consumption per ha is highest in this region. The subsidy on surface irrigation corresponded to the irrigated area: around 81 percent of the irrigation subsidy went to the farmers located in Coastal Andhra Pradesh. Telangana and Rayalaseema shared only 12 percent and 6.7 percent of irrigation subsidy in the state, respectively. On the other hand, the Telangana region has witnessed rapid growth in groundwater irrigation exploitation in recent years and accounted for about 49.3 percent of groundwater irrigated area. As a result, the Telangana region captured a bulk of power subsidy (56.6 percent), followed by Coastal region (20.8 percent) and Rayalaseema (22.6 percent).

The regions with favorable factor endowments tend to benefit more than proportionately from infrastructure subsidies. However, this imbalance in the distribution of subsidies is partly corrected on account of the rising subsidy on the use of power through electric pumpsets. For example, Rayalaseema region, which is characterized as marginal and risk-prone, is deficient in infrastructure facilities but has gradually benefited from power subsidies. It is ironical that seemingly regional corrective measures (for example, power subsidy) are accompanied by depletion of groundwater resources and erosion of investment capacity of the power utilities.

3.2.2.1 By Landholding Size

Marginal and small landholders (<2 ha), who account for 81 percent of total farm holdings in 2000–01, predominate the agricultural sector. Most of the subsidies are framed in the guise of protecting the interests of smallholders. However, contrary to the expectations, subsidies on irrigation and power are highly skewed towards favored

medium and large landholders (>4 ha). Table 3.3 shows that as high as 61.5 percent of total power subsidy was enjoyed by the semi-medium, medium, and large landholders, while the marginal and small landholders (<2 ha) shared less than 38.5 percent in TE 2003–04. The situation was relatively better for marginal and small landholders in irrigation subsidy—their share was about 51.7 percent while that of semi-medium, medium, and large farmers 48.2 percent. And in the case of fertilizer subsidy, the marginal and small landholders have a relatively better edge over semi-medium, medium, and large farmers. However, in terms of unit area (GCA) or holding basis, the benefit of irrigation and power subsidy to marginal and small landholders is much less than to semi-medium, medium, and large farmers.

Table 3.3: Distribution of Fertilizer, Irrigation and Power Subsidy by Size of Landholding: Andhra Pradesh, 2003–04

Landholding size*	Fertilizer subsidy (Rs)		Irrigation subsidy (Rs)		Power subsidy (Rs)		Percentage distribution of subsidy across farm size			
	Per holding	Per ha	Per holding	Per ha	Per holding	Per ha	Fertilizer	Irrigation*	Power	Total
Marginal (<1 ha)	456	1,237	58	91	687	1,555	28.43	25.51	16.34	18.16
Small (1–2 ha)	1,195	999	164	113	2,595	1,833	26.71	26.24	22.12	22.94
Semi-medium (2–4 ha)	2,021	896	418	154	5,207	1,954	24.66	25.34	25.1	25.15
Medium and large (>4 ha)	6,238	709	1,190	206	18,980	2,735	20.2	22.89	36.43	33.74
All	961	985	775	187	2,651	2,051	100	100	100	100

Note: * Irrigation subsidy is for 2002–03
Source: Vashishtha (2006).

3.2.2.2 By Crops

The regions are characterized by dominance of paddy in Coastal Andhra Pradesh, cotton and pulses in Telangana, and sorghum and oilseeds in Rayalaseema. Of these, paddy is the most important crop of the state. As per 2000–01 statistics, paddy accounts for about 30.7 percent of the gross cropped area, and about 36.4 percent in the total value of crop output (Table 3.4).

Table 3.4: Distribution of Irrigation and Power Subsidy across different Crops: Andhra Pradesh, 2000–01

Crop	Share in gross cropped area (percent)	Share in value of crop output (percent)	Distribution of input subsidy (percent)			
			Fertilizer	Irrigation	Power	Total
Paddy	30.7	36.4	37.7	87.5	34.17	45.8
Coarse cereals	10.4	4.7	6.3	1.11	3.98	3.9
Pulses	14	5.2	2.5	0	0	0.53
Oilseeds	19.3	8	6.3	0.32	5.28	4.5
Cotton	8.1	5.2	7.4	0.72	5.89	5.16
Others	17.5	40.5	39.8	10.37	50.68	40.11

Source: Rao (2005).

Table 3.4 shows that about 46 percent of the total subsidy in the state is used by paddy. Disaggregating the subsidy between fertilizer, irrigation, and power, the available estimates reveal that a large chunk of irrigation subsidy is used by paddy because the Coastal region is dominated by paddy and surface irrigation is the principal source of irrigation. Other crops (for example, sugar cane, tobacco, chili, fruits, and vegetables) share about 40 percent of the total subsidy and dominate the power subsidy (50.68 percent). Ironically, more than half of the total cropped area of the state is deprived of irrigation and power facilities and shares a mere 14 percent subsidy.

3.2.3. Impact of Subsidies

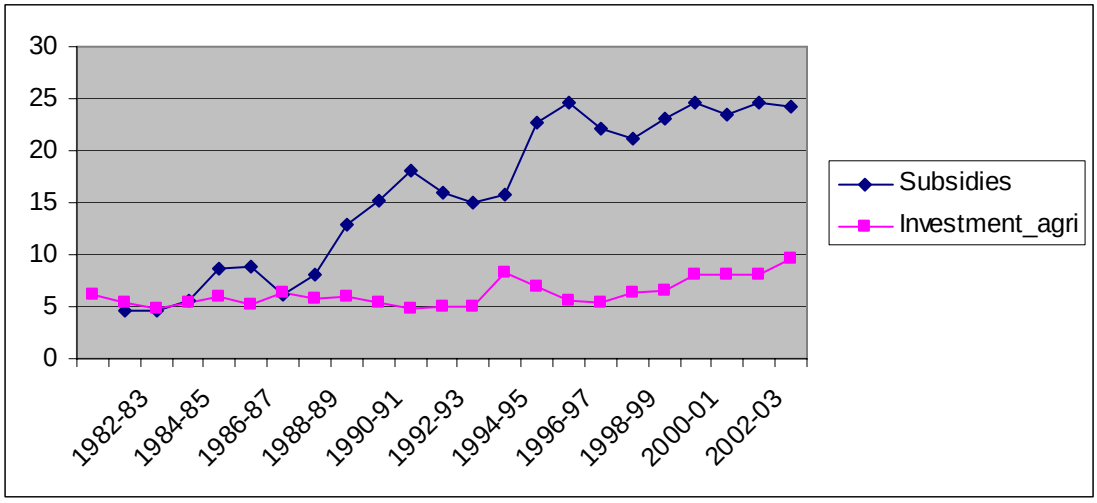
3.2.3.1 Fiscal Imbalance

State finances reached a crisis by 1995–96, largely due to the huge revenue losses arising from subsidized rates for irrigation and power supplied to agriculture, together with the subsidy on rice (Rao and Dev 2003). Although the revenue receipts recovered subsequently, expenditure increased at much higher rates, resulting in an increase in the fiscal deficit from 3 percent of GSDP in 1995–96 to 4.7 percent in 2002–03. As a proportion of the revenue receipts, aggregate input subsidies increased from 11.4 percent in TE 1983–84 to a peak of 27.8 percent in the mid-1990s but declined thereafter to 20.1 percent during TE 2002–03. The subsidy on irrigation and power was equivalent to around 42 percent of the state's gross fiscal deficit during 2002–03.

Excessive expenditure on input subsidies has had an adverse effect on public investment as measured by gross fixed capital formation (GFCF) in the agriculture and

irrigation sectors (Figure 3.2). Public investment in agriculture decelerated sharply during the 1990s to a rate of growth of 1.4 percent from 8.5 percent per annum recorded during the 1980s (Bathla and Thorat 2005).[10] Estimated expenditure on input subsidies was approximately three times the annual GFCF in agriculture for TE 2001–02 (Chand and Kumar 2005).

Figure 3.2: Growth of Public Investment and Input Subsidies in Agriculture (percent): Andhra Pradesh (1993–94 prices), 1980–81 to 2003–04



Source: Bathla and Thorat (2005).

3.2.3.2 Financial Viability of Power Sector

Low returns on supply of electricity to agriculture and high technical and non-technical losses together have resulted in: (i) high cross-subsidy to agriculture and domestic consumers, on the one hand, and high tariff on commercial and industrial users, on the other, the latter complaining of becoming uncompetitive due to high cost of energy input; and (ii) near financial bankruptcy of the State Electricity Board. The revenue deficit of the electricity board increased almost three times: from Rs 8,570 million in 1994–95 to Rs 25 billion in 1999–2000. Similarly, the sale revenue as a

[10] As per the estimates presented by Mahendra Dev and Ravi (2003), the rate of growth in the GFCF in Andhra Pradesh's agriculture declined from 6.6 percent in the 1980s to -1.1 percent in the 1990s implying a decrease in absolute terms at constant (1980–81) prices. In the 1990s, while public investment in state's agriculture recorded a growth of 1.4 percent per annum, private investment recorded a negative rate of growth of 3.8 percent per annum. This decline in private investment in agriculture in the 1990s in Andhra Pradesh is in sharp contrast to the all-India level, where private investment in agriculture has increased at a faster rate than public investment in agriculture.

ratio of cost declined from 94.2 percent in 1992–93 to 72.1 percent in 1994–95 and reached a low level of 55.82 percent in 1999–2000 (Government of India 2002b). The technical and non-technical losses in Andhra Pradesh of total availability of electricity are 23–38 percent. The available information reveals that due to high transmission and distribution (T&D) losses (theft, leakages, etc.) alone, the TRANSCO and distribution companies (DISCOM) incurred a loss of Rs 20.48 billion in TE 2003–04.

3.2.3.3 Environmental Degradation

Subsidies encourage intensive use of fertilizer, surface irrigation, and groundwater, and lead to deterioration in soil and water quality. The state is facing four problems related with soil and water in the agricultural sector: (i) imbalanced use of nutrients; (ii) declining water table due to excessive digging of new wells; (iii) waterlogging and soil salinity due to mismanagement of surface irrigation; and (iv) land degradation due to aquaculture.

Fertilizer application exceeds the recommended levels by as much as 48 percent in the case of paddy and by around 17 percent in the case of groundnut and cotton (Subrahmanyam and Sekhar 2003). The low price of nitrogenous fertilizer due to the high subsidy has tempted farmers to consume more of nitrogenous fertilizers. Besides excessive use, the nutrients are not used in balanced proportion; the N:P:K ratio deviated to 6:2.4:1 in 1990, 10:2.9:1 in 1996–97, and 7:2.6:1 in 2003–04 as against the recommended level of 3:1.5:1. The imbalanced use of nutrients adversely affects crop production.

Irrigated area increased from 35 percent in the early 1980s to 42 percent in 2000, largely due to groundwater irrigation.[11] This was mainly due to availability of electricity, which made it cheap to run electric pumpsets. The shift to groundwater has led to overexploitation of water resources and depletion of water table in several areas. As production from dry lands has become highly uncertain, farmers seek to evade the risk of drought by digging new wells / bore wells at exorbitantly high cost and at a considerable risk of failure. The Rayalaseema region in Andhra Pradesh is particularly vulnerable to falling water table. The region receives scanty rainfall but access to power has led to an increase in the number of pumpsets. More than 35 percent of blocks in the region are now characterized as over-exploited and critical in terms of the groundwater level (Table 3.5). The corresponding number of blocks in Telangana region is about 25 percent. The Coastal region, having high rainfall and better network

[11] The share of groundwater in total irrigated area increased from 21 percent in the early 1980s to 42 percent in 2000, while that of surface irrigation declined both for tank and canal irrigation.

of surface irrigation, is in a better position, with about 86 percent blocks as safe with respect to fall in the groundwater level. The steep fall in the water table is leading to higher failure rates of installing tubewells. [12]

Table 3.5: Percentage Distribution of Blocks according to Status of Groundwater Level in Different Regions: Andhra Pradesh

Region	Over-exploited	Critical	Semi-critical	Safe	Total
Coastal	5.2	2.23	6.44	86.14	100
Rayalaseema	24.17	10.88	22.05	42.9	100
Telangana	17.41	7.49	21.05	54.05	100
All regions	15.22	6.67	16.52	61.59	100

Source: Vashishtha (2006).

In the Coastal region, waterlogging and soil salinity are the main problems in surface-irrigated areas, mainly in rice and sugar cane cultivation. Approximately 150,000 ha in the state are affected by these twin problems. Low recovery of water charges constrains investment in the provision of adequate drainage that further compounds the problems. Since water rates are low, farmers invariably cultivate high-water requirement crops such as rice, without proper drainage, which causes salt build-up in the soil and rise in the water table (Government of Andhra Pradesh 2003). The adverse effects of these problems are declining crop and resource productivity and falling farm income. An alternative production system with less water requirement would minimize these land and water related problems.

Another problem emanating from the mismanagement of the use of surface water and groundwater is related to the degradation of fertile agricultural land due to excessive aquaculture. Although the state's shrimp farming boom raised incomes substantially, it led to many environment-related problems: diversion of farmland; pollution of waterbodies; degradation of land and salinization of soil, leading to reduced agricultural production; and deterioration in drinking water quality (Aquaculture Authority 2001). The lands around the shrimp ponds were reported to have become unsuitable for growing crops. Large-scale abandonment of agricultural production became common around the shrimp ponds. It was also reported that farmers who were

[12] To cite an example from the Andhra Pradesh Rural Livelihood Project (APRLP) in Mahbubnagar district, as many as 200 attempts were made to dig borewells but the success rate was only 42 percent. Even smallholders attempted to drill borewells after borrowing heavily (Rao 2004).

inclined to shift from shrimp farming to crops had to abandon their lands for at least two years in order to minimize the adverse effects of shrimp farming.

3.3 Inefficient Grain Management

Grain management is an issue of increasing debate, with the growing subsidy bill and extreme fluctuation of buffer stocks in recent times. The food subsidy bill in the country increased from Rs 33.2 billion in 1990–91 to Rs 106.6 billion in 2001–02 and further swelled to Rs 142.8 billion in 2003–04, and increased from 0.48 percent of GDP in 1999–2000 to 0.91 percent in 2003.[13] Andhra Pradesh is no exception to the national scenario in grain management, with a food subsidy bill of Rs 3.4 billion in 2003–04.

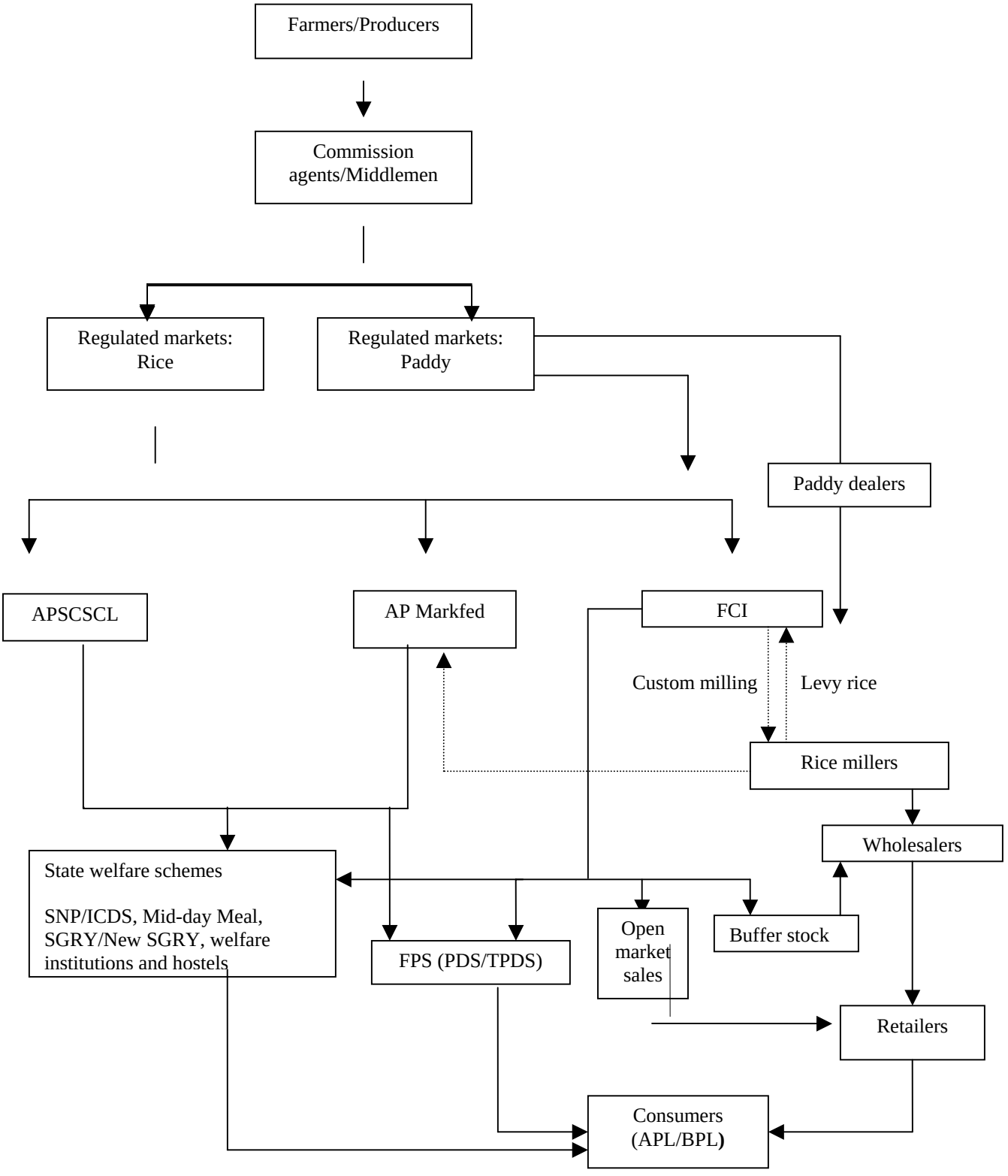
Figure 3.3 shows the supply chain and the key agencies involved in: (i) procurement; (ii) rice milling; (iii) stocking; and (iv) distribution to fair price shops and the government's social safety net programs. Instruments of intervention that are used for the purposes of grain management include support/procurement price, zoning restrictions, compulsory procurement (levy), grain movement controls, issue price, and maintenance of buffer stocks.

Broadly, grain management at the national level is controlled by two principal institutions, namely the FCI and the Commission on Agricultural Costs and Prices (CACP). In Andhra Pradesh, besides FCI, the major player is Andhra Pradesh State Civil Supplies Corporation Ltd. (APSCSCL).

The CACP recommends the MSP of paddy for government approval, and FCI procures from surplus rice-producing states. The recommendation of CACP for price fixation is based on the average C_2 (full, including land rent) cost of production at the national level. Unfortunately, despite enjoying a significant amount of input subsidy, Andhra Pradesh is becoming less competitive in paddy production in comparison to other states. The C_2 cost of paddy production is continuously rising, now exceeding the MSP announced by the government (Figure 3.4). Farmers are still producing paddy mainly due to assured procurement. Almost three-fourths of paddy production in the state is marketed. During 2003–04, the state accounted for about 18.53 percent of total rice procurement in the country.[14] The share of FCI in total procurement in the state grew from 12.8 percent in 2000–01 to 50.3 percent in 2003–04, while that of state agency declined proportionately.

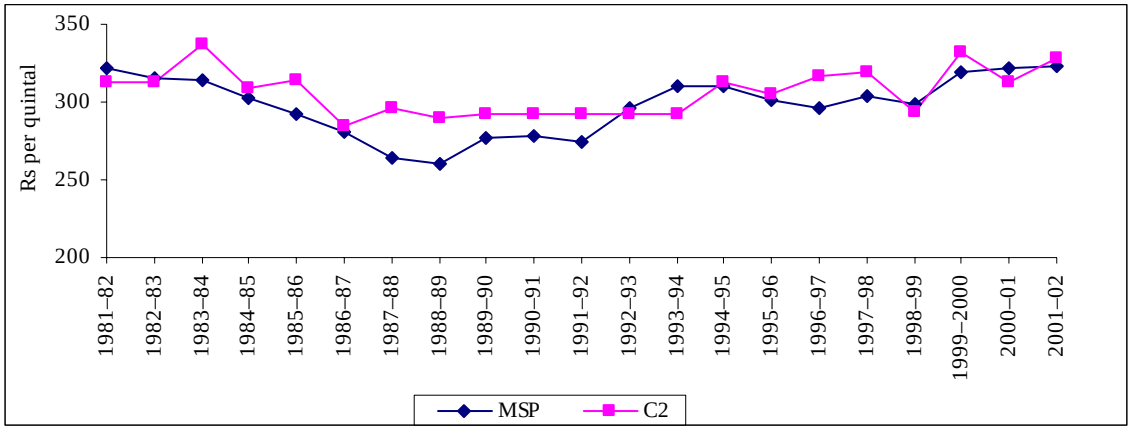
[13] It dipped to 0.83 percent in 2004–05.
[14] The state is second to Punjab in the procurement of paddy (and rice).

Figure 3.3: Supply Chain and Key Agencies in Grain Management



Source: [0]Deb (2006).

Figure 3.4: Comparing MSP and C_2 Cost of Paddy: Andhra Pradesh, 1981–82 to 2001–02



Source: Government of India, *Reports of the Commission for Agricultural Costs and Prices*, various years.

An attempt is made here to assess the factors influencing the procurement of rice in Andhra Pradesh[15] (Table 3.6). The production level of rice in Andhra Pradesh was the significant determinant for rice procurement. Surprisingly, the procurement price of rice did not appear to have a significant role in rice procurement in Andhra Pradesh. Findings by Radhakrishna and Indrakant (1987) for the periods 1970–71 and 1985–86 also had the same conclusions. The contribution of procurement prices gradually decelerated during 1970–71 to 1985–86 (Gulati and Sharma 1991). The chronology clearly revealed that during the early period of procurement, the level of prices contributed in the extent of procurement but gradually that role became insignificant. It appears that the dominating role of assured procurement rather than the procurement prices influence the decision of farmers' to sell rice to the government agencies.

[15] OLS as well as the Cochrance–Orcutt estimates were used to overcome the presence of serial correlation problem in OLS.

Table 3.6: Regression Results for Rice Procurement in Andhra Pradesh, 1970–71 to 1999–2000

Explanatory variables	Dependent variable: Rice procurement in Andhra Pradesh			
	OLS	Cochrane–Orcutt method (AR-3)	OLS	Cochrane–Orcutt method (AR-3)
Constant	-7.3	1.18	-35.77	6.99
	(-0.89)	(0.25)	(-5.1) *	(1.39)
Rice production level	1.02	0.55	3.16	0.52
	(1.78) *	(1.74) *	(7.22) *	(1.71) *
Rice procurement price	-0.87	1.10	–	–
	(-1.14)	(1.6)		
WPI of rice	1.8	-0.27	–	–
	(2.22) *	(-0.38)		
Procurement–WPI ratio	–	–	-0.52	0.26
			(-0.5)	(0.36)
Summary statistics				
R^2	0.84	0.93	0.69	0.93
R-bar^2	0.82	0.91	0.67	0.9
DW-statistic	0.65	2.12	1.11	2.01
F-statistic	39.63 *	39.79 *	26.63 *	42.34 *

Note: * indicates statistical significance at 10 percent level.
Source: Deb (2006).

3.3.1. Rising Cost of Grain Management

The Food Corporation of India (FCI), in partnership with state agencies, is engaged in the procurement, storage, and distribution of rice. The economic cost of rice for FCI, which includes procurement, stocking, and distribution, increased (at 1993–94 prices) from Rs 591.6 per quintal in 1980–81 to Rs 693.7 per quintal in 2002–03. The annual compound growth rate of economic cost during the period 1980–81 to 1989–90 was -0.36 percent and it increased to 1.69 percent during the period 1990–91 to 2000–01. The most important components that pushed up the economic costs were employees' remuneration and benefits, handling expenses, interest payments, and freight expenditure. All these items have registered quantum increases in recent years (Table 3.7).

The expenditure on interest payments made up more than 40 percent of total expenditure of the FCI in 2001–02. The freight expenditure (22 percent) has increased due to increased grain movement in recent years.[16] Similarly, the expenditure on

[16] FCI undertakes grain movement keeping in mind the fresh procurement, stock, allocation, and off-take levels. According to the recent Annual Report, the grain movement by FCI increased from 29.72 million tons in 2003–04 to 33.92 million tons in 2004–05. Further, the grain movement on inter-state account has significantly increased as compared to the previous years.

employees' remuneration and benefits (15 percent) has recorded an increase due to the departmentalization of contractual labor in FCI depots.

Table 3.7: Percentage Annual Compound Growth Rate of Various Components of FCI's Expenses (at 1993–94 prices), 1979–80 and 2001–02

Freight	Handling expenses	Employees' remuneration and benefits	Interest	Depreciation	Others	Total expenses
2.3	4.34	5.72	2.74	-0.26	1.61	3.07

Source: Calculations based on data from FCI's financial data provided in Government of India, *Food Corporation of India Annual Reports*, various years.

3.3.1.1 Procurement Incidentals

Procurement costs at constant prices increased between 1981–82 and 1990–91 at the rate of 2.6 percent for paddy and 1 percent for rice. The procurement cost of paddy was 23.75 percent of the procurement prices in 1999–2000, compared to 17.14 percent in 1980–81. The procurement expenses fall into three broad categories, namely obligatory expenses, charges paid to state agencies, and FCI's own cost. The main cost components for paddy and rice procurement are *mandi* charges, purchase/sales tax, and cost of gunny, which account for as high as 81.2 percent of economic cost for paddy and 74.3 percent for rice (Deb 2006). The cost of gunny has recorded a significant rise in recent years. M*andi* and forward charges also increased in the composition of total procurement cost of paddy. These charges are beyond the control of FCI, and can be changed only through policy intervention. Among other charges,[17] the cost of internal movement has increased (by about 69 percent) due to the expanding number of marketing centers[18] with the objective of providing easy market access to farmers and reducing their transportation costs. Though such an arrangement benefits farmers, it raises the operational cost of FCI.

3.3.1.2 Distribution Cost

Distribution cost was approximately Rs 194 per quintal in 1999–2000 and came down to Rs 123 per quintal in 2001–02. Freight and interest accounted for 60 percent of total distribution cost in 2001–02, down from 74 percent in 1981–82. The share of

[17] These include: (i) cost incurred on *mandi* labor, forward and internal movement by the FCI; and (ii) charges paid by the FCI to other procurement agencies on account of establishment, storage, interest, guarantee fee, arrears, etc.

[18] The number of marketing centers in Andhra Pradesh increased from 574 in 1981 to 870 in 2002.

administrative overheads and handling expenses increased from 11.28 percent in 1981–82 to 22.8 percent in 2000–01. Between 1981–82 and 1999–2000 the annual growth rate of real handling expenses was 4.7 percent while it was 3.2 percent for administrative overheads (Deb 2006).

Interest cost is the largest component of distribution costs. The FCI is entitled to get food credit at concessional rate of interest[19] from a consortium of scheduled commercial banks led by the State Bank of India. The prevailing rate of interest is around 9 percent, while for private trade, the banks normally charge 3–4 percent higher than the prime lending rate.[20] Despite subsidized interest, the real interest costs of FCI grew by 2.72 percent per annum during 1981–82 to 1999–2000. Besides low interest rates, the FCI enjoys two more benefits: (i) no credit limit, and (ii) no deadline for repayment.[21]

Freight cost is the second largest component in distribution cost, despite getting preferential rail transport from the government.

The third largest component of total distribution cost is handling expenses; its share in distribution cost increased from 8.79 percent in 1981–82 to 17.68 percent in 2000–01. One of the factors that have contributed to this extraordinary rise was the departmentalization of contract labor.[22] The real annual growth rate of handling costs increased much faster during the 1990s; it was 3.2 percent during the 1980s and rose to 5.6 percent during the 1990s. The departmental labor of FCI gets preference in handling operations over the contract labor.[23]

Administrative overheads also increased over time due to the rising number of FCI employees[24] and their declining productivity. The annual growth in staff cost was 15.4

[19] The policy of concessional credit was started in 1973–74 when the interest rate for public procurement was 8.5 percent while it was 12 percent for advances against foodgrains. In 1989–90, FCI was charged an interest rate of 14 percent. The FCI receives the lion's share of the food credit to support its procurement, stocking, and distribution operations.

[20] For the State Bank of India, the prime lending rate is 10.25–11.25 percent. The rate of interest on food credit declined from 14.6 percent in 1997 to 11.65 percent in 2002 and 9.1 percent in 2004 (Government of India, *Food Corporation of India Annual Report 2005*).

[21] The RBI sponsored study has inferred that the food credit affected the flexibility of monetary policy (ASCI 2002). Apparently it might look as if the food credit is a purposeful channel to direct the excess bank credit in the specific situation of economic depression and sluggish aggregate demand.

[22] FCI undertakes handling of foodgrains through the handling and labor contracts under the departmental labor system, the direct payment system, mate system, and the labor cooperative society system.

[23] The share of the contract labor in all operations as on March 31, 2002 was 60 percent, while their share in handling costs was only 25.2 percent (Government of India 2003). On the other hand, the departmental labor, which performed only 16 percent of the work, got 53.8 percent of the money spent by the FCI on handling expenses.

[24] The staff strength of FCI as of April 1, 2002 was 59,089 persons.

percent during the period 1987–88 to 1999–2000, as compared to 10.3 percent during the period 1983–84 to 1987–88.[25] But the annual growth in staff productivity of foodgrains handling increased to 3.6 percent from 1987–88 to 1999–2000 as compared to 2.4 percent during 1983–84 to 1987–88. This revealed that while the 1990s were marked by a small increase in the staff productivity, there was phenomenal growth in staff costs.

3.3.1.3 Carrying Cost

The Central government spent more to hold a high level of buffer stock than what it invested on agriculture, rural development, and irrigation and flood control taken together (Government of India 2002a). The carrying cost in 2001–02 was Rs 252 per quintal, which was approximately 59 percent of total procurement, distribution, and storage cost of rice. The carrying cost of the buffer stock was 21.3 percent of the total value of the buffer stock in 1999–2000. The carrying cost of the buffer stock is comprised of handling expenses, storage charges, interest, freight, administrative overheads, transit storage, and storage shortages. Interest, storages and handling charges form the bulk (88 percent in 1999–2000) of the total carrying cost of the buffer stock.

To sum up the above discussion on the procurement, distribution and carry-over costs, interest, freight, and handling expenses account for a bulk of the share in total FCI cost in grain management. Among these costs, FCI is privileged to have concessions on interest and freight as: (i) subsidized credit rates; and (ii) preferential rail services. These concessions are not restricted by the Selective Credit Control Measures, ECA, and Zoning Restrictions. The economic cost of the FCI grain would have been higher, if FCI had to get credit at the same rate of interest at which credit is available to the private traders, and the grain movement had been made by road instead of rail. Given the concessions enjoyed by FCI, private players do not have a level playing field in grain management sector In view of the concessions enjoyed by FCI.

3.3.1.4 Scale Economies in FCI's Cost

One major argument in favor of industry regulation is that a single firm can benefit from the economies in large-scale production and subsequently pass on the benefits of falling average cost to consumers in terms of lower prices. We estimated the average

[25] The monthly staff cost (per person) increased to Rs 15,082.33 in 1999–2000 from Rs 2,340 in 1987–88 (BICP 1990).

cost curve of FCI to examine its scale economies. The possible presence of both economies and diseconomies of scale in the production process leads to the hypothesized long-run average cost (LRAC) function being U-shaped, with a middle flat area.[26] The coefficients of the OLS equation for rice are as follows:

$AC = 435.71 + 0.04\ Q - 0.0000015\ Q^2$

(1.45)* (-0.09)

where Q refers to quantity and AC refers to average cost;

$R^2 = 0.46$, R-Bar$^2 = 0.39$, DW = 1.65, F-Statistic = 7.98, Sample: 1981–82 to 2002–03.

* significant at 20 percent level of significance, t-values within brackets.

It is clear from the equation that no scale economy is present as the FCI cost failed to register a statistically significant decline along with procurement volume. Earlier studies of Gulati and Sharma (1991) and Jha (2002) also reported similar findings. The High Level Committee on Long-term Grain Policy (Government of India 2002a) attributed high stocks as the reason for the diseconomies of scale in FCI operations. Besides higher stocks, growth in transportation cost is often cited for diseconomies of scale. It is argued that the transportation cost of distributing output from one large plant is greater than the cost of distributing from a series of strategically located smaller plants. As noted earlier, the distribution cost has gone up significantly owing to rise in freight costs. The failure of the scale economy relation could be a direct result of the rise in distribution cost of FCI.

3.3.2. Public Sector vs. Private Sector in Grain Management

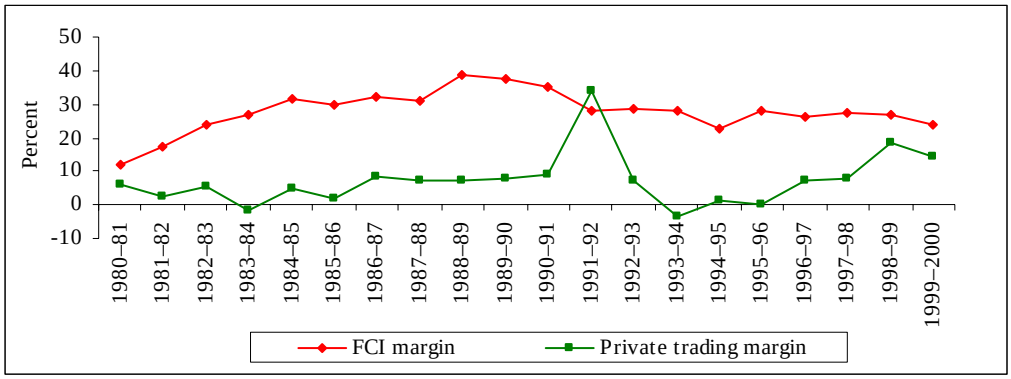
We have compared the FCI operational margin with the profit margin earned by private trading in rice handling operations.[27] Figure 3.5 shows that, with the exception

[26] The algebraic form of the LRAC function can therefore be derived as: $AC = a + bQ + cQ^2$; we estimated this relationship for FCI's rice procurement and handling operations by using average economic cost of FCI rice deflated by Wholesale Price Index (WPI) of rice (base: 1993–94) and the rice procurement volume by FCI as observations.

[27] The FCI margin is calculated as: (economic cost – procurement price) ÷ (procurement price). We have used two indicators for the procurement price of rice: one, the rice equivalent value derived from the all-India procurement price of rice (common variety), and two, the procurement price of levy rice (common variety) in Andhra Pradesh. Similarly, two different indicators are used to capture the private trading margin of rice trade. First, we use a measure based on the calculation of: (WPI of rice – procurement price of levy rice) ÷ (procurement price of levy rice) in Andhra. Second, we hypothesized

of one year (1991–92), the price spread in the case of the private sector was lower than the FCI price spread during the last two decades.

Figure 3.5: Comparing FCI and Private Trading Margins, 1980–81 to 1999–2000



Source: DES (Ministry of Agriculture, Economic Survey (various years) and BICP (1990).

The private margin is even lower if it is interpreted by the spread between retail and wholesale price. These findings point at two pertinent claims: (i) the public cost of procurement–stocking–distribution is much higher than what an efficient (private) enterprise would have incurred, and (ii) the private grain trading margin has become smaller over time. The implication that flow from these is that considerable saving on the subsidy burden can be achieved if the public agencies source grain supplies from open market.

3.3.2.1 Public Sector Cost vis-à-vis Consumer Benefit

The food subsidy burden is unabatedly increasing with high and growing economic cost of rice procurement, storage, and distribution, and low and stagnating issue prices for the PDS and social safety net programs. It may be noted that the Andhra Rice Scheme and Central public distribution system are incurring very high costs as compared to other social safety net programs (Table 3.8).[28] We compared the benefits

that the difference between the wholesale and retail price of rice (common variety) over a period of time can provide some indication of the profit margin earned by the private rice trading.

[28] Jha and Srinivasan (2002) provide the benefit–cost calculation at the all-India level during the 1990s. They defined government costs by adding the difference of Central Issue Price (CIP) from the administrative and storage cost with the procurement price. The benefits are defined as the difference between market price and CIP. Their results indicated a higher cost–benefit ratio for wheat in comparison to rice.

and subsidy costs involved in the Andhra Rice Scheme distribution;[29] the government cost (subsidy) was much higher than the consumer benefits during the period 1982–83 to 2002–03 (Figure 3.6).

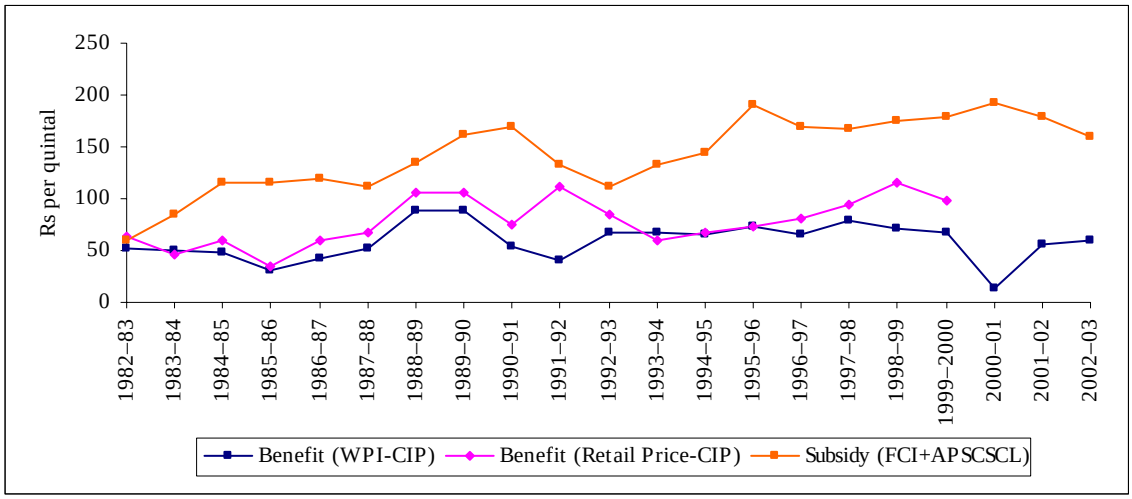
Table 3.8: Delivery Cost of Re 1 Worth of PDS under Various Schemes, 1999–2000

(Rs)

Andhra Rice Scheme	Central PDS	Jawahar Rojgar Yojana	Maharashtra Employment Guarantee Scheme	ICDS
6.37	5.37	2.28	1.85	1.8

Source: Deb (2006).

Figure 3.6: Real Consumer Benefit and Subsidy Cost in Andhra Rice Scheme, 1982–83 to 2002–03



Source: Government of Andhra Pradesh, *Statistical Abstract of Andhra Pradesh*, various years; Government of India, *Agricultural Prices in India*, various years; Government of India, *Bulletin on Food Statistics*, various years.

[29] The consumer benefit is defined as the difference between market price and CIP, and two proxies have been used to capture the market price of rice in Andhra, viz. state wholesale and retail price of common rice variety. The subsidy cost (Rs per quintal) has been arrived by adding the APSCSCL and FCI subsidy rates. Both the consumer benefit and government cost measures have been deflated by applying the WPI of rice.

The above discussion clearly reveals that the public sector is incurring huge cost in grain management and benefits to the consumers have been meager as compared to the subsidy burden. It is, therefore, important to either reduce cost and improve efficiency or involve the private sector in grain management.

3.3.3. Private Sector Participation

To promote private sector participation in grain management, grain trading must be freed from a range of outdated laws and institutions that were more suitable for a situation of scarcities. Several reform measures—towards removing the restrictive provisions, injecting efficiency into the parastatals, and liberalizing grain marketing in the country—were recommended in the past to improve the efficiency of grain management (Appendix Table A3.2). Most of the recommendations reduce the role of government intervention and foresee that the FCI's role be changed from the major buyer to a buyer of the last resort, and simultaneously pave the way for private participation in the grain trade. Some steps have been taken in respect of the procurement, storage, and distribution operations.[30]

3.3.3.1 Feasibility of Private Sector Participation

The success of the reform measures would depend on the sequencing and evolving of appropriate institutions for their implementation. Reforms in grain management may begin with several de-control and deregulation measures before introducing greater private participation. However, the government's reform policies should be not only confined to removing the marketing and movement restrictions and granting the permission to private trade, but should also address some of the fundamental issues such as MSP policy and the size of the public stocks.

The minimum procurement price (MSP) policy of the government would determine the feasibility of private sector participation in grain management. There are two arguments for the poor response from the private sector in grain management under the prevailing regime of MSP policy. First, the MSPs of all the important commodities are raised regularly, often higher than the market prices as well as the international prices, with few exceptions. It is argued that under such circumstances the private sector participation would be hampered if the MSPs are enhanced every year. Second,

[30] The reform measures include (i) National Policy on Grain Handling, Storage & Transportation, 2000; (ii) Stock and Movement Restrictions (Essential Commodities Act, 1955); (iii) Model Agricultural Marketing Act, 2003; (iv) Forward Contract (Regulation) Act, 1952**;** (v) Negotiable Warehouse Receipt System; and (vi) Decentralized Procurement and Distribution, 1997–98.

the MSP would affect the success of futures trading as the price risk in the market is virtually minimized by MSP and assured procurement. The success of a futures contract necessitates that pricing of the underlying item be determined by free market forces without monopsonic or government control and no single buyer–seller–regulator should have any undue importance on prices. Thus, when prices are fixed by the government's MSP policy, and they do not adjust except through change in government policies, there is little incentive for hedging the risk through private means.

In the past, especially before 2005, another problem faced by the government was the piling up of buffer stocks, which adversely affected private sector participation. Overproduction and assured procurement from a few states (Andhra Pradesh, Haryana, Punjab, and some parts of Uttar Pradesh) overcrowded the public storage. The scale of FCI's procurement and the size of buffer stocks, therefore, posed further uncertainty to the development of the private sector. However, the situation dramatically changed in April 2006, when the buffer stock of wheat dipped to such a low level that the government decided to import roughly 3.5 million tons of wheat at zero duty, and allow private sector import at 5 percent duty instead of 50 percent.

On decontrol and deregulation, the Central government took some steps by amending age-old Acts that were obstructing the private sector participation in grain management. However, agriculture is a state subject, and the task of implementing those measures lies completely in the purview of state governments.[31] For example, the 'Model Marketing Act', which is an amendment of the existing Agricultural Produce and Marketing Committee (APMC) Act, has been adopted by some states only. This experience creates some uncertainties regarding the government's resolution on banning the movement restrictions under the Essential Commodities Act (ECA). There is an apprehension that though controls under ECA have been withdrawn, there is no guarantee that the Act will not be reinforced in future. The permission to carry out the purchase, movement, and trade is therefore yet to be granted by the modification of ECA and the APMC Act in most of the states. Agricultural marketing reforms and decontrol on movement restrictions are pre-requisites for private sector participation in grain management. Likewise, the policy for modernizing handling, storage, and transportation of foodgrains should also be stepped up so as to provide the infrastructural support to the grain business.

[31] It is claimed that out of 227 Control Orders in operation, only 196 are issued by the state governments.

The requirement of capital can be expected to become higher with the liberalization of grain markets in India. Private participation in grain management would be more likely to expand if an appropriate mechanism for providing advances against stocks is provided. The negotiable warehouse receipt system can provide the source of inventory credit in the financial transaction of agricultural commodities. Thus, greater private participation can be expected with the creation of a legal framework for the negotiability and transferability of warehouse receipt.

3.3.3.2 Specific Areas for Private Sector Participation

As food insecurity concerns are not as grave as they were when FCI was launched, greater private participation in grain management seems to be the obvious choice under these changed circumstances and high cost incurred by public sector agencies. To do that, some reorganization of the inherent market forces in grain market operations is necessary. Therefore, private participation in the context of grain management can be envisaged as moving from the prevailing public-operated system to one that allows a larger role of private operators. The involvement of the private sector in the grain management should not, however, be limited to the business of grain trading and processing activities. The private sector should fulfil a much greater role, including the areas of physical infrastructure building (bulk handling, storage, and transportation), marketing activities (development of private market yards), and agro-processing. The FCI may also outsource some of the activities to the private sector, especially from procurement to movement of grain on behalf of FCI.

3.3.3.3 Government Steps to Promote Private Sector Participation

The Central government could facilitate speedy clearance of projects, remove stock/movement Control Orders, make railway facilities available, and promote a negotiable warehousing system in the country. The state government's role is to arrange for providing project land and making available other facilities such as water, power, and road. The grain handling companies are, however, of the view that the Build–Operate–Own–Transfer (BOOT) scheme is not an attractive scheme for the private (domestic or foreign) grain companies because they anticipate heavy investment.

The Central government is faced with mounting pressure to cut down the food subsidy bill to ease pressure on the growing fiscal deficit. The role of state governments is

equally important in reducing the subsidy burden and improving the efficiency of grain management. In this direction, the Government of Andhra Pradesh may amend those Acts that obstruct private sector participation, encourage public–private partnerships (PPS) in infrastructure development, and promote the food processing sector. The APSCSCL may outsource some of the activities that are becoming inefficient in the procurement and distribution.

Appendix Table A3.1: Agricultural Input Price Subsidies in Andhra Pradesh, 1981–82 to 2003–04

Year	Fertilizer	Irrigation	Power	Total	Fertilizer	Irrigation	Power	Total
	(Rs million at current prices)				(Rs million at constant 1993–94 prices)			
1981–82	198	1,290	158	1,646	554	3,606	442	4,602
1982–83	88	1,420	290	1,798	228	3,670	749	4,647
1983–84	212	1,650	437	2,299	503	3,919	1,038	5,460
1984–85	1329	1,870	704	3,903	2,935	4,132	1,556	8,623
1985–86	1294	2,080	863	4,237	2,666	4,284	1,778	8,727
1986–87	-74	2,110	1,160	3,196	-142	4,066	2,236	6,160
1987–88	537	2,590	1,484	4,611	946	4,564	2,615	8,124
1988–89	2,221	4,000	1,731	7,952	3,609	6,501	2,813	12,922
1989–90	3,579	4,120	2,321	10,020	5,363	6,173	3,478	15,014
1990–91	5,544	4,710	3,058	13,312	7,518	6,387	4,147	18,052
1991–92	3,846	5,300	3,904	13,050	4,582	6,315	4,651	15,549
1992–93	3,334	5,400	4,654	13,388	3,654	5,918	5,100	14,673
1993–94	3,615	5,880	5,907	15,402	3,615	5,880	5,907	15,402
1994–95	8,679	6,390	9,563	24,632	7,931	5,839	8,739	22,509
1995–96	10,544	6,900	11,386	28,830	8,838	5,783	9,543	24,164
1996–97	10,231	7,420	99,78	27,629	7,981	5,788	7,784	21,553
1997–98	7,726	7,620	13,392	28,738	5,650	5,572	9,793	21,016
1998–99	9,534	7,860	16,823	34,217	6,459	5,325	11,398	23,182
1999–2000	6,993	8,040	20,159	35,192	4,558	5,240	13,139	22,937
2000–01	8,384	8,440	20,420	37,244	5,240	5,275	12,763	23,278
2001–02	8,332	8,800	24,913	42,045	5,045	5,328	15,084	25,456
2002–03	11,894	8,430	23,987	44,311	6,954	4,929	14,024	25,907
2003–04	15,009	NA	NA	NA	8,521	NA	NA	NA

Note: Estimates in constant prices are obtained by deflating the current price series by the implicit GDP deflator at the all-India level.
Source: Vashishtha (2006).

Appendix Table A3.2: Salient Recommendations of Various Government-sponsored Committees relevant to Reform of Grain Management

Study	Major suggestions/recommendations
Expenditure Reforms Commission: Report on Food Subsidy (Government of India 2000)	Greater involvement of the state government and private sector in the procurement and storage operations; Rationalize the tax/levy structure on procurement from different states
A Study of the Costs of Acquisition and Distribution of Foodgrains by the Food Corporation of India' (ASCI 2001)	Restructure FCI; Federalize FCI among states
Report of the Working Group on Public Distribution System and Food Security for the 10th Five Year Plan (2002–2007) (Government of India 2001)	Decentralized PDS; MSP in line with cost of cultivation; Review ECA and APMC Act.
Excess Food Stocks, PDS and Procurement Policy (Government of India 2002c)	State government and private sector's participation in procurement and storage; Decentralized PDS
Long Term Grain Policy (Government of India 2002a)	Universal PDS; MSP in line with cost of cultivation; Improve FCI's performance; larger private participation
Buffer Stock Policy for the 10th Five Year Plan (Government of India 2003)	Lower buffer norms; Allocation to states according to previous off-take pattern
Central Government Subsidies in India (Government of India 2004)	Reduction of MSP; Replace the present two-tier system of APL–BPL issue price with food-coupons for BPL

Source: Deb (2006).

Chapter 4

Conclusions and Policy Recommendations

Agriculture in Andhra Pradesh is in a state of crisis. Agricultural growth, which used to be little higher (3.4 percent) than the national average (3.3 percent) during the 1980s, significantly slumped in the 1990s (2.3 percent compared to the national average of 3 percent). An especially serious debacle in agriculture has been observed since 2000; the average annual growth in agriculture was a negative 1.96 percent between 2000 and 2005 as compared to a positive 1.98 percent at the all-India level. Rice production (about 9.5 million tons) has declined to below the level achieved ten years earlier. Production of other important crops such as groundnut and cotton has also declined between 2000–01 and 2004–05. This is partly due to the consecutive droughts that have worsened agricultural production. Several parts of the state are afflicted by drought at irregular intervals. Other problems also contribute to their declining production. For example, rice irrigated area has shrunk by 27 percent between 2000–01 and 2004–05. Though rice yields in Andhra Pradesh are higher than the all-India average, profitability is lower than in many low-yielding rice growing states due to rising costs. The C_2 cost of rice production in Andhra Pradesh exceeds both that of other major rice-growing states and the MSP, indicating that the state does not have a competitive advantage in rice production. In the case of cotton, high incidence of pests and indiscriminate use of pesticides are substantially reducing yields and increasing the cost of production. Groundnut yields are also declining steeply due to drought conditions and pest infestation.

The agricultural production environment in Andhra Pradesh has deteriorated. There is high pressure on groundwater due to drought conditions and defective policies, especially the availability of free power. As a result, groundwater has been increasingly exploited—22 percent of *talukas* (blocks) are now characterized as dark zones. The irrigation efficiency of important canal irrigation projects is as low as 35 percent. And, about 11 percent of canal-irrigated area has become saline due to mismanagement, largely driven by low water rates. Similarly, the nutrients are misallocated, resulting in distorted balance among nitrogen, phosphorous and potash (NPK). Nitrogen is being used exceedingly more than other nutrients (the NPK ratio deviated to 6:2.4:1 in 1990 and 7:2.6:1 in 2003–04 as against the recommended level of 3:1.5:1). Micronutrient deficiency is becoming more critical (almost half of the soil samples in the state show zinc deficiency). The TFP of the crop sector has shown

declining trends; from 0.23 percent during the 1980s to -0.17 percent during the 1990s.

But things are not all bad. New opportunities are also unfolding with growing income, urbanization, and globalization leading to an increase in the demand for HVCs. Consumption of milk for BPL people increased by 30 percent, of vegetables by 50 percent, of meat, eggs, and fish by 100 percent, and of fruits by 163 percent over the 1990s; and the changes in upper income groups were even larger. The global demand for high-value and processed commodities is also increasing. The share of high-value and processed commodities in agricultural exports from India went up from less than 20 percent in 1990–91 to more than one-third in 2003–04. The growing demand for high-value and processed commodities in the domestic and global markets can benefit farmers in Andhra Pradesh if the state improves incentives, strengthen institutions, and develops infrastructure.

Andhra Pradesh is responding to the changing demand for food, and diversifying production in favor of HVCs. Amongst states, Andhra Pradesh leads in the production of eggs, meat, and fish. Fruits are finding niches in rainfed and water-scarce areas, where watershed programs are operational. Among fruits, areas under mangoes, grapes, guavas, and papaya are significantly expanding. The HVCs are promising sources for augmenting farm income and generating employment. Production of HVCs absorbs more labor as compared to cereals and is thus smallholder-friendly. HVCs are important for women who account for about 50 percent of the labor force engaged in vegetable production and about 41 percent in livestock. These commodities are also environment-friendly; with the exception of shrimp farming, HVCs require less water and have higher water productivity than rice and sugar cane.

However, the scaling up of HVCs is constrained by the current agricultural policy thrust that is founded on the philosophy of attaining food self-sufficiency. The current grain management and input subsidies are favoring production of foodgrains and leading to inefficiencies. Subsidies on power, irrigation, and fertilizer in the state reached Rs 25 billion in 2002–03 from a level of Rs 4.9 billion in 1981–82 (at constant prices). Input subsidies were nearly 13 percent of the GSDP in 2002–03. Public investment in agriculture decelerated sharply during the 1990s to a growth rate of only 1.4 percent per annum during the 1990s from 8.5 percent per annum during the 1980s due to siphoning of resources by the unabatedly growing input subsidies. High subsidies on irrigation and power encourage farmers to grow more water-intensive crops, such as rice and sugar cane. A large chunk of input subsidy is going into rice production, inhibiting diversification towards HVCs.

Similarly, the food subsidy bill (especially rice) in the state has shown an increase from Rs 459 million in 1982–83 to Rs 8,651 million in 2002–03 (at constant prices). Unfortunately, the FCI has not enjoyed economies of scale, and the subsidy burden (government cost) has been much higher than consumer benefits. The private sector performs better than the public sector in rice marketing. The price spread (i.e. difference between economic cost and procurement price) for the FCI has increased from 23 percent in 1980–81 to more than 50 percent in 2003–04, but has never exceeded 20 percent for the private trade. The current policy environment, however, obstructs the private sector in grain management.

To reinvigorate the agricultural sector, Andhra Pradesh needs to focus on (i) rationalizing input subsidies; (ii) improved technologies and practices; (iii) undertake risk mitigation and market reform; (iv) promoting agricultural diversification; and (v) investing in infrastructure development.

4.1 Rationalize Input Subsidies

Subsidies contribute to 'getting prices wrong', encouraging unsound environmental practices and competing with investments to promote those commodities that augment the income of smallholders. These results undermine the economic performance of farmers using extension services and of the institutions providing these services. Improving the situation requires a comprehensive approach that would include institutional changes, technological interventions, and price reforms. The objective should be to ensure quality and timely delivery at affordable prices.

4.1.1 Surface Irrigation

About 95 percent of the area under rice is irrigated, accounting for about 60 percent of total irrigated area in the state. Water productivity in rice is, however, very low (Rs 21 per hour) compared to flowers (Rs 368 per hour) and vegetables (Rs 174 per hour). The irrigation efficiency in the state is also low (25–40 percent) compared to 60–70 percent in the developed countries. The efficiency of the irrigation system must be improved and scarce water may be allocated to more remunerative and water-saving commodities such as vegetables, fruits, and flowers. The following measures are suggested to improve irrigation efficiency and cut subsidies.

4.1.1.1 Strengthen Water Users' Associations

Appropriate institutions can effectively manage both individual and collective water use, and more effectively use surface and subsurface water. The institutional arrangements should be location-specific and flexible (Government of Andhra Pradesh 2003). In this context, Water Users' Associations (WUAs) have a fundamentally important role in managing canal water for irrigation. Currently about 9,800 WUAs cover over 4 million ha irrigated area in the state. These WUAs should be strengthened by conducting timely elections of people's representatives and decentralizing the decision-making processes.

4.1.1.2 Promote Water-saving Devices

Saving water not only reduces subsidies but also expands the irrigated area and helps in controlling the problem of soil salinity and waterlogging. Water-saving devices such as drip irrigation and sprinkler irrigation save considerable water and improve water efficiency by 70–90 percent. Incentives should be provided for adopting drip and sprinkler irrigation.

4.1.1.3 Raise Water Rates

Irrigation water rates in Andhra Pradesh have not been revised since July 1997. The low canal-water rates encourage farmers to over-irrigate the fields and emphasize water-intensive crops (such as paddy and sugar cane). This results in a gradual rise in the water table and causes waterlogging and soil salinity problems. Low water rates adversely affect the fiscal balance. The rates should be raised to at least recover O&M costs and check environmental problems.

4.1.2 Groundwater (or power in agriculture)

There is a high concentration of electricity-run tubewells in medium to low rainfall areas for rice cultivation. The logical solution is to promote low-water and more remunerative commodities such as fruits, poultry, and dairy in low and medium rainfall areas

4.1.2.1 Institutional Reforms

The existing power sector is faced with several problems: (a) power connections outside the legal framework; (b) influential farmers contributing to corruption of officials of the electricity department; and (c) poor maintenance of transformers and power lines. Some of the alternatives to overcome these problems include privatization, micro-privatization, management by users' associations, and pre-payment meters (IWMI–Tata 2003). Promoting user groups—through forming and supporting agricultural power users' groups—could empower the users for better power management at the village or transfer level. The users' associations may be made responsible for collecting the tariff from the farmers[1] besides addressing the above mentioned problems. The users' associations could be strengthened by evolving a dispute settlement mechanism. Simultaneously, the Transmission Corporation of Andhra Pradesh Limited (APTRANSCO) could be given more functional autonomy.

4.1.2.2 Power Meters and Pre-Paid Cards

The un-metered supply of electricity to agriculture is one of the key issues in the recovery of charges for the use of electricity for pumpsets. In Maharashtra, attempt was made to separate the rural and urban supply network, and in Tamil Nadu agricultural feeders were separated from other uses (Sinha 2005; Shankari et al. 2005). Such moves would facilitate the task of installing 11 kilovolt (KV) feeder,[2] and allow replacement of flat electricity charges by metered charges as attempted by Rajasthan at a pilot level (Katiyar 2005). For effective implementation of meter system and reduction of transactions costs, meters could be designed to operate with pre-paid cards. To benefit the smallholders, the value of pre-paid cards could be discriminated based on the use of power—low-power users could be charged relatively less on per unit basis than those using more units (or quantity).

4.1.2.3 Target Subsidy and Raise Power Tariff

At present the expenses in the power sector exceed the revenue generated.[3] Raising power tariff could reduce the revenue deficit and maintain viability of the power

[1] There could be one main meter of the users' association and then sub-meters may be fixed with each user. The responsibility of collecting users' charges may be given to the association. It is envisaged that the users' association would check the power theft.
[2] 11 KV feeder is the lowest unit of power supply at which level distribution losses can be computed.
[3] The revenue deficit was Rs 16.03 billion in 2004–05, which was 16.6 percent of the current expenditure of the utilities.

sector. Alternative scenarios have been analyzed to reduce the subsidy burden through a hike in tariff rates:

- *Scenario 1*: Give initial 200 units[4] free to all farm holdings and hike tariff by 50 percent in the base year (2006–07), and subsequently by 10 percent annually until 2013–14 at assumed elasticity of power tariff (e_p) of -0.38.
- *Scenario 2*: Same as scenario 1 but at higher e_p at -0.50.
- *Scenario 3*: Hike power tariff by 50 percent across the board in the initial year and increase by 10 percent annually until 2013–14.

The results are presented in Table 4.1. The saving in subsidy will be more with lower price elasticity of electricity. The reduction in subsidy burden would be Rs 2,037 million in 2013–14 (with e_p -0.38), and Rs 1,251 million (with e_p -0.50). With higher price elasticity of electricity (e_p -0.5), there would be a steep decline (about 30 percent) in the use of power in agriculture, which would adversely affect the agricultural production. In scenario 3, the hike in tariff would affect smallholders, and substantially reduce the demand for power across the board and adversely affect agricultural production in tubewell-irrigated areas. In scenarios 1 and 2, the smallholders would be unaffected and the entire additional cost would be borne by medium and large farmers. Scenario 1 seems least controversial as only a gradual and modest rise in the tariff rate (10 percent annually) is envisaged and additional burden on smallholders is not created (Vashishtha 2006).

[4] The criteria of 200 units as cut-off was chosen because the smallholders (<2 ha) consume less than 200 units of power.

Table 4.1: Additional Burden and Subsidy Reduction due to Raising Power Tariff under Various Scenarios

Year	Scenario 1 (e_p = -0.38)			Scenario 2 (e_p = -0.50)			Scenario 3 (e_p = -0.38)		
	Additional burden (Rs per holding)	Additional burden (Rs per ha)	Subsidy reduction (Rs million)	Additional burden (Rs per holding)	Additional burden (Rs per ha)	Subsidy reduction (Rs million)	Additional burden (Rs per holding)	Additional burden (Rs per ha)	Subsidy reduction (Rs million)
2006–07	9.9	10.4	128.6	1.3	1.3	16.5	110.6	117.9	1,432
2007–08	28.7	30.7	379.4	16.2	17.3	213.7	138.3	147.4	1,830
2008–09	47.2	51.6	638	30.1	32.9	406.6	166.8	177.8	2,255.6
2009–10	65.4	73.1	904.2	43.0	48	593.8	196.2	209.1	2,711.1
2010–11	83.4	95.2	1,177.8	54.8	62.6	773.9	226.5	241.5	3,199.1
2011–12	101	117.9	1,458.3	65.5	76.4	945.0	257.9	274.9	3,722.2
2012–13	118.3	141.1	1,745	74.9	89.4	1,105.1	290.4	309.6	4,283.4
2013–14	135.1	164.7	2,036.9	83	101.2	1,251.6	324.1	345.5	4,885.8

Note: Scenario 1: 200 units free electricity to all farmers, tariff hiked by 50 percent in the base year and subsequently by 10 percent annually (e_p - 0.38); Scenario 2: Same as scenario 1 but e_p = -0.5; Scenario 3: Same as scenario 1 but without any free power.
Source: Vashishtha (2006).

4.1.2.4 Sequencing of Reforms

Institutional reform in the power sector must precede price reform. There is considerable scope for reducing aggregate transmission and commercial losses and/or increasing collection efficiency. In 2001–02, these losses were about 33 percent of the total availability of electricity as against 28 percent at the all-India level. Tariff rationalization is likely to succeed only if the stakeholders perceive that the reform process is likely to improve the quality of supply in a significant fashion. A gradual rise in tariff with minimum adverse affect on smallholders has a higher chance of success over a significant increase in tariff across the board.

4.1.3 Fertilizer

Fertilizer subsidy can be rationalized through the following options: (i) reduce retention price to be paid to the fertilizer- (mainly urea) producing plants; (ii) raise farm-gate prices (prices paid by the farmers) in a phased manner; and (iii) increase

efficiency of fertilizer use by improving agricultural technology development and dissemination. Each option will have a different impact on the national economy and on different stakeholders. Option (i) will affect the fertilizer industry adversely in terms of reduction of their profits. Some of the high-cost urea plants may not be viable if the government allows imports to compensate for the fall in domestic urea production. Option (ii) will adversely affect the farmers through increase in fertilizer cost and probably, by reducing their income. A fallout may be felt at the national level too due to the likely decline in agricultural production.[5] Option (iii) will save fertilizer and improve fertilizer-use efficiency without adversely affecting farmers.

4.1.3.1 Urea Industry under Free Trade

It was estimated that at import price of US$ 160, about 26.69 percent of domestic urea production (at resource cost) will become unviable, and the country may have to import 7.7 million tons of urea (for more detail, see Vashishtha 2006). At US$ 130 per ton,[6] about 38.5 percent of domestic production becomes unviable (at resource cost), which may necessitate the import of 17.31 million tons. Under this extreme scenario of free trade, savings in subsidies would be Rs 23.65 billion. Alternatively, domestic urea manufacturers could collaborate among themselves to set up urea plants in countries with plenty of natural gas.

4.1.3.2 Raise Fertilizer Prices

To assess how much subsidy can be saved as a result of increasing fertilizer prices, the following scenarios were analyzed, assuming elasticity of fertilizer (e_f) is -0.3[7].

- *Scenario 1:* 5 percent hike in fertilizer price in the base year (2006–07) for the next five consecutive years.
- *Scenario 2:* Same as scenario 1 with policy initiative to improve fertilizer use efficiency [e.g. through use of leaf color chart (LCC)].
- *Scenario 3:* Same as scenario 2 with ploughing back of saved fertilizer.

[5] There are counter-arguments that raising urea prices may lead to balanced use of nutrients and may raise agricultural production.
[6] Ruling price in CIS and Middle East countries.
[7] One percent increase/decrease in price results in 0.3 percent decrease/increase in fertilizer use.

Table 4.2 shows that fertilizer consumption decreases with increase in prices. The highest fall in fertilizer consumption is noted under scenario 2; though subsidy burden in this scenario will be reduced considerably, there will be dramatic fall in cereal production. Under scenario 3, cereal production could increase as the saving in fertilizer is ploughed back.

Table 4.2: Price and Technology Intervention to Reduce Subsidy Burden, Andhra Pradesh

Item	Cumulative change over base year (2006–07) under different scenario		
	Scenario 1	Scenario 2	Scenario 3
Change in fertilizer use (kg per ha)	-77.1	-140.3	-68.9
Change in fertilizer cost (Rs per ha)	616	-266	737
Change in fertilizer subsidy (Rs million)	-2,056	-3,739	-1,837
Change in value of production (Rs million)	-3,254	-2,754	1,384

Note: Scenario 1: 5 percent hike in fertilizer price in the base year (2006–07) for the next five consecutive years; Scenario 2: Same as scenario 1 with policy initiative to improve fertilizer use efficiency [e.g. through use of leaf color chart (LCC)]; Scenario 3: Same as scenario 2 with ploughing back of saved fertilizer.
Source: Vashishtha (2006).

4.1.3.3 Rejuvenate Research and Extension Services

Research services are under-funded, extension services are almost non-functional, and soil testing facilities are limited. The imbalanced use of fertilizer (especially towards nitrogen) is adversely affecting production. Technologies are available to save fertilizers and improve their efficiency. Newer, more effective technologies could be developed. Effective dissemination could reduce cost and subsidy burden. For example, the latest technology in fertilizer application is LCC. Estimates suggest that to achieve the same amount of paddy production (6 tons per ha), use of LCC saves about 26 percent of nitrogen. There is an urgent need to develop an inventory of best practices in fertilizer use, to promote the development of better practices, and to campaign for their adoption.

4.2 Introduce Improved Technologies and Practices

Technologies such as watershed development; improved varieties/hybrids of rice, maize, pulses and other crops; Bt cotton; Integrated Pest Management (IPM); and Integrated Nutrient Management (INM) are available to increase profit and reduce the cost of production. We suggest:

- Making full use of biotechnology, taking into account bio-safety concerns, to develop stress-resistant crops that respond better to threats of drought and pests.
- Promoting watershed development programs to conserve and harvest rainwater for maximizing productivity and profitability.
- Promoting water-saving devices such as micro-irrigation, drip irrigation, and sprinkler irrigation systems.
- Introducing a statewide campaign to promote IPM.
- Popularizing appropriate Bt cotton cultivars, appropriately safeguarding bio-safety concerns. Bt cotton is expected to reduce the use of pesticides, bring down the cost of production, and increase yield levels. [8]
- Developing and disseminating varieties and practices to enhance the quality of traditional crops such as rice, groundnuts, cotton, maize and sorghum to fetch higher prices from *niche markets,* that is, make them HVCs. For example, confectionary groundnuts, quality-protein maize, maize for poultry feed and ethanol, and sorghum for beer have potential in the state to augment incomes.
- Popularizing pulses in rice-fallow and rainfed production systems to increase their production and improve soil health for saving nitrogenous fertilizers in rice production by disseminating high-yielding and pest-resistance varieties of black gram, green gram, lentil, chickpea, and pigeonpea.
- Evolving insurance mechanisms to overcome risks in production due to drought or pest attack. Perhaps in the initial stages, the government may share part of the premium to demonstrate the advantages of insurance schemes.

[8] Arguably, the positive impact of Bt cotton in the state is yet to be proven as has been realized in other states such as Gujarat and Maharashtra.

4.3 Risk Mitigation and Market Reform

The public sector may have a constructive role in grain management but there is a need to redefine its activities and to provide a 'level playing field' to the private sector.

4.3.1 Procurement and Price Policy

4.3.1.1 Revisit the MSP Policy

The policy underlying the minimum support prices (MSP) is to insure farmers against risks due to fall in prices. The government also ensures procurement at MSP to meet the requirements for its PDS and social safety net programs. In the changing circumstances, it is proposed that the MSP should be frozen and the market be allowed to determine prices. To provide insurance in the case of falling prices, the average variable cost A2 (all paid out pocket expenses) may form the base for fixing MSP (Gulati 2006). The government could procure from the open market to meet its social obligations.

4.3.1.2 Decentralize Procurement and Distribution

The scheme of decentralized procurement of foodgrains was introduced in 1997–98 to increase the efficiency of procurement and raise local procurement in individual states. Andhra Pradesh has not yet fully adapted the decentralized procurement scheme and still continues to draw from the Central reserves in addition to its own procurement carried out through the APSCSCL. Additional storage capacity, road networks, market places and other infrastructures would have to be created in the state prior to the commencement of decentralized procurement operation.

4.3.1.3 Maintain Recommended Level of Buffer Stock

The buffer stock was a major issue of debate in 2001–02, when stocks reached a peak level of 63 million tons in July 2002[9] as a result of rising (open-ended) procurement and targeted PDS. Growing interest, handling, and storage charges on accumulated buffer stock causes high subsidy on foodgrains. To ensure food security, it is proposed

[9]. However, the stocks were reduced to 15.7 million tons in April 2006 (Government of India, *Economic Survey 2006–07*), with wheat stocks of only 2 million tons as a result of export at subsidized rates and low procurement of wheat.

that the recommended level of buffer stocks be strictly adhered to. This will reduce unnecessary costs incurred in stocking and handling of the excess amount.

4.3.1.4 Link MSP and Issue Price

A mismatch between MSP for farmers and issue prices for PDS is leading to the growing food subsidy bill of the Central government. These costs are aggravated by special schemes introduced by different governments on several occasions. The issue prices are seldom revised.[10] Interest, handling, and storage—the main components of the food subsidy bill—have risen at a rapid rate and now account for 70 percent of the economic cost of grains sold to above the poverty line (APL) families. The financial recovery on grains sold to BPL families is way below the normative 50 percent level. If the Central government continues to control the grain management, the issue prices must be linked with MSPs and the economic costs.

4.3.2 Reduce Public Sector Intervention in Grain Management

The private sector is already managing commodities other than rice and wheat in the country. There are apprehensions that the private sector may manipulate the foodgrains sector by exploiting farmers and the consumers. A gradual shift would overcome such fears. Once the enabling environment is created and restrictions on the role of the private sector in agriculture are streamlined, we can expect the following: (i) farmers obtain access to the latest technology, (ii) production is geared to meet quality standards, brand-building, value-addition, and exports, and (iii) strengthened supply chain leading to lower transactions costs. The role of government should be restricted to facilitate and monitor the entry of the private sector in agri-business.

The transition could start with outsourcing some of the activities that are uneconomic to FCI. In the long run, strengthened futures markets and warehouse receipts could facilitate greater private sector participation in grain management.

4.3.2.1 Outsourcing Activities

The cost incurred by FCI is higher than the private sector. Outsourcing a part of procurement, movement, and distribution could reduce inefficiencies. FCI has recently

[10] There is a pending proposal with the government to hike the issue price of both rice and wheat sold through PDS for APL families at Rs 915 and Rs 705 per quintal respectively. For BPL families, the proposed issue price is Rs 650 and Rs 505 per quintal respectively for rice and wheat. The proposal also suggests cutting down monthly grain quota sold to BPL families from the prevailing 35 kg to 30 kg.

hired a private risk management company to carry out grain procurement in the states of Madhya Pradesh and Orissa.[11] The APSCSCL should consider initiating similar arrangements to procure rice and other cereals (including millets).

4.3.2.2 Promote Warehouse Receipts and Futures Markets

Warehouse receipts and futures markets minimize price uncertainty. The Department of Food and Public Distribution has prepared an action plan for the introduction of Negotiable Warehouse Receipt System. The Department also considered the option of establishing an independent accreditation agency to improve the warehousing standards in the country. The Centre has recently given its approval for introducing the Warehousing Development and Regulation Bill to provide a regulatory framework for warehouse development, including private warehouses, and issue of negotiable warehouse receipts. The introduction of negotiable warehouse receipts will open an additional source of marketing credit for agricultural traders in the country. Traders/Millers of paddy/rice will obtain credit from banks against stocks deposited in warehouses. But the use of warehouse receipts for bank advances requires appropriate legislation.

Similarly, the futures markets in foodgrains needs to be encouraged. Steps were initiated by the government in 2002–03 towards futures trading in agricultural commodities (Appendix Table A4.1). Already commodity exchanges have been identified for futures trading, though the volume of transaction is low in comparison to the production levels (Appendix Table A4.2).

The fear of re-imposition of the Essential Commodities Act (ECA) jeopardizes the functioning of warehouse receipts and futures markets.

4.3.2.3 Amend Marketing Related Acts

Private sector participation is low in grain management due to several age-old Acts that were introduced at a time of food deficit, low foreign exchange, and acute poverty. The situation has completely changed with adequate foodgrains, enough foreign exchange and lower poverty level (though malnourishment still persists). The ECA and APMC Act restrict the free movement of agricultural commodities and

[11] The private company, National Collateral Management Services Ltd (NCMSL), which is floated by the National Commodity and Derivatives Exchange Limited (NCDEX), procured around 200 thousand tons of rice at MSP for the FCI. The arrangement is that NCMSL buys FAQ (fair average quality) grain at MSP, transfers it to the state warehouses, and subsequently gets paid back by FCI the cost of grain and incidental charges as per approved costing.

active participation of the private sector. These need to be abolished or amended with the long-term perspective of developing an appropriate business environment in grain management.

4.4 Promote Diversification

4.4.1 Strengthen Institutions

4.4.1.1 Evolve Commodity Committees

Commodity Committees (or farmers' association by commodities) should be established for horticulture crops (fruits, vegetables) and other HVCs including livestock and poultry. Crop-specific associations at the farmer level can not only facilitate bulking, grading, and storing of produce and selling directly to processors through appropriate market linkages but also facilitate farmers to adopt schemes offered by various government departments related to horticulture.

The state-level committee would include representatives from all stakeholders, i.e., farmers, concerned government departments, state and Central agencies related to horticulture crops, research departments, bankers, industry, exporters, and farmers' organizations. At the regional level, commodity committees should include all the above representatives from the region.

The state-level committee would provide market intelligence and take up policy issues with the government. The regional committees would create awareness among farmers on the latest technologies, package of practices, and schemes and subsidies available from the government. At the primary level, farmers should be encouraged to form into commodity growers associations to enable them to utilize incentives from various government departments. The association can also take corrective measures in the case of glut of a particular crop by reducing area, bulk storing of produce, or simple value addition.

Strategies to promote fruits and vegetables should include both short- and long-term strategies. Short-term strategies would include facilitating the export of fruits and vegetables through appropriate grading, packing, pre-cooling, vapor heat treatment, fast-track transport, and subsidy on air/sea freight. Long-term strategy would include promotion of contract farming, value-addition, market intelligence for both domestic and international markets, rationalization of land leasing laws, research and development, and formation of AEZs.

4.4.1.2 Promote Contract or Cooperative Farming

The real challenge in promoting agricultural diversification and involving smallholders is to connect them with the markets. It can be eased by promoting contract farming and by encouraging agri-business for processing, export, and/or retail chains. Case studies on poultry, gherkins, and grapes demonstrate the success of contract farming and benefit-sharing by smallholders. Such models need to be replicated. This will require building confidence of the agri-business to invest in developing infrastructure (such as cold storage, packaging, roads, etc.) for promoting processing, export, and developing supermarkets and retail chains by promoting contracting farming or farmers' cooperatives.

4.4.1.3 Credit

Credit is an important requirement for the production of HVCs due to their long gestation period, high initial investment, and high input costs. Banks are unable to lend to a large number of farmers (30–35 percent) of farmers who are often either sharecroppers, do not have *pattadar* passbooks, or are defaulters. More farmers, including tenant farmers and women farmers, should be eligible for loans. Alternatively, banks need to consider crop loans to tenants on group-guarantee basis. Insurance schemes should be made more smallholder-friendly. *Kissan* credit card scheme may also be promoted in less endowed regions that are emerging hub centers for HVCs.

The number of rural bank branches should be increased and this should be accompanied by an increase in the credit–deposit ratio of rural banks to around 80 percent from the current 60 percent level. To the extent possible, all loans for agriculture should be charged at the same interest rate. There is a need to improve the functioning of regional rural banks and cooperatives as they suffer from political interference, lack of professionalism, and end up as loss-making units.

4.4.1.4 Extension

There is an urgent need to change the mindset related to extension. At present, the focus is on food crops and not on HVCs. The Government of India's Policy Framework for Agricultural Extension, 2002 intends to focus on increasing farm household income through diversification. The goal is to make extension more market-driven, promote public–private partnerships in extension, and withdraw public extension where farmers are willing to pay. The demand for paid services in India is

higher in non-foodgrain crops, especially horticulture crops and oilseeds (World Bank 2005a).

Some of the latest developments in extension include Agriculture Technology Management Agency (ATMA), a registered society of key stakeholders in a district that serves as a focal point for integrating research and extension; agri-clinics scheme, introduced by the National Bank of Agriculture and Rural Development (NABARD) in 2002 and designed to supplement the government extension system; and increasing the role of private extension by agri-business firms, non-governmental organizations (NGOs), cooperatives, input suppliers, etc. The state government should adopt or take advantage of some of these models for more effective extension.

4.4.2 Strengthen Public–Private Partnership

As discussed earlier, the agri-food system is rapidly changing, driven by market forces, globalization, changing consumers' preferences, and retailing strategy (von Braun 2005). Public–private partnerships could harness the opportunities for smallholders and agri-business in developing countries but is a new concept in Andhra Pradesh. Historically, due to the perceived presence of scale economies and demand externalities, the management of the grain sector and provisions of infrastructure services have been entrusted to the government. Strict regulation and control measures on private infrastructure service providers were imposed presumably on the ground of preventing monopolistic exploitation due to private operations. However, because of the poor quality of publicly provided infrastructure services and the inefficient operations, private provision of these services is now being welcomed. This policy change is being argued to meet the twin objectives (i) bring in competitive forces and efficiency in the public enterprises, and (ii) ease the subsidy burden of the government.

The Central government has accordingly taken up initiatives to increase investment in agricultural infrastructure, including public–private partnerships. The government is encouraging such partnerships because frequently there remains a gap between the required expenditure level and public funding in such projects.[12] The Andhra Pradesh

[12] The government has recently moved a proposal to set up a Public–Private Partnership Appraisal Committee (PPPAC) to assess projects with a capital cost of more than Rs 1 billion. The PPPAC approval will not be needed for projects where the capital cost is less than Rs 1 billion. The plan for the proposed special purpose vehicle (SPV) for funding infrastructure projects is also on the cards.

government has also started involving private sector participation in the provision of large infrastructural projects (including ports and express highways). [13]

Effective public–private partnership would immensely benefit smallholders and agri-business. 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, working with an exporter and local producers, the Brazilian Agricultural Research Corporation (EMBRAPA), Brazil's national agricultural research organization, has developed technology for small-scale processing of cashew nuts. 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, bakers, and other stakeholders formed a partnership to improve the competitiveness of Uruguayan wheat. Drawing lessons from different success stories, a similar venture of the government of the state of Punjab in India, PepsiCo India, and producers has been launched to produce, process, and market orange juice. These examples suggest that public–private partnerships facilitate the process of involving smallholders in HVCs. We, therefore, expect 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.

4.4.2.1 Promote Food Processing Industry

Considerable investment opportunities exist in agro- and food-processing industries in the state. Though the growth of grain milling has slowed down (from 5.63 percent per year in the 1980s to 1.43 percent in the 1990s), it is rapidly increasing for bakery (4.27 percent in the 1990s), dairy products (4.91 percent in the 1990s) and fish products (3.91 percent in the 1990s). The state needs to tap the opportunities from the demand side as well as various schemes initiated by the Central government to boost the agro-processing sector. An enabling environment may also be created to increase production of HVCs (especially dairy, fisheries, and horticultural commodities).

Andhra Pradesh has opportunities in processing sorghum, maize, mango, grapes, and tomato. Rayalaseema region (poverty-ridden and fragile) is dominated by sorghum production, which can be processed for livestock feed, beer, and ethanol. In Africa,

[13] In 1994, the government advertised for privatizing four ports, viz. Kakinada, Machilipatnam, Nizampatnam, and Krishnapatnam. Later, the ports of Bhavanapadu, Kalingapatnam, Bheemunipatnam, Mutyalammapalam, Gangavaram, Narsapur, and Vodarevu were also put on offer for privatization.

sorghum beer production is increasing. SABMiller, one of the world's largest brewers, has launched a new brand of clear sorghum beer, which is aimed at helping African sorghum producers by expanding sorghum growing industries and creating new job opportunities. (http://business.iafrica.com/news). Similarly, sweet sorghum varieties are now available for ethanol production to blend with petrol and diesel for producing Gasohol. Maize has high potential for livestock (especially poultry) feed, ethanol production, and value-added food products (like corn flakes).

Mango processing can take a lead in the state, especially in the coastal region in Andhra Pradesh. The total market value of mango and mango pulp represents 25 percent of the value of agricultural and processed food products exported by India. The growth in consumption of mangoes in the United States and Europe has averaged 10–15 percent per annum during the last five years. Other examples are grapes for wine and tomato for ketchup or sauce. A favorable business environment needs to be created for promoting agro-processing in the state.

Foreign Direct Investment up to 100 percent is allowed in the food processing sector. Though the inflow of FDI is increasing,[14] it was only 4 percent of total FDI approved by the government (Srinivas 2006). It is because the industry is facing a number of challenges that include monopoly commodity markets leading to high cost of procurement for raw materials, poor infrastructure, high transactions cost, multiplicity of laws, price controls, and high taxes on processed foods. To take an example from the horticulture sector, India is a major producer of fruits, vegetables, and milk in world production. However, due to low share in processing, less than one percent of fruits and vegetables are exported. Unless necessary steps are taken, the high potential of this sector will remain untapped.

A single window facility to all stakeholders in the food industry could deal with clearances, subsidies, and other schemes of the state and Central government. Taxes on processed food could be reduced in line with taxes in other countries. Contract farming could be legalized and contract production registered under the Model Market Act. Procedures for arbitration in case of disputes between growers and contracting agencies could be simplified. As the case studies indicate, the role of government should be restricted only to facilitation.

[14] Reaching US$ 2,804 million in March 2006.

4.5 Invest in Infrastructure

Andhra Pradesh has the advantage of having nine ports (including India's largest major port at Visakhapatnam) and four airports (including one international). Almost all the villages are electrified (compared to only 84 percent at the all-India level). However, the state has poor road, rail, and market connectivity as compared to many other states, including Punjab. There is a need to invest on infrastructure development, especially roads, cold storage, and cold chains. The quality of HVCs is adversely affected when transported to long distances in the absence of adequate road or rail network. Therefore, improving road and rail connectivity will help farmers to access markets. Also facilities at airports and ports should be upgraded and linked with good roads and rail network to promote exports.

Post-harvest losses of fruits and vegetables are very high. Driven by supply and demand factors, prices of HVCs fluctuate considerably across seasons. Cold chains provide an opportunity to producers to store their products and sell them to long-distance markets when local markets are not favorable. Secondly, cold chains are essential to preserve the quality of the product over a longer period. There is a positive correlation between the number of cold storage units and production of fruits and poultry products.

In the state, more cold storages are concentrated in the coastal region and less in rainfed areas. Unfortunately, farmers' awareness about cold storage units is very poor. Hence, in some of the areas, the units are not fully occupied round the year. High levels of power tariff and erratic power supply are the main problems in maintaining cold storage units. The use of generators escalates the cost of storage and leads to deterioration in the quality of product. In this connection, the following are important: (i) build more cold storage, (ii) educate farmers about the cold storage, and (iii) ensure electric supply for cold storage facilities.

Similarly, agricultural research needs to tune its research agenda in view of changing demands for food commodities, especially HVCs and quality improvements of traditional crops. Involvement of the private sector (especially agri-business) in understanding and identifying constraints in the supply chain of HVCs would help in better targeting of technologies for various markets.

4.6 Our Vision

The suggested measures need to be embarked in an integrated framework for mitigating risk, accelerating agricultural growth, and improving the quality of life. The

suggestions revolve around conserving water, reducing subsidies, improving technologies, and promoting agricultural diversification towards HVCs. Conserving water and reducing subsidies means releasing resources for investment to create infrastructure and promote agricultural diversification. If the state follows what has been proposed earlier and improves incentives, strengthens institutions, and develops infrastructure, the future Andhra Pradesh is expected to be characterized as follows:

- Rice production concentrated in the Coastal region, utilizing surface irrigation, and HVCs concentrated in the Rayalaseema and Telangana regions.
- Production centers of traditional crops with high quality for niche markets (such as confectionery groundnut, quality protein maize, high ethanol content maize and sorghum, and superior rice).
- Large production centers for poultry and maize, dairy, livestock meat, fisheries, fruits and vegetables.
- Hubs of processed commodities, for example mangoes for juice and pulp; grapes for juice and wine; maize for livestock feed and fuel; sorghum for livestock feed and fodder, fuel and beer; tomatoes for ketchup or sauce; poultry for meat and egg powder to the Gulf countries and the EU.
- Centers for export of mangoes, grapes, gherkins, mango pulp, chilies, meat, eggs, aqua-products to the Gulf countries, EU, and the Central Asian countries.
- Greater private sector participation in developing infrastructure (like cold storage, refrigerated vans), and agri-business by offering incentives and reducing bureaucratic hurdles.
- Well-organized retail network spread across the state and strong farm–firm linkages through contract farming.
- Improved use of scarce water resources by adopting water-saving technologies and commodities.

With these developments, we envision a strong and vibrant agriculture in the state with higher farm incomes, lesser risk, more jobs opportunities, and better environment.

Appendix Table A4.1: List of Agricultural Commodities Allowed for Futures Trading (2003)

Category	Commodity
Foodgrains and pulses	Wheat, Gram, Jowar, Bajra, Maize, Ragi, Small Millets (Kodan Kulti, Kodra, Korra, Vargu, Sawan, Rala, Kakun, Samai, Vari and Banti), Tur (Arhar), Urad (Mash), Mung, Moth, Masur, Kulthi, Peas, Lakh (Khesari), Barley, Guar, Rice or Paddy, Arhar Chuni, Mung Chuni, Tur Dal (Arhar Dal), Urad dal, Mung dal, Gram Dal, Khandsari Sugar
Oilseeds, oil and oil cakes	Linseed oil, Linseed Oilcake, Celeryseed, Cotton pods, Cotton Yarn, Cotton Cloth, Art Silk Yarn, Raw Jute (including Mesta)
Spices	Methi, Coriander Seed, Aniseed, Pepper, Betel Nuts, Cardamom, Chilies, Cinnamon, Cloves, Ginger, Nutmeg

Source: Deb (2006).

Appendix Table A4.2: Value of Trading in Agricultural Commodities

Exchange	Value of trade (till November 2004) (Rs million)
National Commodity and Derivatives Exchange Limited (NCDEX), Mumbai	914,700
Multi Commodity Exchange (MCX), Mumbai	43,840
National Multi Commodity Exchange (NMCE), Ahmedabad	93,250

Source: Deb (2006).

References

Administrative Staff College of India (ASCI). 2001. 'A Study of the Costs of Acquisition and Distribution of Foodgrains by the Food Corporation of India'. (Commissioned by the Ministry of Consumer Affairs, Food and Public Distribution, Government of India), Hyderabad.

Anonymous. 2005. Building Public–Private Partnerships for Agricultural Innovation. IFPRI Forum, International Food Policy Research Institute, Washington, D.C., March.

Aquaculture Authority. 2001. 'Shrimp Aquaculture and the Environment: An Environment Impact Assessment Report'. http://aquaculture.tn.nic.in/shrimpfarming.html. Accessed, December 23, 2004.

Barghouti, Shawki, S. Kane, K. Sorby and Ali Mubarik. 2004. 'DOA for the Poor: Guidelines for Practitioners'. Agriculture and Rural Development Discussion Paper 1, The World Bank, Washington, D.C., March.

Bathla, S. and S. Thorat. 2005. 'Trends and Determinants of Public Investment in Agriculture at the Regional Level'. Paper presented at the seminar on 'Rationalising Investments and Subsidies in Indian Agriculture' jointly organized by Centre for Research in Rural and Industrial Development, Indian Society of Agricultural Engineers, and International Food Policy Research Institute, Chandigarh, India, April 9–10.

Bureau of Industrial Costs and Prices (BICP). 1990. *Report on the Operation of Food Corporation of India.* Ministry of Industry, Government of India, New Delhi.

Birthal, P. S., P. K. Joshi and A. Gulati. 2005. 'Vertical Coordination in High-Value Food Commodities: Implications for Smallholders'. Markets, Trade and Institutions Division (MTID) Discussion Paper No. 85, International Food Policy Research Institute, Washington, D.C.

Chakravarty, D. 2003. 'Industry: Policy and Performance'. In C. H. Hanumantha Rao and S. Mahendra Dev (eds), *Andhra Pradesh Development: Economic Reforms and Challenges Ahead*, Centre for Economic and Social Studies, Hyderabad, India, distributed by Manohar Publishers, New Delhi.

Chand, R. and Pramod Kumar. 2005. 'Determinants of Capital Formation in Agriculture and its Implications for Agricultural Growth'. Paper presented at the seminar on 'Rationalising Investments and Subsidies in Indian Agriculture' jointly organized by Centre for Research in Rural and Industrial Development, Indian Society of Agricultural Engineers, and International Food Policy Research Institute, Chandigarh, India, April 9–10.

Chandrasekhara Rao, N. 2005. 'Total Factor Productivity in Andhra Pradesh Agriculture'. *Agricultural Economics Research Review*, Vol. 18, No. 1, pp 1–19.

Chengappa, P. G., Lalith Achoth, Arpita Mukherjee, B. M. R. Reddy, P. C. Ravi and Dega Vijayalakshmi. 2005. 'Evolution of Food Retail Chains in India'. Draft report submitted to the International Food Policy Research Institute, Washington, D.C.

Central Institute of Brackishwater Aquaculture (CIBA). 1996. 'Comprehensive Survey of Impact Assessment of Shrimp Farms in Nellore District'. Mimeo., Chennai.

Confederation of Indian Food Trade and Industry (CIFTI). 2002. www.cifti.com/cifti/definitepolicy.htm.

Centre for Monitoring Indian Economy (CMIE). 2002. *Agriculture*. Economic Intelligence Service, Centre for Monitoring Indian Economy Pvt. Ltd., Mumbai.

——. 2005. *Agriculture*. Economic Intelligence Service, Centre for Monitoring Indian Economy Pvt. Ltd., Mumbai.

Deb, S. 2006. 'Grain Management in Andhra Pradesh: Scope for Reforms and Private Sector Participation'. Unpublished manuscript, International Food Policy Research Institute, New Delhi.

Delgado, C. L., C. A. Narrod and M. M. Tiongco. 2003. 'Policy, Technical, and Environmental Determinants and Implications of the Scaling-Up of Livestock Production in Four Fast-Growing Developing Countries: A Synthesis'. Final research report of Phase II of the Project on livestock industrialization, trade and social–health–environment impacts in developing countries. Submitted to the Food and Agricultural Organization of the United Nations by International Food Policy Research Institute, July 24.

Deshingkar, Priya, K. Usha, R. Laxman and R. Srinivas. 2003. 'Changing Food Systems in India: Resource-Sharing and Marketing Arrangements for Vegetable Production in Andhra Pradesh'. *Development Policy Review*, Overseas Development Institute. Vol. 21, Nos. 5–6, pp. 627–639.

Dolan, C. and K. Sorby. 2002. 'Gender and Employment in High-Value Agriculture Industries'. Agriculture and Rural Development Working Paper 7, The World Bank, Washington, D.C.

Dorjee, K., S. Broca and P. Pingali. 2002. 'Agricultural Diversification in South Asia'. Paper prepared for the Workshop on 'Agricultural Diversification in South Asia', organized by IFPRI in collaboration with the National Center for Agricultural Economics and Policy Research (NCAP) and the Royal Government of Bhutan, Ministry of Agriculture, held at Paro, Bhutan, November 21–23.

Government of Andhra Pradesh. 1999. *Vision 2020: Andhra Pradesh*. Government of Andhra Pradesh, Hyderabad.

——. 2001. *Special Report on Major Horticulture Crops*. Bureau of Economics and Statistics, Hyderabad, India.

——. 2002. *Development Activities and Action Plan 2004–05*. Department of Fisheries, Government of Andhra Pradesh, Hyderabad, India, available at http://www.apfisheries.org/development.htm, Accessed December 29, 2004.

——. 2003. *Water Vision, Volume 2*. Mission Support Unit, Water Conservation Mission, Government of Andhra Pradesh, Hyderabad, India.

——. 2004. *Economic Survey 2003–04*. Planning Department, Government of Andhra Pradesh, Hyderabad, India.

——. 2005. *Contract Farming*. Department of Horticulture, available at www.aphorticulture.com/aph.ppt, Accessed May 24.

——. Various years. *Statistical Abstract of Andhra Pradesh*. Directorate of Economics and Statistics, Government of Andhra Pradesh, Hyderabad, India.

Government of India. 2000. 'Expenditure Reforms Commission: Report on Food Subsidy', Ministry of Finance, Government of India, New Delhi.

——. 2001. 'Report of the Working group on Public Distribution System and Food Security for the 10th Five Year Plan (2002–2007)'. Tenth Five Year Plan Working Group Serial No. 66/2001, Planning Commission, Government of India, New Delhi.

——. 2002a. *Report of the High Level Committee on Long-term Grain Policy*. Department of Food and Public Distribution, Ministry of Consumer Affairs, Food and Public Distribution, Government of India, New Delhi.

——. 2002b. Annual Report on the working of state electricity boards and electricity departments. Planning Commission (Power and Energy Division), Government of India, New Delhi.

——. 2002c. 'Excess Food Stocks, PDS and Procurement Policy'. Working Paper No. 5/2002-PC, May, Planning Commission, Government of India, New Delhi.

——. 2003. *Buffer Stock Policy for the 10th Five Year Plan*. Government of India, New Delhi.

——. 2004. *Central Government Subsidies in India*, Ministry of Finance, Government of India New Delhi.

——. 2005a. *Approach Paper towards Formulation of National Policy on Food Processing Industries*. Ministry of Food Processing Industries and Ministry of Agriculture, New Delhi. Available at http://mofpi.nic.in/APPRACH1.htm, Accessed January 27.

——. 2005b. *Draft Food Processing Policy 2005*. Ministry of Food Processing Industries, Government of India, New Delhi. Available at http://www.mofpi.nic.in/fpipolicy.htm, Accessed January 19.

——. 2005c. *Agricultural Statistics at a Glance 2005*. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.

——. Various years. *Agricultural Prices in India*. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi

——. Various years. *Bulletin on Food Statistics*. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.

——. Various years. *Economic Survey*. Economic Division, Ministry of Finance, Government of India, New Delhi.

——. Various years. *Food Corporation of India Annual Report 2004–05*. Ministry of Consumer Affairs, Food and Public Distribution, Government of India, New Delhi.

——. Various years. *Reports of the Commission for Agricultural Costs and Prices*. Department of Agriculture and Co-operation, Ministry of Agriculture, Government of India, New Delhi.

Gujarati, D. N. 1995. *Basic Econometrics*. McGraw-Hill, New York.

Gulati, Ashok. 2006. 'Time the government quit mandis'. *The Economic Times*, New Delhi, July 3.

Gulati, Ashok and Sudha Narayanan. 2003. *The Subsidy Syndrome in Indian Agriculture*. Oxford University Press, New Delhi.

Gulati, Ashok and Pradeep Sharma. 1991. 'Government Intervention in Agricultural Markets: Nature, Impact and Implications'. *Journal of Indian School of Political Economy*, Vol. 3, No. 2, pp. 205–236.

Rao, C. H. Hanumantha and S. Mahendra Dev. 2003. 'Economic Reforms and Challenges Ahead: An Overview'. *Economic and Political Weekly*, Special Issue on Andhra Pradesh, March 22–29, pp. 1130–1141.

http://business.iafrica.com/news.

India Brand Equity Foundation. 2007. 'The Retail Industry'. Available at http://ibef.org/industry/retail.aspx, accessed March 28.

Indian Agricultural Statistics Research Institute (IASRI). 2001. *Agricultural Research Data Book 2001*. Indian Agricultural Statistics Research Institute, New Delhi.

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). 2003. *Baseline Survey Data, 2002–03*. Patancheru, Andhra Pradesh, India.

International Water Management Institute (IWMI)–Tata. 2003. 'Water, Livelihoods and Environment in India: Frontline Issues in Water and Land Management and Policy'. 2nd IWMI–Tata Annual Partners' Meet Report, IWMI–Tata Research Team, Anand.

Jha, S. 2002. 'Domestic Trade Restrictions and Food Security'. In Kirit S. Parikh and R. Radhakrishna (eds), *India Development Report*, Oxford University Press, New Delhi.

Jha, S. and P. V. Srinivasan. 2002.

Joshi, P. K, Ashok Gulati, P. S. Birthal and Laxmi Tewari. 2004. 'Diversification of Agriculture in South Asia'. *Economic and Political Weekly*, June 12–19, pp. 2457–2467.

Joshi, P. K, Ashok Gulati, Laxmi Tewari and P. S. Birthal. 2003. 'Agricultural Diversification in South Asia: Patterns, Determinants and Policy Implications'. Markets, Trade and Institutions Division (MTID) Discussion Paper No. 57, International Food Policy Research Institute, Washington, D. C.

Joshi, P. K., Laxmi Joshi, and P. S. Birthal. 2006. 'Diversification and Its Impact on Smallholders: A Study on Vegetable Production'. *Agricultural Economics Research Review*, Vol 19, No 2.

Katiyar, S. K. 2005. 'Political Economy of Electricity Theft in Rural Areas: A Case Study from Rajasthan'. *Economic and Political Weekly*, February 12, pp. 644–648.

Kaul, G. L. 1997. 'Horticulture in India: Production, Marketing and Processing'. *Indian Journal of Agricultural Economics*, Vol. 52, No. 3, pp. 561–573.

Kumar, P., Mruthyunjaya and P. S. Birthal. 2006. 'Changing Consumption Pattern in South Asia'. In P. K. Joshi, A. Gulati and R. Cummings Jr. (eds), *Agricultural Diversification and Small Holders in South Asia*, Academic Foundation, New Delhi, pp. 151–187.

Kumar, Praduman and Mruthyunjaya. 2002. 'Long-term Changes in Food Basket in India'. Paper prepared for the Workshop on 'Agricultural Diversification in South Asia', organized by IFPRI in collaboration with the National Center for Agricultural Economics and Policy Research (NCAP) and the Royal Government of Bhutan, Ministry of Agriculture, held at Paro, Bhutan, November 21–23.

Mahendra Dev, S. and C Ravi. 2003. 'Macroeconomic Scene: Performance and Policies'. *Economic and Political Weekly*, March 22–29, pp 1143–1157.

Mahendra Dev, S and N. Chandrasekhara Rao. 2004. 'Food Processing in Andhra Pradesh: Opportunities and Challenges'. Working Paper, Centre for Economic and Social Studies, Hyderabad.

NABARD. 2001. 'Food (Mango) Processing in Visakhapatnam and Chittoor Districts'. Evaluation Study Series No. 9, National Bank for Agriculture and Rural Development, Hyderabad Regional Office.

Naik, Gopal. 2004. 'Bridging the Knowledge Gap for Building Competitive Agriculture: The Case of Grapes in India'. WBO 125, Indian Institute of Management, Bangalore, India. Available at http://www.passlivelihoods.org.uk, accessed on January 7, 2005.

Shankari, Uma, G. Narendranath and K. R. Reddy. 2005. 'To Free or Not to Free Power: Understanding the Context of Free Power to Agriculture'. *Economic and Political Weekly*, Vol. 40, No. 53, pp. 5561–5569.

National Sample Survey Organisation. 2000a. *Employment and Unemployment in India, 1999–2000: Key Results*. National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, New Delhi.

——. 2000b. *55th Round Employment and Unemployment Survey*. National Sample Survey Organisation, Ministry of Statistics and Implementation, Government of India, New Delhi.

——. 2005. 'Situation Assessment of Farmer Households: Indebtedness of Farmer Households'. Report No. 498 (59/33/1), NSS 59th Round (January–December 2003), National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, New Delhi.

——. Various years. *National Sample Survey*. National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, New Delhi.

Parthasarathy Rao, P., P. S. Birthal, P. K. Joshi and D. Kar. 2004. 'Agricultural Diversification in India: Role of Urbanization'. Markets, Trade and Institutions Division (MTID) Discussion Paper 77, International Food Policy Research Institute, Washington, D. C.

Parthasarathy Rao, P., P. K. Joshi, and Ashok Gulati. 2007. 'Agricultural Diversification in Andhra Pradesh, India: Patterns and Determinants'. Draft report, International Food Policy Research Institute, New Delhi.

Pingali, P and Y. Khawaja. 2004. 'Globalization of Indian Diets and the Transformation of Food Supply Systems'. ESA Working Paper No. 04–05, Agricultural and Development Economics Division, The Food and Agriculture Organization of the United Nations, Rome, February.

Pingali, P. L. and M. W. Rosegrant. 1995. 'Agricultural Commercialization and Diversification: Processes and Policies'. *Food Policy*, Vol. 20, No. 3, pp. 171–186.

Planning Commission. 1996.

Radhakrishna, R. and S. Indrakant. 1987. 'Effects of rice Market Intervention Policies in India: The Case of Andhra Pradesh'. In J. K. Johnson (ed.), *Evaluation of Rice Market Intervention Policies: Some Asian Examples*, Asian Development Bank, Manila.

Ramaswami, B., P. S. Birthal, and P. K. Joshi. 2005. 'Measuring Gains from Contract Farming: An Empirical Analysis of Poultry in Andhra Pradesh, India'. Markets, Trade and Institutions Division (MTID) Discussion Paper 91, International Food Policy Research Institute, Washington, D. C.

Rao, K. P. C. 2004. 'Survey report of Nemmikal (APRLP watershed village) and Isthalapuram (non-watershed village) in Nalgonda district, Andhra Pradesh, India'. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh, India.

——. 2005. 'Rationalization of Input Subsidies in Andhra Pradesh Agriculture'. Unpublished Draft report submitted to the International Food Policy Research Institute.

Ramachandra Rao, K.S. and A. K. Tripathi. 2001. 'Indebtedness of Households: Changing Characteristics'. *Economic and Political Weekly*, Vol. 36, No. 19, pp.1617–1626.

Rath, Nilakantha. 2005. 'Revival of Cooperatives'. *Economic and Political Weekly*, Vol. 40, No. 43: October 22–28, pp. 4582–4584.

Ratna Reddy, V., P. Prudhvikar Reddy and U. Hemantha Kumar. 2004. 'Ecological and Economic Aspects of Shrimp Farming in Andhra Pradesh'. *Indian Journal of Agricultural Economics*, Vol. 59, No. 3, July–September, pp. 435–447.

Reardon, T., C. Peter Timmer and Julio A. Berdegué. 2003. 'The Rise of Supermarkets in Latin America and Asia: Implications for International Markets for Fruits and Vegetables'. In Anita Regmi and Mark Gehlhar (eds), *Global Markets for High value Food Products*, Agriculture Information Bulletin, United States Department of Agriculture, Economic Research Service, Washington, D. C.

Ryan, J. G. and D. C. Spencer. 2001. *Future Challenges and Opportunities for Agricultural R&D in the Semi-Arid Tropics*. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh, India.

Shiferaw, B. A., S. P. Wani and G. D. Nageswara Rao. 2003. 'Irrigation Investments and Ground Water Depletion in Indian Semi-Arid Villages: The Effect of Alternative Water Pricing Regimes'. Working Paper Series No. 17, International Crops Research Institute for the Semi Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh, India.

Shikhamany, S. D. 2001. 'Grape Production in India Grape'. in Minas K. Papedemetriou and Frank J. Dent (eds), *Grape Production in the Asia-Pacific Region*, Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific, Bangkok, Thailand, July (RAP Publication 2000/13).

Shivkumar, S. D., R. Balasubramanian and N. Srinivasan. 1999. 'Growth Linkages Effects of Agro-Industrialization'. *Indian Journal of Agricultural Economics*, Vol. 54, No.3, July–September, pp. 412–419.

Simmons, Phil, Paul Winters and Ian Patrick. 2005. 'An Examination of Three Farm Contracts in Indonesia'. *Agricultural Economics*, Vol. 33, No. 3, pp. 513–525.

Sinha, S. 2005. 'Introducing Competition in the Power Sector: Open Access and Cross Subsidies'. *Economic and Political Weekly*, Vol. 40, No. 7, pp. 631–637.

Srinivas, Nidhi Nath. 2006. 'Food sector's FDI pie to hit $2bn mark'. *The Economic Times*, New Delhi, June 21, available at http://economictimes.indiatimes.com/articleshow/msid-1665271,prtpage-1.cms.

Subrahmanyam, S., P. Bezkorowajnyj, B. Shiferaw, S. P. Wani, P. Parthasarathy Rao and G. D. Nageswara Rao. 2006. 'Crop-livestock Linkages in Watersheds of Andhra Pradesh'. GT Agroecosystems Report Number 29, International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Andhra Pradesh, India.

Subrahmanyam, S. and P. S. Sekhar. 2003. 'Agricultural Growth: Pattern and Prospects', *Economic and Political Weekly*, March 22–29, pp. 1202–1211.

The Economic Times. 2003. 'Changing gears: retailing in India'. Times Multimedia India, Mumbai, India.

The Economist. 2006. 'Coming to market (special report on retailing in India)'. April 15–21, pp. 65–67.

United Nations. 2002. *World Urbanization Prospects*. Population Division. Department of Economic and Social Affairs, The United Nations, New York.

Vashishtha, Prem S. 2006. 'Input Subsidy in Andhra Pradesh Agriculture'. Draft report, International Food Policy Research Institute, New Delhi.

von Braun, Joachim. 1995. 'Agricultural Commercialization: Impacts on Income and Nutrition and Implications for Policy'. *Food Policy*, Vol. 20, No. 3, pp. 187–202.

——. 2005. 'Pro-Poor Public–private Partnerships ("5P") in Food and Agriculture'. Theme Presentation delivered at the International Conference on 'Public–Private Partnerships for Harnessing the Potential of Rainfed Agriculture', organized jointly by International Food Policy Research Institute (IFPRI), Federation of Indian Chambers of Commerce and Industry (FICCI), and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), New Delhi, India, October 19–20. Available at www.ficci.com/media-room/speeches-presentations/2005/oct/renfed/hars.pdf.

World Bank. 2003. 'Unlocking Andhra Pradesh's Growth Potential: An Agenda to Achieve the Vision 2020 Growth Targets'. Poverty Reduction and Economic Management Unit, South Asia Region. The World Bank, Washington, D. C.

——. 2005a. 'Andhra Pradesh Overview'. http://siteresources.worldbank.org/INTINDIA/Resources/295482-1124149238518/APBriefState.pdf, Accessed May 2.

——. 2005b. *India: Re-Energizing the Agricultural Sector to Sustain Growth and Reduce Poverty*. Oxford University Press, New Delhi.

Zellner, A. 1962. 'An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggression Bias'. *Journal of the American Statistical Association*, Vol. 57, pp. 348–368.