Structural Changes in Agricultural Economy of Andhra Pradesh, India: Irrigation and Cropping Pattern Aspects

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Abstract: This paper assesses the structural changes in the economy of state of Andhra Pradesh, India and more precisely focusing on the aspects of irrigation and cropping pattern.The study covers the post green revolution period from 1950-51 to 2008-09. The structural changes at the major sectoral level are examined in terms of the variations in the shares of sectoral output in the total output of the state. In this paper, the analysis is carried out in terms of the changes in the proportion of area under the crops to the total gross cropped area. And the trends in growth of area under different source of irrigation in Andhra Pradesh are analyzed of using compound growth rates. We find that the agriculture is the major sub-sector in the primary sector and the structural changes that have been taking place in the state economy may have an impact on this sub-sector and on the livelihoods of the rural masses. However, the research results exhibits that the increasing ground water irrigation leads to declining ground water table; and it causes environmental degradation to the state. In addition, the cropping pattern shifts have been taking place in the state is favorable to commercial crops; it indicates that the cropping pattern trend may cause the distress especially to the small and marginal farmers; because the capacity to invest and risk bearing of the farmers are low.

Keywords: Agricultural economy, irrigation, cropping pattern, Andhra Pradesh

Introduction

Historically the growth of the economics has been associated with the structural changes. The most common structural changes followed a sequence of shift from agriculture to industry and then to services. This pattern has also been observed across the countries with different levels of development. Today's developed countries followed the common pattern of steadily declining share of agriculture in the total output, increasing share of industry for a considerable long period and a steadily increasing share of services although. The economic development in India during the last 50 years seems to have followed more or less the same structural changes. However, the most striking feature of the structural changes of the Indian economy in recent decades has been the pre-eminence of services sector as the major contributor to growth. Industry, particularly manufacturing, which has been observed historically as the main contributor of economic growth, at least in the initial period of economic growth has played only a minor role in India's economic growth in recent years. Observing this phenomenon, the questions have been raised

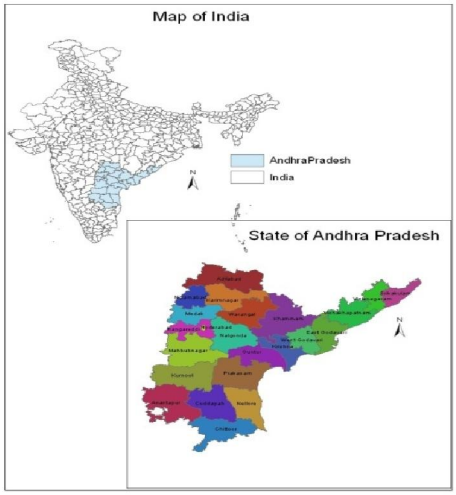
whether India is on the way to become a post-industrial service economy without industrialization? Whether such a pattern of growth and development in the Indian economy sustainable? What are its implications on the distribution of income and poverty? Many studies examined these aspects at the all India level. As India is a country with large variations in climatic conditions, resource base, and social and cultural milieu, observations at the all India level may be different from those at the state level. Hence the state level studies assume importance.

Andhra Pradesh is predominantly a resource poor small farm agricultural economy. The pattern of structural changes observed at the all India level may also be followed in the state economy. It may have implications for the living conditions of rural masses and rural poverty. In this paper an attempt has been made to examine the structural changes in the economy of Andhra Pradesh in general and the structural changes in the agricultural economy in particular focusing the aspects of irrigation and cropping pattern.

Geographical Location of the State and Topography

The State of Andhra Pradesh is situated between the latitude of 12° 14'N to 19°54'N and longitude 76°50'N to 84°50'E (Figure-1). Andhra Pradesh is bounded on the Northeast by Orissa and Madhya Pradesh on the Northwest by Maharastra, on the East by Bay of Bengal, on the South by Tamilnadu on the West by Karnataka state. It is spread over an area 275069 sq. kms. It is the 4th largest State in the Indian Union in terms of area and accounts for 8.37 percent of Country's area. The State is in the East coast, having coastal plain areas, midlands and uplands. It has a coastline of 974 km. It is mostly plain area with hills here

Figure-1: State of Andhra Pradesh, India



and there. The uplands, which are also called the agency area, mostly consist of the hilly regions covered by Eastern Ghats and they run parallel to the Coast. It is the forest area rich in flora and fauna having good scenic beauty. The area between the coastal plains and uplands is the midlands, which are located at a height above the coastal plains. The coastal plains are located almost at the sea level. As the state is spread over the regions located at different altitudes, there are variations in climate rainfall and soils. The diversity makes the state conducive for growing a variety of crops and rearing different types of livestock. The state is endowed with good water bodies like rivers, lakes and canals. They not only enrich the scenic beauty of the state, but also provide water for irrigation and other purposes, and facilitate transportation. The major rivers flowing through the State are Godavari and Krishna. They are practically perennial. Besides these two large rivers they are many other rivers such as Vamsadhara, Nagavali

and Sarada. Godavari and Krishna flow mainly through the districts of Telanagana and Coastal Andhra. Pennar flows through Rayalaseema. While Vamsadhara, Nagavali and Sarada flow through Coastal Andhra region. The major lakes in the state are Pulicat Lake covering an area of 327.33 sq.kms and Kolleru Lake with an area of 245 sq.kms. These water bodies along with estuaries on the coast make the State conducive for taking up aqua culture and pisci culture.

The method and source of data

This study is mainly based on the secondary sources of information obtained from the various issues of Statistical Abstracts of Andhra Pradesh, published by Bureau of Economics and Statistics, Government of Andhra Pradesh. The study covers the post green revolution period from 1950-51 to 2008-09. In order to eliminate the effect of the year-to-year variations in the area under crops, 'triennium average ending' is used for computing the proportion of area under crops, and area under irrigation. There had been shifts in the various crops grown in the State. The structural changes at the major sectoral level are examined in terms of the variations in the shares of sectoral output in the total output of the state. This analysis covers the period from 1980-81 to 2008-09. The study of the changes in the agricultural sector with respect to irrigation and cropping pattern covers the period 1950-51 to 2008-09. To analyze the pattern of these shifts, the triennium centered (T.C.)averages of the areas under the various crops at the periods 1970-1971, 1980-81, 1990-91, 2000-01, and 2004-05 are considered and the analysis is carried out in terms of the changes in the proportion of area under the crops to the total gross cropped area. In this study trends in growth of area under irrigation by types of source in Andhra Pradesh are analyzed of compound growth rates.

The paper is organized as follows: the section 2 outlines the geographical location of the state and topography; section 3 describes the structural changes in the economy of Andhra Pradesh. Section 4 describes the structural changes in agricultural sector-irrigation and shifts in the cropping pattern, followed by section 5 conclude the major findings of the study.

Structural Changes in the Economy of Andhra Pradesh

As per the CSO methodology estimating the State income, the economy consists of three major sectors viz., primary sector, secondary sector and tertiary sector. The primary sector consists of sub-sectors: agriculture and livestock, forestry and logging, fishing. Secondary sector consist of the sub-sectors: mining and quarrying, registered manufacturing, unregistered manufacturing, electricity, gas and water supply; and constructions. The tertiary sector consists of the sub-sectors: trade, hotels and restaurants, railways, transport, other means of communication, banking and insurance, real-estate, ownership of dwelling, public administration and other services. The estimates of the shares of these major sectors and the sub-sectors in the total output are presented in the Table 1.

During the study period these has been a continuous decline in the share of primary sector and a continuous increase in the share of tertiary sector in the total output. But in the case of secondary sector, the contribution is subjected to neither an upward nor a downward movement. The share of the primary sector declined drastically

from 42.00 per cent in 1980-81 to 25.14 per cent in 2008-09 while the share of tertiary sector increased from 37.21 per cent in 1980-81, 55.16 per cent in 2008-09. The share of the secondary sector varied between 20.74 per cent and 22.70 per cent. Thus the structural changes in the state economy are not in accordance with the changes at the all India level, especially in respect of the secondary sector. In the state economy the decline in the shares of agricultural sector and increase in the shares of tertiary sector are much faster relative to the changes at the all India level. The continuous upward trend in the shares of secondary sector at the national level is also not found in the state economy.

Table 1: Sectoral shares of Net State Domestic Product (at 1993-94 Prices) - Andhra Pradesh

S. No.	Sector	1980-81	1990-91	2000-01	2008-09
1. Agriculture, Forestry and Fishing					
1.1	Agriculture and Livestock	37.09	32.42	27.79	22.52
1.2	Forestry and Logging	2.64	1.58	0.95	0.64
1.3	Fishing	3.21	1.79	2.18	1.98
Sub Total: Primary Sector (1.1+1.3)		42.00	35.99	30.92	25.14
3. Manufacturing					
2	Mining and Quarrying	1.66	1.53	2.22	3.12
3.1	Registered	6.89	8.84	6.80	5.70
3.2	Unregistered	6.42	4.89	4.59	2.76
4	Electricity, Gas and Water Supply	0.04	1.44	1.42	1.31
5	Construction	5.73	5.54	6.04	9.81
Sub Total: Secondary Sector (2 TO 5)		20.74	22.24	21.07	22.70
6	Trade, Hotels and Restaurants	11.58	12.61	14.64	14.64
7. Transport, Storage and Communication					
7.1	Railways	1.11	1.09	1.28	1.15
7.2	Transport by other means	2.93	2.89	2.95	4.80
7.3	Communication	0.77	0.85	2.42	4.96
8. Financing, Insurance and Real Estate					
8.1	Banking and Insurance	1.74	4.56	5.24	5.11
8.2	Real Estate, Ownership of Dwelling	6.57	6.75	6.54	7.83

9. Community, Social and Personal Services					
9.1	Public Administration	3.10	4.03	4.79	3.83
9.2	Other Services	12.95	9.64	10.14	9.83
Sub Total: Tertiary Sector (6 TO 9)		37.21	41.94	48.00	52.16
Net State Domestic Product (NSDP)		100.00	100.00	100.00	100.00

Source: Statistical Abstract of Andhra Pradesh, various issues.

Within the primary sector the major component is agriculture and livestock. The contributions of forestry and logging, fishing to the total primary sector income is very less. However, the welcoming changes are declining contributions of forestry and logging, which is environmentally friendly and increasing contributions of fishing. But the decline in the shares of agriculture and livestock are not desirable changes. The increasing exploitation of mining and quarrying pose environmental problems and the declining contributions of agriculture and livestock cause deterioration in the living conditions of the rural masses.

Within the secondary sector the major contributions are construction followed by registered manufacturing, mining and quarrying, and unregistered manufacturing. The contribution of electricity, gas and water supply to the secondary sector income is very less. Unlike the pattern of contributions of registered and Unregistered manufacturing and electricity gas and water supply, the contribution of construction to the secondary sector income has been on an increasing trend during the study period. To the tertiary sector income the major contributor is the services followed by real estate, ownership of dwelling and banking and insurance. Among these the fastest growing one is banking and insurance. In recent years, real estate & ownership of dwelling is observed to be growing at a faster rate than the other sub-sectors of the tertiary sector.

Structural Changes in Agricultural Sector-Irrigation

As already pointed out, the major sub sector in the primary sector is agriculture and livestock and its share in the NSDP declined from 37.09 percent in 1980-81 to 22.52 percent in 2008-09. This declining trend in the shares of agricultural sector might be the outcome of the changes that have been taking place with in the agriculture sector itself. Since irrigation is a critical factor influencing the agriculture production the study of the irrigation aspect assume importance. The net irrigated area as a percentage of net sown area, which was 27.52 percent in 1970-71 gradually increased to 43.99 percent in 2008-09. Similarly the percentage of gross irrigated area in gross cropped area increased from 31.07 percent in 1970-71 to 48.74 percent in 2008-09. Consequently the irrigation intensity increases from 113.42 in 1970-71, to 139.84 in 2008-01 (Table 2).

Table 2: Trends in Irrigation and Irrigation Intensity in Andhra Pradesh

Particulars	Triennium Centered (T.C.)				
	1970-71	1980-81	1990-91	2000-01	2008-09
Proportion of Net irrigated area in Net area sown	27.52	31.84	39.03	40.52	43.99
Proportion of Gross irrigated area in Gross area sown	31.07	35.25	40.88	43.66	48.74
Irrigation Intensity	113.42	115.38	119.53	121.48	139.84

The most striking feature of agriculture in Andhra Pradesh is increasing the net irrigated area and irrigation intensity during the period 1970-71 to 2008-09. The structure of irrigation in the state is such that, irrigation waters are provided through canals, tanks, wells including tube wells and other sources. In 1950-51 the major source of irrigation was canals, which accounted for 49.87 percent of the irrigated area followed by tanks (33.71 percent), wells & tube wells (12.61 percent). Over the last 50 years period structural changes took place in the system of irrigation- canals and tanks lost they prominence, and the ground water sources gained importance. By 2008-09 in the total irrigated area, canal irrigated declined to 34.63 percent, tank irrigated area declined 13.44 percent while the area under tube wells and other sources increased to 51.93 percent (Table 3).

Table 3: Structural Changes in Irrigation in Andhra Pradesh *(Area in Hectares)*

Source	Triennium Centered						
	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2008-09
Canals	1211719 (49.87)	1292888 (43.64)	1529294 (48.29)	1698493 (49.09)	1860962 (43.14)	1615351 (36.85)	1669447 (34.63)
Tanks	818918 (33.71)	1221272 (41.23)	998582 (31.53)	897844 (25.95)	980548 (22.73)	648585 (14.80)	647809 (13.44)
Tube wells	306422 (12.61)	342559 (11.56)	526482 (16.63)	767597 (22.19)	1304816 (30.25)	1927223 (43.97)	2323168 (48.20)
Other sources	92548 (3.81)	105703 (3.57)	112319 (3.55)	95929 (2.77)	167364 (3.88)	192082 (4.38)	179827 (3.73)
Net irrigated area	2429608 (100.00)	2962422 (100.00)	3166677 (100.00)	3459863 (100.00)	4313690 (100.00)	4383240 (100.00)	4820251 (100.00)

Source: Statistical Abstract of Andhra Pradesh, various issues.

These structural changes in irrigation in the state are the outcome of the growth of area under the different sources of irrigation. During the period 1950-51 to 2004-05 the canal irrigated area

recorded as a significant positive growth but the rate of growth is only 0.56 percent per annum. The tank irrigated area recorded as a significant negative growth and it declined at the rate of 1.10 percent per annum. On the other hand, the area under wells and tube wells increased at the rate of 3.0 percent (Table 4) during this period. The rapid increase in the ground water irrigation and fast deterioration the tank irrigation are not desirable changes with the fast or rapid increase in the ground water irrigation the water table goes down and environmental degradation may occur as a result of intrusion of sea water in to the land. It may also lead to the increase of power charges for lifting water for irrigation. The surface source of irrigation i.e., tanks and canals are the sustainable sources. Therefore deterioration of tank irrigation with no significant increase in the canal irrigation may pose the problem of sustainability.

Table 4: Trends in the Growth of Irrigation by Source in Andhra Pradesh

Source of Irrigation	Rate of Growth						
	1950-51 to 1959-60	1960-61 to 1969-70	1970-71 to 1979-80	1980-81 to 1989-90	1990-91 to 1999-00	1990-91 to 2004-05	1950-51 to 2004-05
Canals	0.0057* (3.76)	0.0096 (1.66)	-0.0079* (-4.63)	0.0054 (0.97)	0.0426* (11.88)	-0.0249* (-4.84)	0.0056* (5.70)
Tanks	0.0494* (5.66)	-0.0275 (-1.73)	-0.0245* (-6.84)	-0.0043 (-0.21)	0.0200* (2.87)	-0.0436* (-4.64)	-0.0110* (-6.35)
Tube wells	0.00009 (0.02)	0.0347* (4.99)	0.0375* (26.31)	0.0456* (6.00)	-0.0304* (11.88)	0.0288* (8.45)	0.03* (49.49)
Other sources	0.0178 (0.74)	-0.0128 (-0.56)	0.0093* (3.94)	0.1127 (1.57)	0.0046 (0.74)	-0.0062 (-0.85)	0.0146* (5.04)
Net irrigated area	0.0217* (5.33)	-0.0010 (-0.18)	0.0045* (3.70)	0.0232* (2.96)	-0.0161* (-3.20)	-0.0052 (-1.19)	0.0101* (16.47)

* Significance at 1 percent level. ** Significance at 5 percent level.

Thus the structural changes that have been taking place in the irrigation system of Andhra Pradesh are not environmentally friendly and pose sustainability problem.

Structural changes in - shifts in Cropping Pattern

Another important factor behind the structural changes in the agricultural sector is the cropping pattern shifts. This section examines the shifts in cropping pattern in Andhra Pradesh during the period 1970-71 to 2004-05. In the early seventies, cereals, pulses and oilseeds dominated the cropping pattern in the state. In the triennium centered (T.C.) 1970-71, they respectively accounted for 59.47 percent, 11.07 percent, and 18.04 percent. Among the cereal crops the major one is rice and it accounted for 25.08 percent in gross cropped area. The coarse cereals accounted for 34.39 percent. The commercial crops: cotton, sugarcane, tobacco and chillies accounted for only 6.63 percent in the gross cropped area. By T.C.2004-05, the area under coarse cereals declined to 11.44 percent of gross

cropped area including major crop rice exhibits declining trend from 31.86 percent in T.C. 2000-01 to 25.17 percent on T.C. 2004-05. The area under total pulses and total oilseeds increased to 17.25 percent and 22.49 percent respectively. Similarly the area under cotton, sugarcane, tobacco and chillies increased to 7.99 percent, 1.86 percent, 1.07 percent and 2.01 percent respectively. There was also a significant increase in the area under fruits and vegetables from 2.58 percent to 6.90 percent (Table 5). Thus the most striking shifts in the cropping pattern in Andhra Pradesh over the last 30 years is that there has been a drastic decline in the area under coarse cereals and big jump in the cultivation of commercial crops.

The cropping pattern shifts in favour of commercial crops at the cost of coarse cereal crops have serious implications in small farm agriculture with in adequate irrigation facilities. The coarse cereal crops are drought resistant and less capital intensive. Therefore in the resource poor small farm agriculture, which is subjected to frequent occurrence of droughts, coarse cereal crops are relatively more suitable, although they are low value crops. On the other hand commercial crops are more capital intensive and more risky, although they are high value crops in the event of low risk bearing capacity of the farmers, which is generally the case with the small and marginal farmers in resource poor economies; cultivation of commercial crops may pose problems. It also increases the market dependence for food and poses the problem of nutritional security especially to the small and marginal farmers and agricultural labourers. This situation, call for strengthening of Public Distribution System (PDS).

Table 5: Cropping Pattern Shifts in Andhra Pradesh, India

Sl.No.	Crops	Andhra Pradesh				
		T.C. 1970-71	T.C. 1980-81	T.C. 1990-91	T.C. 2000-01	T.C. 2004-05
1	Rice	25.07	29.30	30.71	31.86	25.17
2	Jowar	19.28	17.69	9.07	5.46	5.02
3	Bajra	4.22	4.06	1.73	0.94	0.90
4	Wheat	0.14	0.14	0.07	0.11	0.09
5	Maize	1.93	2.53	2.35	3.74	5.39
6	Ragi	2.23	2.05	1.22	0.74	0.62
7	Small Millets	6.59	4.65	1.35	0.45	0.42
8	Total Cereals	59.47	60.43	46.51	43.30	37.61
9	Total Pulses	11.07	11.25	12.29	14.55	17.25
10	Total Oilseeds	18.04	15.36	24.68	19.51	22.49
11	Cotton	2.43	3.50	5.12	8.44	7.99

12	Sugarcane	0.99	1.32	1.51	1.83	1.86
13	Tobacco	1.66	1.41	1.61	0.94	1.07
14	Chillies	1.55	1.31	1.73	1.94	2.01
15	Total Condi-Ments & Spices	1.18	1.23	1.02	1.29	1.68
16	Fruits and Vegetables	2.58	3.12	4.36	6.79	6.90
17	Other Dyes & Narcotics	0.03	0.04	0.05	0.48	0.09
18	Fodder Crops	0.98	1.03	1.13	0.93	1.06
19	Gross Cropped Area	100.00	100.00	100.00	100.00	100.00

Source: Statistical Abstract of Andhra Pradesh, various issues

Conclusions

Structural shifts have been taking place in the economy of Andhra Pradesh from primary sector to tertiary sector with no significant change in the secondary sector. However, the pattern of change is slightly different from the one observed in the national economy. The decline in the shares of primary sector and increase in the shares of tertiary sector are much faster in the state economy relative to the national economy. Agriculture is the major sub-sector in the primary sector and the structural changes that have been taking place in the state economy may have an impact on this sub-sector and on the livelihoods of the rural masses. The two aspects that need to be examined in this connection are changes in the structure of irrigation and cropping pattern shifts. In spite of the various efforts made by the government for creation of irrigation facilities, irrigation coverage could be extended to only about 48.74 percent of the cropped area by 2008-09. The structure of irrigation in the state is such that irrigation is provided through canals, tanks and wells. Canals and tanks are sustainable sources of irrigation and well irrigation is an unsustainable source. While there is no significant increase canal irrigation over the last two decades, there has been a drastic deterioration in the tank irrigation in the state. On the other hand, the ground water irrigation has been increasing at a faster rate. It is not a desirable trend. The increase in ground water irrigation leads to decline in the ground water table and causes environmental degradation and poses a threat to the sustainability of water resources for irrigation and other purposes.

The cropping pattern shifts in favorable commercial crops at the cost of coarse cereals have been taking place in the state. In the resource poor small farm agricultural economies where the capacity to invest and risk bearing capacity of the farmers are low, this trend may cause the distress especially to the small and marginal farmers. Therefore for protecting the farmers from the adverse consequences of the changes in the

agricultural economy resulting from the structural changes, efforts are to be made on the lines of expanding the surface sources of irrigation and regulating the ground water irrigation. Efforts should also be made to regulate the cropping pattern according to the resource availability and risk bearing capacity of the farmers.

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References

Baling, B V S, and Tambad S B., (1964), 'Risk and uncertainty in irrigated crops', Indian Journal of Agricultural Economics, Vol. XIX.No.1 (Jan-March).

Chenery H B. (1979): 'Structural Changes and Development Policy', World Bank.

Government of Andhra Pradesh (1950 to 2009), 'Statistical Abstract of Andhra Pradesh', Bureau of Economics and Statistics, Government of Andhra Pradesh, India. (various issues)

Hanumantha CH., Rao and MahendraDev S (2003), 'Economic reforms and challenges ahead: an overview, Economic and Political Weekly, March 22-29, pg. 1130-41.

Nampoothiry, M M. (2003), 'Trends in cropping pattern vis-à-vis price trends', Agricultural Situation in India, Aug. pp. 297-306.

Subrahmanyam S and SatyaSekhar P., (2003), 'Agricultural growth: pattern and prospects', Economic and Political Weekly, March 22-29, pg. 1202-1211.

Sundaram, R M., (1987): 'Growth and Income Distribution in India- Policy and Performance Since Independence', Sage Publications India Pvt. Ltd., 32 M-Block, Market Greater Kailash-1, New Delhi 110048.

Venkataramanan L S., &Achar, M Prahlad (1978), ' Study of cropping pattern changes in Andhra Pradesh during 1960-75', Indian Economic Review 13(2): 117-142.