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Full Length Research Paper

Dynamics of the agricultural economy of Andhra Pradesh, India since the last five decades

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Andhra Pradesh is one of the largest state in India, with agriculture as a major source of income for about 60% of its population. In the last 50 years, the annual growth rate of agriculture has been 2.88%, which is far below the target growth of 4% per annum. Further, Andhra Pradesh is divided into three district regions with growing demand for separate state from less developed regions. The paper examined regional disparities in agriculture in Andhra Pradesh since its formation in 1956. The study illustrates that there is a convergence among districts in agricultural growth, but least developed districts are left out of this convergence process. Both agricultural intensification and diversification strategies played important role in development of districts based on their resource endowment. Livestock based agricultural growth is evident in districts adjacent to large urban centres since the last two decades. Overall, TFP growth in agriculture and allied activities in Telangana is 13% per decade, 11% per decade in Coastal, while in Rayalaseema TFP growth has been stagnant from 1956 to 2009. Irrespective of region, the most backward districts in agriculture, that is Srikakulam, Visakhapatnam, Anantapur, Kadapa, Adilabad, Nalgonda, Mahbubnagar and Nizamabad showed stagnation in TFP growth during the last 50 years. With the existing resource endowment and technology, Telangana can increase its output by 28% from the existing level, while Rayalaseema region can enhance its output by 25%, Coastal region by only 14% as revealed from efficiency estimates.

Key words: Agriculture, regional disparities, Andhra Pradesh, India.

INTRODUCTION

Andhra Pradesh is ranked the 4th largest in India in terms of area, its projected population of 8.4 crores as at 2010, makes it the 5th most populous State. The total geographical area of Andhra Pradesh is 275.04 lakh ha. out of which 39.8% is under the net area sown (109.58 lakh ha) with cropping intensity of 1.26. Average annual rainfall in the state is 940 mm. About 72% of the population lives in rural areas. Even though about 62.2% of workers are dependent on agriculture (out of which 22.5% are cultivators and the remaining 9.6% are agricultural labourers), its share in GSDP decreased from about 40% in 1980 to about 17% in 2009. The unweighted average poverty ratios and monthly per capita expenditure (MPCE) for the year 2004 to 20005 calculated from NSSO 61st Round as reported (Chaudhuri and Gupta, 2009) indicates that the percent of poor is quite low (7.6%) in the Coastal region when compared to both Telangana (12.1%) and Rayalaseema (16.5%) regions. This paper presents regional disparities in agricultural development of Andhra Pradesh state since 1956, the year of Andhra Pradesh formation, keeping the current debate of separate state of Telangana as the main argument. It is widely recognised that the direct and indirect effects of the agricultural growth that accounts for most of the poverty decline in developing country like India. Datt and Ravallion (1996) show that poverty measures respond to rural/agricultural economic growth than to urban economic growth.

Hence, agricultural growth is crucial to reduce poverty levels. However, some studies concern over the technological progress in less developed regions. For example, Fulginiti and Perrin (1997) studied 18 less developed countries and found that 14 of these countries showed a decline in agricultural productivity over the period 1961 to 1985. Such results indicate a divergence in agricultural productivity, in contrast to the trends in

manufacturing sector, which show signs of convergence (Barro and Sala-i-Martin, 1991). Keeping this in view, this paper examines the pattern of the agricultural sector growth across regions and districts in Andhra Pradesh. There are some studies on regional disparities in Andhra Pradesh, but only few (Reddy and Kumar, 2006; Reddy, 2010) examined with detailed data, from a regional perspective. In this paper, we have also examined whether agricultural growth shows convergence or divergence over the last 50 years among the districts? What is the pattern of change among different sub-sectors of agricultural outputs and inputs? Historically, high yielding technology and agricultural intensification is suitable for increased agricultural growth in favourable regions (like Coastal), whether, the same is also applicable for less developed regions (like Rayalaseema and Telangana) where rainfed agriculture dominates or a new strategy is required is still not clear.

What are the missing links in high and low potential areas that are critical to their growth for different types of growth patterns? What is the role of livestock in agricultural transformation in different areas, and how is this affected by urbanization? What are the necessary conditions for diversification to high-value crops to take off under different agro-economic conditions? Andhra Pradesh is having three historical regions, namely Coastal, Rayalaseema and Telangana. The data has been analysed by using ratio methods and Gini concentration ratio, disparity index and TFP growth rates, which are unit free and popular methods to study regional disparities over a long period of time. The main argument is to follow changes in human capital, changes in structure of agricultural and allied sectors and input levels and TFP growth in agriculture and allied sectors across regions and districts.

METHODOLOGY

Andhra Pradesh is historically having three distinct regions namely Telangana (Mahbubnagar, Hyderabad (Rangareddy+Hyderabad), Medak, Nizamabad, Adilabad, Karimnagar, Warangal, Khammam, Nalgonda), Rayalaseema (Chittoor, Kadapa, Anantapur and Kurnool) and Coastal (Srikakulam, Visakhapatnam (Visakhapatnam+Vizianagaram), East Godavari, West Godavari, Krishna, Guntur (Guntur+Prakasam), Nellore). In addition, we have also done two more classifications based on per capita income and agricultural diversification level of the districts. And the classification of districts based on monthly per capita expenditure (MPCE) for the year 2003 to 2004 based on NSSO 55th round is as follows, low-income region (Adilabad, Nizamabad, Kurnool, Anantapur, Chittoor, Nellore, Khammam with MPCE below Rs.530), medium-income region (Medak, Karimnagar, Visakhapatnam, Nalgonda, Mahbubnagar, Srikakulam and Guntur with MPCE up to Rs.644), high-income region (East Godavari, Krishna, Kadapa, West Godavari, Warangal, Hyderabad with MPCE above Rs.652). The last classification of districts based on diversification of agriculture was done based on the share of high value crops (HVCs) in total value of agricultural production at constant prices. In this classification, districts are classified as three distinct clusters as follows. High-diversification zone (districts with more than 40% share of HVCs in the total value of agricultural production; include Srikakulam, Kadapa, Mahabubnagar, Chittoor, Visakhapatnam and Hyderabad), Medium-diversification region (districts with 35 to 40% share of HVCs; include West Godavari, Nellore, Khammam, Krishna, Nalgonda and East Godavari) and Low-diversification zone (districts with less than 35% share of HVCs; include Nizamabad, Warangal, Adilabad, Guntur, Karimnagar, Anantapur, Kurnool and Medak.).

The district level data has been collected from Andhra Pradesh Statistical Abstracts from 1956 to 2007 and the total period is sub-divided into 5 decades, 1956 to 1965, 1966 to 1975, 1976 to 1985, 1986 to 1995, 1996 to 2005 respectively and the last two periods 2006 and 2007 were taken as separate periods. Simple mean and ratios used for tabulation, further widely used Gini concentration (GI) index and disparity index (DI) have been applied for district level data. All the tables except GI and DI index indicates that the comparison of Telangana and Rayalaseema regions (in %) to Coastal region, that is, a value above 100 for Telangana region indicates that Telangana region's absolute value is more than Coastal's in that period, whereas less than 100 indicates that Telangana region's absolute value is less than Coastal's for that particular period. In the same way, medium-income and low-income regions compared with high-income regions; and medium-diversified and low-diversified regions are compared with high-diversified region. Hence, the data in the tables for Telangana and Rayalaseema regions, medium-income and low-income regions, medium- diversified and low-diversified regions are in % relative to the Coastal regions absolute figures in that particular period, while figures for Coastal, high-income and high-diversified regions are absolute figures.

The data envelopment analysis (DEA) approach is used for measuring productivity change and efficiency. The DEA methodology was initiated by Charnes et al. (1978) which is largely based on the frontier concept pioneered by Farrell (1957). This method attempts to measure the efficiency of decision making units through linear programming techniques, which 'envelop' observed input - output vectors as tightly as possible. The original model developed by Charnes et al. (1978) (CCR model) was applicable when technologies were characterized by constant returns to scale (CRS) and all farms operate at an optimal scale (Coelli et al., 1998). We have taken the value of crop output (Rs. Crores) and value of livestock and fisheries products (Rs. Crores) as two outputs and gross irrigated area (GIA) in 1000 ha, rainfed area in 1000 ha, labour in thousands (agricultural workers plus cultivators), livestock population (cattle equivalents; one cattle is equal to one buffalo or 8 sheep or 8 goats), fertilizer use (NPK tons), mechanization (tractor equivalent; one tractor is equal to 40 iron ploughs or 80 wooden ploughs) as inputs. We have used methodology followed in Fare et al. (1994), to estimate a Malmquist-type measure of productivity and its decomposition into efficiency and technical changes. The method assumes output orientation with constant returns to scale (CRS), as the input oriented and variable returns to scale (VRS) suffer from some methodological problems while analyzing regional data (Coelli and Rao, 2003). In order to check reliability of efficiency estimates of the DEA method, we also estimated the efficiencies by using Battese and Coelli's (1995) frontier production function approach, with the same input and output data (aggregated two outputs, namely crop and livestock value to make one dependent variable) with the assumption of Cobb-Douglas production function and results are presented.

RESULTS

Trends in growth of agricultural output

The results from Table 1 indicates that the value of agricultural production per annum increased from Rs.5672 to Rs.20883 crores in Coastal, from Rs.3078 to

Table 1. Trends in value of agricultural production per annum at constant prices (2004-2005).

Period	Coastal (Rs. crores)	Rayalaseema (% of Coastal)	Telangana (% of Coastal)	Highly Diversified (Rs.Crores)	Medium diversified (% of highly diversified)	Low diversified (% of highly diversified)	High-income (Rs. Crores)	Medium Poor (% of high-income)	Poor (% of high -income)
Value of agricultural production									
1956-65	5672	42	45	3078	120	123	3608	97	96
1966-75	7724	38	44	4065	123	123	4929	99	87
1976-85	10180	34	47	4783	128	156	6006	119	88
1986-95	15579	32	44	6846	147	152	9656	105	77
1996-2005	19573	34	56	9424	147	147	13771	93	76
2006-07	20883	32	66	8938	173	192	14894	100	79
Value of livestock production									
1956-65	317	46	64	220	101	103	183	127	137
1966-75	611	38	82	458	100	94	466	107	83
1976-85	1142	34	89	915	100	80	1045	87	57
1986-95	1719	32	91	1379	102	76	1648	82	50
1996-2005	2291	31	93	1852	102	75	2274	80	46
2006-07	2642	31	93	2153	101	74	2643	80	45
Value of total agricultural production									
1956-65	5987	42	46	3302	118	122	3794	98	98
1966-75	8340	38	47	4524	120	120	5372	100	87
1976-85	11351	34	51	5744	123	143	7035	114	84
1986-95	17318	32	48	8226	139	139	11301	102	73
1996-2005	21832	34	60	11278	141	135	16061	91	72
2006-07	23471	33	69	11083	159	169	17551	97	74

Figures for Telagaa and Rayalaseema regions are the % of Coastal region absolute values; if this % is more than 100, the value for that region is higher than Coastal region vice versa.

Rs.Rs.8938 crores in highly-diversified region and from Rs.3608 to Rs.14894 crores in high-income regions between 1956-1966 to 2006-2007 respectively. Even though initial value of agricultural production in Telangana is about 45%, that of Coastal over the period increased to 66%, which shows the convergence in value of agricultural production between Telangana and Coastal regions. While high-income and medium-income regions started with the same base as low-income regions in 1956 to 1966, they have increased their share over the period to 127 and 126% respectively. Rayalaseema showed decline in agricultural value over the period with lower base, compared to Coastal, as this region is not able to increase their agricultural production.

Overall, the figures indicate that there is a significant convergence of agricultural development among the medium developed region, but left the least developed regions (that is, low-income region and Rayalaseema region) in the development process. The value of livestock production increased from Rs.317 to Rs.2642 crores in Coastal, from Rs.220 to Rs. 2153 crores

in the highly-diversified region and from Rs.183 to Rs.2643 crores in high-income region. Value of livestock products significantly increased in Telangana compared to Coastal, while it decreased in low-diversified and low-income regions compared to their counterparts. Overall, growth of livestock products is higher in and around major urban centres and high-income regions, which shows that the production of livestock is more dependent on demand factors than the supply factors. The total value of agriculture and allied sectors increased in Telangana from 46 to 69%, compared to Coastal from 1956-1965 to 2006-2007, while in Rayalaseema it decreased from 42 to 33%. This again shows that Rayalaseema region's growth is poorer than both Telangana and Coastal. The cropwise area under resource incentive crops are presented in Table 2. Area under rice increased from 1,968 to 2,189 kha, area under sugarcane increased from 61 to 142 kha, area under mango increased from 61 to 168 kha, area under cotton increased from 32 to 252 kha, under chillies increased from 65 to 104 kha, under tomato increased from 7.3 to 10 kha, while area under tobacco decreased from 153 to 108 kha in the Coastal region. In comparism to Coastal, in Telangana, area under resource incentive crops like rice (increased from 44 to 60%), mango (from 4 to 60%) and cotton (227 to 294%), tomato (23 to 300%) was increased, while area under sugarcane, chillies and tobacco decreased. In Rayalaseema, area under all the aforementioned crops decreased except tomato in relation to Coastal. High-income cluster of districts showed similar trend as that of the Coastal region. It indicates that in Rayalaseema, area under resource incentive crops is less at the beginning and also declined subsequently, but in Coastal, area under these crops was significantly higher at the beginning and also increased subsequently, while in Telangana mixed results exist. This also confirms the theory that the initial high-level of resource endowment region (Coastal), increases chances of future growth for the regions than low-resource endowed region (Rayalaseema), which enhanced regional disparities in Andhra Pradesh to some extent.

The crop's group wise information is presented in Table 3 (cereals, pulses, oilseeds, spices, fruits, vegetables and land-put to non-agriculture), which shows except cereals, and oilseeds area under all crops increased in Coastal in absolute terms (Reddy et al., 2011). Area under cereals (from 115 to 93% of Coastal) and pulses (from 455 to 87%) decreased in Telangana (Reddy, 2004), while area under fruits (from 37 to 47%), oilseeds (from 175 to 222%), spices (from 48 to 141%) vegetables (from 28 to 118%) and land-put-to-non-agricultural use (from 73 to 108%) increased compared to Coastal region. Disparities in area under fruits are much higher compared to cereals, for example area under fruits in Telangana is half that of Coastal. Regional disparities peaked during 1976 to 1985 period; with area under fruits in Telangana is $1/6^{th}$ that of the Coastal region; however, since the last two decades these disparities decreased. Area under oilseeds is much higher in Rayalaseema and its concentration is increased over the period. While area under pulses was increased, since the 1990s in Coastal, mainly due to expansion of area under black-gram in rice fallows. Area under spices decreased in Rayalaseema, while in Telangana it increased compared to the Coastal region, as there is a large expansion of area under chillies in Telangana region. Even though area under vegetables is higher in initial years both in Coastal and Rayalaseema, its share decreased over years. Overall, even though disparities among regions in fruits and vegetables are stark in the base year, disparities decreased then after, as there is expansion of area under these crops in backward districts surrounding Hyderabad. However, proportion of land put to non-agricultural use increased in Telangana due to high level of urbanization around Hyderabad. It is a very disturbing fact that the already high level of fallow lands (un-utilised agricultural land) in Telangana (283% of Coastal fallow area) is increased to 329% of coastal fallow land. Mainly due to low investment in agricultural development in Telangana, in terms of large scale dams and canal irrigation systems and neglect of traditional tank irrigation.

The Gini ratio and disparity index of total agricultural production, cereal and pulses production are presented in Table 4. Both disparity index and Gini ratio have increased for both cereals and pulses, while in the case of value of agricultural production both disparity index and Gini ratio were decreased. Which shows that, districts have become more specialized in the case of cereals and pulses production, but in terms of value of production districts are converging, as loss from reduction of area under one crop is compensated by income from expansion in area under other crops, and also the districts, which are not concentrated in growing cereals and pulses are increasing value of production from other crops. The trends in the yields of major crops are illustrated in Table 5 which illustrates trend in yields of major crops that is, rice, groundnut and cotton. Yield of rice increased from 778 to 2980 kg/ha, yield of groundnut increased from 581 to 1292 kg/ha, and yield of cotton increased from 339 to 2057 kg/ha in Telangana. Yield of rice, groundnut and cotton declined in both Coastal and Rayalaseema regions compared to Telangana, while in high and medium-income regions it showed increase in yield compared to low-income regions, except in the case of cotton in the medium-income region. In high and medium diversified regions, paddy yield is declined while cotton and groundnut yield increased compared to the low-diversified region.

Farm inputs and irrigation

The proximate causes of agricultural growth as measured

Table 2. Trends in area of resource intensive crops.

Crop	Period	Coastal (1000 ha)	Rayalaseema (% of Coastal)	Telangana (% of Coastal)
Rice	1956-65	1967.1	20	44
	1966-75	2009.0	19	44
	1976-85	2198.9	16	51
	1986-95	2338.4	12	50
	1996-2005	2224.1	12	56
	2006-07	2188.5	10	60
Sugarcane	1956-65	61.3	32	41
	1966-75	84.6	28	34
	1976-85	87.7	30	43
	1986-95	108.4	27	50
	1996-2005	131.3	26	37
	2006-07	142.4	17	32
Mango	1956-65	61.1	36	4
	1966-75	70.7	38	10
	1976-85	86.5	32	14
	1986-95	124.6	28	29
	1996-2005	167.0	38	41
	2006-07	167.8	45	60
Tobacco	1956-65	153.8	11	21
	1966-75	148.3	13	20
	1976-85	142.0	12	19
	1986-95	112.6	16	21
	1996-2005	115.6	13	12
	2006-07	108.4	10	8
Cotton	1956-65	31.6	666	227
	1966-75	42.4	439	244
	1976-85	159.1	82	84
	1986-95	256.5	34	127
	1996-2005	254.1	49	244
	2006-07	252.1	15	294
Chilli	1956-65	64.8	30	95
	1966-75	82.7	22	82
	1976-85	65.9	27	111
	1986-95	85.7	19	118
	1996-2005	96.0	23	111
	2006-07	104.0	20	91
Tomato	1956-65	7.3	32	23
	1966-75	9.6	84	75
	1976-85	5.3	189	114
	1986-95	9.5	169	120
	1996-2005	10.2	338	213
	2006-07	8.0	418	303

Table 3. Trends in area (in 1000 ha) for major crop groups.

Crop group	Period	Coastal (1000 ha)	Rayalaseema (% of Coastal)	Telangana (% of Coastal)
Cereals	1956-65	2939	59	115
	1966-75	2823	53	112
	1976-85	2866	46	112
	1986-95	2724	29	94
	1996-2005	2436	22	94
	2006-07	2422	18	93
Fruits	1956-65	57	24	37
	1966-75	99	27	23
	1976-85	170	27	16
	1986-95	238	27	26
	1996-2005	411	34	34
	2006-07	447	45	47
Oilseeds	1956-65	370	142	175
	1966-75	397	200	189
	1976-85	374	242	169
	1986-95	532	298	156
	1996-2005	407	412	196
	2006-07	368	476	222
Pulses	1956-65	161	82	455
	1966-75	332	64	256
	1976-85	379	57	238
	1986-95	694	28	120
	1996-2005	827	36	99
	2006-07	847	50	87
Spices	1956-65	452	73	48
	1966-75	494	61	52
	1976-85	575	48	53
	1986-95	655	34	83
	1996-2005	669	38	127
	2006-07	670	17	141
Vegetables	1956-65	25	50	28
	1966-75	31	61	41
	1976-85	32	67	46
	1986-95	49	73	53
	1996-2005	56	129	86
	2006-07	53	158	118
Land put to non-agricultural use	1956-65	755	58	73
	1966-75	912	57	70
	1976-85	955	58	70
	1986-95	1045	57	68
	1996-2005	1102	56	76
	2006-07	1011	55	108
Fallow land	1956-65	678	110	283
	2006-07	745	121	329

Table 4. Trends in GINI index and disparity index (DI) of district agricultural production value (at constant prices), cereal and pulses production.

Period	Agricultural production value		Cereal production		Pulses production	
	DI	GINI	DI	GINI	DI	GINI
1956-1965	0.301	0.038	0.177	0.014	0.286	0.049
1966-1975	0.280	0.041	0.161	0.028	0.286	0.121
1976-1985	0.267	0.075	0.199	0.051	0.295	0.005
1986-1995	0.278	0.080	0.240	0.040	0.337	0.174
1996-2005	0.238	0.027	0.241	0.089	0.328	0.204
2006-2007	0.202	0.037	0.238	0.103	0.379	0.169

Table 5. Trends in yield of important crops.

Crop	Period	Coastal (kg/ha)	Rayalaseema (kg/ha)	Telangana (kg/ha)
Rice	1956-1965	1003.7	1291.6	778.1
	1966-1975	1392.4	1551.5	1326.1
	1976-1985	1913.7	1822.6	1822.6
	1986-1995	2419.1	2352.6	2219.4
	1996-2005	2873.2	2588.5	2588.5
	2006-2007	3218.7	3039.9	2980.3
Groundnut	1956-1965	959.3	970.9	581.4
	1966-1975	971.7	849.4	643.5
	1976-1985	983.5	831.6	799.6
	1986-1995	1130.1	849.7	849.7
	1996-2005	1156.6	726.5	955.9
	2006-2007	1383.2	762.7	1292.7
Cotton	1956-1965	922.1	168.1	339.0
	1966-1975	1436.1	170.2	309.5
	1976-1985	2419.6	563.5	517.0
	1986-1995	2097.8	1250.4	1033.4
	1996-2005	2195.3	1144.0	1546.0
	2006-2007	3045.0	1234.4	2057.4

by the growth in land productivity in the context of states like Andhra Pradesh can be found mainly in the increased use of inputs into the agricultural production process - irrigation facilities, labour, the use of fertilizers, and tractors (Reddy 2010). But investment in irrigation is technically and economically feasible only in favourable areas and in unfavourable areas it is costly (as building lift irrigation in Telangana). Many Coastal districts benefited from green revolution, while some of the districts in Telangana and Rayalaseema have experienced agricultural growth mainly of oilseeds and pulses following technical innovations and favourable price support regimes in the 1980s. Some districts are benefiting from growth of higher value agricultural products as urbanisation and growth of incomes in the 1990s onwards. Table 6 depicts the cropped area, irrigated area and cropping intensity along with irrigation intensity. Net cropped area (NCA) is marginally increased over 50 years from 3072 kha in 1956-1965 to 3944 kha in 2006 to 2007 in the Coastal region, while it decreased significantly in Telangana (from 128 to 106% of Coastal) and Rayalaseema (from 79 to 71% of Coastal) compared to the Coastal region. Gross cropped area (GCA) increased from 3397 to 5302 kha in the Coastal region during 50 years, it also decreased significantly in Telangana and Rayalaseema region compared to Coastal region. The net irrigated area (NIA) increased from 1793 to 2204 kha in Coastal, the increase is much higher in Telangana (from 41 to 76% that of Coastal) but stagnate in Rayalaseema. Gross irrigated area (GIA) increased from 3072 to 3944 kha in the Coastal region, but it decreased relative to the Costal region from 128 to

Table 6. Trends in NCA, GCA, NIA, GIA, cropping intensity and irrigation intensity.

Item	Period	Coastal (1000 ha)	Rayalaseema (% of Coastal)	Telangana (% of Coastal)
Net cropped area (NCA)	1956-65	3072	79	128
	1966-75	3676	79	128
	1976-85	3659	75	123
	1986-95	3758	74	111
	1996-2005	3869	73	111
	2006-07	3944	71	106
Gross cropped area (GCA)	1956-65	3397	79	118
	1966-75	4606	69	112
	1976-85	4651	63	108
	1986-95	5090	59	93
	1996-2005	5099	57	93
	2006-07	5302	58	93
Net irrigated area (NIA)	1956-65	1793	25	41
	1966-75	1902	27	43
	1976-85	1996	26	50
	1986-95	2089	26	60
	1996-2005	2171	28	66
	2006-07	2204	28	76
Gross irrigated area (GIA)	1956-65	3072	79	128
	1966-75	3676	79	128
	1976-85	3659	75	123
	1986-95	3758	74	111
	1996-2005	3869	73	111
	2006-07	3944	71	106
			%	
Cropping intensity (%)	1956-65	111	110	101
	1966-75	125	108	110
	1976-85	127	107	111
	1986-95	135	107	114
	1996-2005	132	102	111
	2006-07	134	110	117
Irrigation intensity (%)	1956-65	113	129	119
	1966-75	121	129	131
	1976-85	125	130	135
	1986-95	131	129	135
	1996-2005	130	120	132
	2006-07	136	122	141

106% during the last 50 years. Cropping intensity from 111 to 134% in Coastal, slightly increased from 101 to 117% in Telangana, but stagnant in Rayalaseema. In same lines, irrigation intensity increased both in Telangana and Coastal regions and while in Rayalaseema it decreased. Overall there is a convergence in irrigated area and cropping intensity between Telangana and Coastal, but Rayalaseema region was left out.

The trends in source wise irrigated area is presented in Table 7, which shows that the area under canals increased from 1087 to 1256 kha, area under tube wells increased from 18 to 454 kha, area under other wells increased from 44 to 84 kha, area under total wells

Table 7. Trends in sources of irrigation.

Source	Period	Coastal (1000 ha)	Rayalaseema (% of Coastal)	Telangana (% of Coastal)
Canals	1956-65	1087	10	14
	1966-75	1147	12	17
	1976-85	1285	12	21
	1986-95	1310	12	23
	1996-2005	1320	12	24
	2006-07	1256	11	21
Tanks	1956-65	487	34	93
	1966-75	491	31	78
	1976-85	466	23	81
	1986-95	450	20	70
	1996-2005	395	17	65
	2006-07	361	17	55
Tube wells	1956-65	18	24	32
	1966-75	47	9	13
	1976-85	120	5	7
	1986-95	203	32	48
	1996-2005	326	52	101
	2006-07	454	69	156
Other wells	1956-65	44	134	263
	1966-75	69	169	345
	1976-85	90	185	370
	1986-95	129	188	417
	1996-2005	112	176	476
	2006-07	84	124	588
Total wells	1956-65	62	101	194
	1966-75	116	104	210
	1976-85	211	82	163
	1986-95	332	92	191
	1996-2005	438	83	197
	2006-07	539	77	224

increased from 62 to 539 kha, while area under tanks decreased from 487 to 361 kha. The area under canals was very low in both Telangana and Rayalaseema, compared to the Costal region and not catching up (area under canals increased in Telangana from 14 to 21% that of the Coastal region, from 10 to 11% in Rayalaseema), area under tube wells increased in both Telangana and Rayalaseema regions, area under other wells increased in Telangana, but reduced in Rayalaseema compared to the Coastal region. Overall, area under total wells increased in Telangana, but decreased in Rayalaseema compared to the Coastal region. This disaggregated analysis also shows that, there is a convergence in area under canal and wells between Coastal and Telangana regions, but in Rayalaseema region, area under canals and wells reduced from lower base. However, in the case of area under tanks, there is a striking reduction in area in all three regions; however speed of reduction is fast in Telangana and Rayalaseema regions. Table 8 presents Gini ratio and disparity index for NCA, NIA, GCA and GIA during 1956 to 2007. Gini ratio is slightly increased for NCA, while disparity index is almost stagnant during the period. Both DI and GR decreased in case of NIA, while in the case of GIA, DI decreased, but GR increased.

Overall disparity in irrigated area decreased, but geographical concentration slightly increased in gross cropped area during the study period. While in the case of NCA, GCA and GIA there is a mixed trend. The trends in inputs used in the agricultural sector are stated in Table 9, wherein, number of diesel pump sets increased

Table 8. Trends in Gini index and disparity index of NCA, NIA, GCA and GIA.

Period	NCA		NIA		GCA		GIA	
	DI	GINI	DI	GINI	DI	GINI	DI	GINI
1956-65	0.168	0.001	0.258	0.034	0.176	0.009	0.252	0.043
1966-75	0.156	0.014	0.238	0.008	0.149	0.013	0.235	0.038
1976-85	0.149	0.021	0.224	0.028	0.133	0.014	0.219	0.064
1986-95	0.142	0.041	0.202	0.034	0.129	0.034	0.209	0.079
1996-2005	0.147	0.058	0.187	0.028	0.144	0.049	0.205	0.074
2006-07	0.165	0.068	0.187	0.029	0.157	0.053	0.214	0.079

from 18,600 to 67,200, number of electric pump sets increased from 12,400 to 191700, number of tractors increased from 1200 to 36300, iron ploughs increased from 4,700 to 162,800, while wooden ploughs decreased from 1,433,000 to 545,500 and agricultural credit increased from Rs.576 to Rs.35666 crores during the same period in the Coastal region (Reddy, 2005, 2006). In Telangana, the number of diesel pump sets as % of Coastal region decreased from 294 to 154%, in Rayalaseema, it also showed a declining trend from 138 to 57% of the Coastal region. While proportion of electric pumps increased both in Telangana and Rayalaseema regions compared to Coastal region. Proportion of tractors in Telangana stagnates at lower level compared to Coastal region. Share of iron ploughs increased in Telangana, while it decreased in Rayalaseema compared to the Coastal region. Proportion of wooden ploughs increased in both Telangana and Rayalaseema regions. Trends in credit delivery shows that, there is an increase in share of credit uptake Telangana, but declined in Rayalaseema region. In farm mechanization and inputs there is a convergence between Telangana and the Coastal regions, but Rayalaseema region is left out of the growth of important inputs like tractors and credit.

Trends in livestock and its products

Table 10 depicts the trends in livestock population and its products which are more resource incentive. The egg production increased from 1000 to 93000 lakhs, production of meat increased from 8 to 76 kilotons, production of milk increased from 241 to 4434 kilotons, production of fish increased from 237 to 4510 kilotons, production of poultry (in numbers) increased from 51 to 2302 lakh between 1956 to 2007 in the Coastal region. In egg, meat and poultry production both Telangana and Rayalaseema regions showed declining trend compared to the Coastal region. In milk, fish production,

Telangana's relative position decreased, while Rayalaseema relative position slightly increased over the last 50 years. Unlike fish, concentration in the poultry industry is less among regions.

TFP growth and efficiency over time

Table 11 presents the district level TFP growth and its components for Telangana districts. The highest TFP growth is recorded in Hyderabad, followed by Karimnagar, Warangal, Khammam, Medak, Adilabad, Nalgonda, Mahbubnagar and Nizamabad. In case of Hyderabad, the first 3 decades are with higher TFP growth (24% during 1956 to 1966, 69% during 1966 to 1976, 50% during 1976 to 1986) and larger share of TFP growth is contributed by efficiency change, while in the last 2 decades productivity growth is stagnant, maybe due to a shift of resources like land and labour to meet the demands of urbanization in Hyderabad. On the other hand, in case of Karimnagar, Mahbubnagar, Nalgonda and Khammam TFP growth is higher in last 3 decades, while in Adilabad, maximum TFP growth is recorded in last 2 decades. In most of the districts, during 1986 to 1996, efficiency change contributed a larger share, while during 1996 to 2007 technical change contributed a larger share in TFP growth. Overall, there is stagnation in TFP growth in Mahbubnagar and Nalgonda since the last 50 years with decrease in efficiency from 0.90 during 1956-1966 to 0.66 during 1996 to 2007 in Mahbubnagar and from 0.76 to 0.70 in Nalgonda during the same period. In Medak, higher TFP growth was recorded during 1966 to 1976 and 1986 to 2007, with overall TFP growth of 16% per decade coupled with significant increase in efficiency from 0.44 to 0.75. While in Warangal, TFP growth is 26% per decade in the last 50 years with consistent increase, except in 1966 to 1976, for which TFP growth is decelerated, in line with many other districts during 1976 to 1996, technical change has contributed a larger share, while during 1996 to 2007, the share of efficiency change (catching up) was higher in TFP growth. The only district with deceleration in TFP growth in Telangana is Nizamabad with -3% per decade, with significant reduction in efficiency from 0.93 to 0.54 during the last 50 years; however, even in this district, TFP growth is 24% during 1986 to 1996, mostly contributed by technical change (51%) while efficiency change declined by 18%.

Table 12 presents the TFP growth and its components for Rayalaseema districts. In Rayalaseema region, TFP

Table 9. Trends in resource endowment (Inputs) relating to agriculture.

Inputs	Period	Coastal (absolute value)	Rayalaseema (% of Coastal)	Telangana (% of Coastal)
Diesel Pump sets(number)	1956-65	18679	138	294
	1966-75	29929	100	233
	1976-85	40386	80	196
	1986-95	51311	67	172
	1996-2005	61559	60	159
	2006-07	67254	57	154
Electric pump sets (number)	1956-65	12424	114	119
	1966-75	46019	147	313
	1976-85	87127	148	370
	1986-95	126891	152	400
	1996-2005	165775	154	417
	2006-07	191742	154	417
Tractors (number)	1956-65	1210	21	83
	1966-75	6540	30	46
	1976-85	14200	37	70
	1986-95	23220	39	78
	1996-2005	30750	39	81
	2006-07	36300	40	83
Iron plough (Numbers)	1956-65	4708	580	143
	1966-75	28840	250	97
	1976-85	66424	200	143
	1986-95	104539	186	159
	1996-2005	141106	181	169
	2006-07	162833	179	172
Wooden plough (numbers)	1956-65	1433498	41	105
	1966-75	1294266	43	115
	1976-85	1077221	49	133
	1986-95	871347	57	159
	1996-2005	664807	70	200
	2006-07	545500	81	238
Loans (Rs.Crores)	1966-75	576	31	88
	1976-85	1149	28	96
	1986-95	10217	27	98
	1996-2005	22978	28	99
	2006-07	35666	28	99

growth is decelerated in Anantapur and Kadapa, while it is slightly higher at 8 and 3% per decade in Chittoor and Kurnool respectively. In Anantapur, both efficiency and technical change decelerated, while in Kadapa, there was a significant upward movement during 1986 to 1996. In Kurnool, there was a significant increase in technical change that helped in slight increase in TFP growth, even though efficiency decelerated, on the other hand in case of Chittoor efficiency change contributed to TFP growth. Table 13 presents TFP growth in the Coastal region. In Coastal, the highest TFP growth was recorded in Nellore followed by Krishna, Guntur, East Godavari, West Godavari, Srikakulam and Visakhapatnam. In Nellore, TFP growth was significantly higher with 40% per decade, of which 24% is contributed by efficiency change and the remaining 13% contributed by technological

Table 10. Trends in livestock (resource incentive) and its products.

Livestock products	Period	Coastal (absolute value)	Rayalaseema (% of Coastal)	Telangana (% of Coastal)
Egg (1000 lakhs)	1956-65	1	84	323
	1966-75	1	47	172
	1976-85	14	14	71
	1986-95	44	11	64
	1996-2005	75	11	63
	2006-07	93	10	62
Meat (1000 tons)	1956-65	8	80	196
	1966-75	10	81	172
	1976-85	22	69	125
	1986-95	42	56	130
	1996-2005	63	51	133
	2006-07	76	49	135
Milk (1000 tons)	1956-65	229	28	87
	1966-75	241	28	88
	1976-85	866	25	63
	1986-95	2234	29	59
	1996-2005	3621	30	57
	2006-07	4434	31	57
Fish (1000 tons)	1956-65	237	30	91
	1966-75	251	30	91
	1976-85	887	26	65
	1986-95	2276	29	60
	1996-2005	3684	31	59
	2006-07	4510	32	58
Poultry (lakh)	1956-65	51	48	64
	1966-75	100	39	82
	1976-85	186	34	90
	1986-95	276	32	93
	1996-2005	363	32	95
	2006-07	2302	33	48

change. In Krishna, TFP growth is about 18% per decade of which 11% is contributed by technical change and 7% is contributed by efficiency change. In Guntur, TFP growth is 13% per decade, all of which is contributed by technical change. In East Godavari, there is almost a stagnant TFP growth, with deceleration in technological change. Srikakulam, Visakhapatnam and West Godavari showed stagnation in TFP growth, even though in Srikakulam it improved during the last 2 decades. Among the top 10 districts in terms of TFP growth 6 districts are from Telangana, 3 from Coastal and 1 from Rayalaseema. Among the top 4 districts namely Nellore, Hyderabad, Karimnagar and Warangal, the contribution of efficiency change is higher than technological change, which indicates they are catching up with other frontier districts. Among the top 10 districts in efficiency, 6 are from Coastal (East Godavari, West Godavari, Krishna, Guntur, Visakhapatnam and Srikakulam) 3 are from Rayalaseema (Anantapur, Chittoor and Kurnool) and only 2 are from Telangana (Nizamabad and Khammam). While technological change contribution is higher in Krishna, Kurnool, Khammam, and Nizamabad.

Table 14 presents the region wise trends in TFP growth. Overall TFP growth in Telangana is about 13% per decade, while the same is 11% per decade in Coastal, while TFP growth in Rayalaseema is stagnant. In Telangana and Coastal, until 1976 there was stagnation in TFP growth, then after there was a good

Table 11. Mean efficiency and TFP growth per decade and its decomposition from 1956 to 2007 in Telangana districts. .

District	Variable	1956	1956-66	1966-76	1976-86	1986-96	1996-2007	Mean
Hyderabad	Mean efficiency (B&C)	0.28	0.27	0.31	0.46	0.56	0.61	0.43
	TFP growth	1	1.24	1.69	1.50	1.00	1.03	1.26
	Efficiency change	1	1.10	1.80	1.38	1.00	1.00	1.22
	Technical change	1	1.12	0.94	1.08	1.00	1.03	1.03
Karimnagar	Mean efficiency (B&C)	0.48	0.46	0.40	0.45	0.58	0.64	0.50
	TFP growth	1	1.12	0.79	1.63	1.68	1.32	1.26
	Efficiency change	1	1.19	0.92	1.25	1.23	1.30	1.17
	Technical change	1	0.94	0.86	1.31	1.36	1.01	1.08
Warangal	Mean efficiency (B&C)	0.35	0.36	0.38	0.45	0.57	0.72	0.49
	TFP growth	1	1.30	0.62	1.72	1.46	1.57	1.26
	Efficiency change	1	1.81	0.80	1.38	1.03	1.48	1.25
	Technical change	1	0.72	0.77	1.25	1.42	1.06	1.01
Khammam	Mean efficiency (B&C)	0.61	0.64	0.59	0.58	0.78	0.87	0.69
	TFP growth	1	1.14	0.60	1.66	1.41	1.37	1.17
	Efficiency change	1	1.25	0.59	1.12	1.07	1.27	1.02
	Technical change	1	0.91	1.01	1.48	1.32	1.08	1.14
Medak	Mean efficiency (B&C)	0.44	0.40	0.47	0.59	0.64	0.75	0.56
	TFP growth	1	1.10	1.21	1.05	1.31	1.15	1.16
	Efficiency change	1	1.03	1.42	0.90	1.26	1.09	1.13
	Technical change	1	1.07	0.85	1.16	1.04	1.06	1.03
Adilabad	Mean efficiency (B&C)	0.50	0.50	0.57	0.67	0.73	0.89	0.67
	TFP growth	1	1.01	1.04	0.95	1.20	1.22	1.08
	Efficiency change	1	0.98	1.09	0.91	1.10	1.00	1.01
	Technical change	1	1.03	0.96	1.05	1.08	1.22	1.07
Nalgonda	Mean efficiency (B&C)	0.77	0.76	0.61	0.64	0.68	0.70	0.68
	TFP growth	1	1.12	0.65	1.43	1.15	1.12	1.06
	Efficiency change	1	1.25	0.82	0.99	0.96	0.96	0.99
	Technical change	1	0.90	0.79	1.44	1.20	1.17	1.07
Mahbubnagar	Mean Efficiency (B&C)	0.90	0.80	0.64	0.63	0.63	0.66	0.67
	TFP growth	1	0.97	0.60	1.58	1.18	1.10	1.04
	Efficiency change	1	0.96	0.75	1.11	1.13	1.04	0.99
	Technical change	1	1.01	0.81	1.42	1.04	1.06	1.05
Nizamabad	Mean efficiency (B&C)	0.93	0.92	0.83	0.82	0.59	0.54	0.72
	TFP growth	1	1.00	1.00	0.91	1.24	0.76	0.97
	Efficiency change	1	1.00	1.00	0.83	0.82	0.70	0.86
	Technical change	1	1.00	1.00	1.10	1.51	1.08	1.12

Mean efficiency (B&C) estimates are based on Battese and Coelli (1995) model.

growth, while in Rayalaseema except in 1986 to 1996, there was stagnation in growth. In both Coastal and Telangana, most of the growth came from technological change, which indicates technological progress ushered by green revolution in major crops like paddy. In Coastal, efficiency is highest throughout the period, while in Telangana efficiency is the lowest, it indicates that with the existing resource endowment and technology,

Table 12. Mean efficiency and TFP growth per decade and its decomposition from 1956 to 2007 in Rayalaseema districts.

District	Data	1956	1956-66	1966-76	1976-86	1986-96	1996-2007	Mean
Chittoor	Mean Efficiency (B&C)	0.78	0.87	0.84	0.81	0.89	0.85	0.85
	TFP growth	1	1.45	1.00	1.00	1.00	1.00	1.08
	Efficiency change	1	1.90	1.00	1.00	1.00	1.00	1.14
	Technical change	1	0.77	1.00	1.00	1.00	1.00	0.95
Kurnool	Mean efficiency (B&C)	0.95	0.87	0.83	0.80	0.87	0.88	0.85
	TFP growth	1	0.67	0.83	1.23	1.55	1.09	1.03
	Efficiency change	1	0.71	0.91	1.03	1.28	0.82	0.93
	Technical change	1	0.94	0.91	1.20	1.21	1.33	1.11
Kadapa	Mean efficiency (B&C)	0.47	0.45	0.44	0.48	0.53	0.61	0.50
	TFP growth	1	0.71	0.62	1.05	1.56	1.04	0.94
	Efficiency change	1	0.99	0.77	0.90	1.13	1.02	0.95
	Technical change	1	0.72	0.80	1.16	1.38	1.01	0.99
Anantapur	Mean efficiency (B&C)	0.96	0.89	0.67	0.66	0.72	0.68	0.72
	TFP growth	1	0.99	0.92	0.84	1.00	1.04	0.95
	Efficiency change	1	1.09	0.98	0.75	1.05	0.99	0.97
	Technical change	1	0.91	0.93	1.12	0.96	1.05	0.99

Telangana can increase its output by more than 28% from the existing level, while Coastal region could enhance it by only 14% and Rayalaseema by 25% in 2007.

CONCLUSIONS AND POLICY OPTIONS

The agricultural development in the less developed districts is a big challenge as they are resource poor regions and crops are grown under more risky agro-ecological conditions, over the time they become specialized in dry land crops, which are technologically less productive and high risk crops, farmers are deprived of physical and financial capital, higher costs in developing, delivering and accessing services (for input or output markets, or research, extension from both public and private sectors), greater competition in their output markets make their agriculture unsustainable. Many of these difficulties are endogenous, such as agro-ecological, locational, demographic and socio-economic which affects agricultural transformation is a direct result of these differences. It is unfortunate that an already difficult task has been made harder by broader processes of change (for example some aspects of globalization and withdrawal of state from support services). Governments must try to reduce transaction costs and increase profitability to farmers and traders where high transaction costs and low profits are constraining development of these unfavourable regions. With more variability, risk and uncertainty and with lower densities of economic activity (like Anantapur and Mahbubnagar), the need for state support is even greater than it was in the high-income regions.

So far in this paper, we have argued that agricultural growth, particularly cereal based intensification, offers the best potential in the Coastal region. On the other hand. Telangana and Rayalaseema regions are not suitable for such cereal based revolution. This leaves policy makers with a major challenge as external action to reduce transaction costs and raise the profitability of agricultural diversification led growth. What then are the best policy options for agricultural growth in these areas in the long run, keeping their competitiveness? Some policy options are not controversial: the benefits of education, improved governance and communications infrastructure are widely recognised and benefit farm sectors in under developed regions. Some researchers also question effectiveness of research and extension services without complementary markets and infrastructure, and there is a continuing process of experimentation about the best means and practices to finance and deliver these services to commercial and subsistence farmers. High transaction costs may be even more constraining on agricultural diversification towards commercial crops, there is a greater need for price support and stabilisation to make the technologies financially attractive to farmers (Reddy, 2009a, b). Due to lack of policies which address regional disparities,the gap widened between the potential and the actual productive capacities of agriculture.

The paper also examined productivity growth, since the

Table 13. Mean efficiency and TFP growth per decade and its decomposition from 1956 to 2007 in Coastal districts.

District	Data	1956	1956-66	1966-76	1976-86	1986-96	1996-2007	Mean
Nellore	Mean efficiency (B&C)	0.52	0.41	0.41	0.62	0.86	0.89	0.61
	TFP growth	1	0.90	1.15	2.39	1.58	1.39	1.40
	Efficiency change	1	1.11	1.27	1.68	1.10	1.12	1.24
	Technical change	1	0.82	0.90	1.43	1.44	1.24	1.13
Krishna	Mean efficiency (B&C)	0.75	0.74	0.74	0.79	0.92	0.92	0.82
	TFP growth	1	1.15	0.94	1.27	1.40	1.17	1.18
	Efficiency change	1	1.06	0.98	1.22	1.02	1.03	1.06
	Technical change	1	1.09	0.95	1.04	1.37	1.14	1.11
Guntur	Mean efficiency (B&C)	0.90	0.80	0.89	0.94	0.88	0.88	0.90
	TFP growth	1	1.23	1.03	1.27	1.02	1.13	1.13
	Efficiency change	1	1.19	0.96	1.14	0.81	0.96	1.00
	Technical change	1	1.03	1.07	1.12	1.25	1.18	1.13
East Godavari	Mean efficiency (B&C)	0.91	0.86	0.81	0.80	0.92	0.92	0.86
	TFP growth	1	1.16	1.01	1.00	1.06	1.00	1.04
	Efficiency change	1	1.35	1.02	1.00	1.00	1.00	1.07
	Technical change	1	0.86	0.99	1.00	1.06	1.00	0.98
West Godavari	Mean efficiency (B&C)	0.95	0.92	0.86	0.81	0.87	0.82	0.85
	TFP growth	1	1.00	1.00	1.00	1.13	1.00	1.02
	Efficiency change	1	1.00	1.00	1.00	1.00	1.00	1.00
	Technical change	1	1.00	1.00	1.00	1.13	1.00	1.02
Srikakulam	Mean efficiency (B&C)	0.61	0.60	0.60	0.66	0.80	0.91	0.71
	TFP growth	1	0.97	0.97	0.66	1.34	1.26	1.01
	Efficiency change	1	1.47	1.01	0.61	0.94	1.16	1.00
	Technical change	1	0.66	0.96	1.08	1.43	1.09	1.01
Visakhapatnam	Mean efficiency (B&C)	0.90	0.86	0.84	0.85	0.93	0.92	0.88
	TFP growth	1	1.00	1.00	1.00	1.00	1.00	1.00
	Efficiency change	1	1.00	1.00	1.00	1.00	1.00	1.00
	Technical change	1	1.00	1.00	1.00	1.00	1.00	1.00

formation of united Andhra Pradesh in 1956 at district level, by using Malmquist productivity indices. Overall, TFP growth in agriculture and allied activities in Telangana is about 1.3% per annum, the same are 1.1% per annum in Coastal, while TFP growth in Rayalaseema is stagnant. It indicates that, there is a convergence in TFP growth among districts of developed coastal and less developed Telangana regions, but districts in Rayalaseema region are left out of this growth process, as Rayalaseema region is not able to catch up with the other two regions in agricultural productivity. Another important finding is that irrespective of region most backward districts in agriculture, that is Srikakulam, Visakhapatnam, Anantapur, Kadapa, Adilabad, Nalgonda, Mahbubnagar and Nizamabad showed stagnation in TFP growth during the last 50 years. With the existing resource endowment and technology, Telangana can increase its output by more than 28% from the existing level, while Rayalaseema region can enhance its output by 25%, Coastal region by only 14% as revealed from efficiency estimates. Shadow input shares indicate that, still gross irrigated area, fertilizer use and availability of labour are three important inputs, which limits the district production frontier. Inefficiency effects model (Bettese and Coelli, 1995) reveals that market infrastructure and credit availability are two important variables in increasing efficiency. Study results also emphasize importance of resource endowment (physical

Table 14. Region wise mean efficiency and TFP growth per decade and its decomposition from 1956 to 2007.

Region	Data	1956	1956-66	1966-76	1976-86	1986-96	1996-2007	Mean
	Mean efficiency (B&C)	0.54	0.53	0.51	0.58	0.64	0.70	0.59
	Mean efficiency (DEA)	0.52	0.60	0.58	0.63	0.67	0.72	0.62
Telangana	TFP growth	1	1.10	0.85	1.34	1.28	1.16	1.13
	Efficiency change	1	1.15	0.97	1.08	1.06	1.07	1.06
	Technical change	1	0.96	0.88	1.24	1.21	1.08	1.07
	Mean efficiency (B&C)	0.78	0.73	0.70	0.77	0.89	0.90	0.80
	Mean efficiency (DEA)	0.68	0.79	0.81	0.85	0.83	0.86	0.80
Coastal	TFP growth	1	1.05	1.01	1.14	1.20	1.13	1.11
	Efficiency change	1	1.16	1.03	1.05	0.98	1.04	1.05
	Technical change	1	0.91	0.98	1.09	1.23	1.09	1.05
	Mean efficiency (B&C)	0.76	0.74	0.67	0.68	0.73	0.75	0.72
	Mean efficiency (DEA)	0.77	0.85	0.77	0.71	0.78	0.75	0.77
Rayalaseema	TFP growth	1	0.91	0.83	1.02	1.25	1.04	1.00
	Efficiency change	1	1.10	0.91	0.91	1.11	0.96	0.99
	Technical change	1	0.83	0.91	1.12	1.12	1.09	1.01
	Mean efficiency (B&C)	0.65	0.63	0.60	0.66	0.74	0.77	0.68
	Mean efficiency (DEA)	0.62	0.71	0.69	0.72	0.74	0.77	0.71
Andhra Pradesh	TFP growth	1	1.04	0.90	1.20	1.24	1.12	1.10
	Efficiency change	1	1.14	0.98	1.03	1.04	1.04	1.04
	Technical change	1	0.91	0.92	1.16	1.20	1.09	1.05

Mean efficiency (DEA) estimates are with data envelopment analysis.

and human) in base year for subsequent growth. Some of the issues policy should address are:

(i) Ensuring market access at village level to finance and inputs, and hence to output markets can only be addressed by policy intervention to promote agricultural diversification growth strategy,

(ii) Direct and indirect costs and benefits need to be accounted while addressing exposure to risk in the more marginal agro-ecological regions,

(iii) Policy analysis should consider the costs, benefits and difficulties of market interventions together with those of welfare interventions, as they both compete for the same resources with similar objectives and outcomes,

(iv) Development of new institutions and market structures that will require less state support and become self sustainable,

(v) Action research is needed in institutional innovation, trying out innovative institutional arrangements involving for example, elements of interlocking transactions, producer groups, regulated monopsony, cooperative competition and use of agents such as traders, trader information groups, and

(vi) Promotion of new communication technology, transport, contract farming and market infrastructure to reduce transaction costs.

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