Declining Labour Use in Agriculture : A Case of Rice Cultivation in Andhra Pradesh

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Abstract

The present paper examines the changing nature of labour use in rice cultivation in Andhra Pradesh. Rice production in India is, however, concentrated in a few pockets. A few states in India produce around two thirds of rice production. Andhra Pradesh is the third largest state in India with respect to rice production. In Andhra Pradesh too, rice is the single largest crops occupying around 30% of area cultivated. The state was one of frontrunners leading the Green Revolution, particularly in rice cultivation.

The study observed that there is a fast decline in labour use in respect of rice cultivation in Andhra Pradesh. All three forms of labour (family, casual and attached) have followed the same trend. But the share of casual labour in the total labour used in rice cultivation is increasing with a corresponding decline in the share of family labour. By gender, although both male and female labour use in rice cultivation has been declining, it is faster for female labour. Also, a noticeable decline in the share of harvesting and threshing/winnowing which are increasingly mechanized, in total labour used per hectare of rice cultivation. Between wage rate and labour inputs it is observed that there are higher relatively female labour inputs per hectare in areas (Zones) where male wages are lower and vice versa.

Key Words: *Labour Use, Employment, Agriculture, Rice Cultivation, India, Andhra Pradesh.*

JEL Classification*:*

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I Introduction

The present paper attempts to examine changing nature of labour use in rice cultivation in the context of a South Indian state Andhra Pradesh. In fact, Andhra Pradesh is the third largest state in India with respect to rice production. Rice production in India is, however, concentrated in a few pockets. A few states in India produce around two thirds of rice production. In Andhra Pradesh too, rice is the single largest crops occupying around 30% of area cultivated. The state was one of frontrunners leading the Green Revolution, particularly in rice cultivation.

Rice cultivation is an important source of livelihood and food security especially for those living in the rice growing countries. It is, in fact, the second largest food crop in production all over the World next to maize. But as a major part of maize produce would go to non-human consumption, rice has become the largest staple food crop used for human consumption in the World. Most of the rice cultivation takes place in Asian countries[1] wherein China and India are the two largest rice producing countries in the world. In Asia, rice is staple food for about 90 per cent of the population living in the region (FAO).

Over time the cultivation practices of rice crops have improved. It transformed from a traditional and simple broadcasting method to a modern and systematic transplantation of seedling. Accordingly there has been a continuous growth in yield rate or productivity of rice crop is apparent. However, still there are wide variations in practices of rice cultivation and the level and growth of yield rate/productivity, across countries and regions within countries.

The most notable technological changes observed for agriculture especially that of developing countries during the second half 20th century are – introduction of high yield

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[1] See Wickezer and Bennet (1941) and Barker *et al.* (1985) for significance of Rice cultivation in Asia.

variety (HYV), mechanization, and intensive use of other inputs such as irrigation, chemical fertlisers etc. The impact of the labor-saving technology/implements on labor reallocation and the nature of farm households has been cause of concern ever since the on-set of mechanisation. Rice cultivation in Asia and around the world has undergone such a technological change.

In India, rice is one of the few important food grain crops targeted for the application of the Green Revolution package. With the application of HYV seeds, enhanced irrigation, chemical fertilizers rice cultivation in India is intensified. As a result there is a quantum jump in rice production and a phenomenal change input use. Subsequently, there is a gradual mechanization of agricultural operations in general and rice cultivation in particular. Rice is still the single largest crop (around one-fourth of the cultivated area) in India in terms of area. Considerable proportion of the total labour use in all agricultural operations is associated with the rice cultivation. Indeed, rice was considered one of the most labour-intensive crops. But the mechanization process has reduced the labour intensity in rice cultivation.

One of the severe criticisms against mechanization of agriculture was it is dispensing the agriculture dependent labour without alternative employment opportunities (see Zarkovic, 1987). Such kind of criticism carried till 1990s. But in the 2000s especially in the later part, there is other argument emerging is that there is a labour shortage for agricultural operations and thereby sharp rise in farm wages especially in the context of Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) implementation (see Gulati, 2013).

Having said, the rest of the paper is organized as follows. A review of studies related to labour absorption in general and agriculture and rice cultivation in particular is presented in Section II. Section III present changes in rice cultivation in Andhra Pradesh over time. Section IV presents the changing labour force absorption in agriculture in general in the context of Andhra Pradesh. The situation of changing labour use in rice cultivation in Andhra Pradesh is presented in Section V. The changes in agricultural wage rates and its implication on rising cost of rice cultivation are analysed in Section VI. Section VII presents the status of mechanization in Andhra Pradesh in the context of all India, scope for further increase in mechanization and its implication on further declining in labour use in agriculture are discussed in this section. Finally, summary and concluding remarks presented in Section VIII.

II A Review

With relatively high growth of population and thereby the increasing labour force, absorption of such labour force in the economy has been remained a challenge and thus a policy concern particularly among the developing countries such as India. The traditional subsistence sector (including agriculture and household industry and other services) seen as the residual sector absorbing the increasing labour force despite of the fact that marginal productivity of such increasing labour force absorption in this sector was reduced to zero. In this context, the post-war development thinking evolved a development strategy for the developing countries as a solution to absorption of surplus labour force in these countries as well as for their economic development.

The strategy of two sector model based on the developed countries experience, has shown that with the development of capitalist sector which is urban by location and modern in nature, as it can absorbs the redundant and surplus labour of subsistence or agriculture sector economic development of developing countries is possible (Lewis, 1954 & 1958; Ranis and Fei, 1961). It is seen as a solution to surplus labour, economic efficiency in labour absorption and economic development of developing countries (Ranis and Fei, 1961). But, such a strategy, however, could not bring in desired outcomes for many of the developing countries. A failure of two-sector model, owing to different reasons, made development thinkers to look out for alternative strategies for development and labour absorption in developing countries (Chadha, 2003).

An alternative thinking on strategies for economic development turned it focus on a solution in productive use of increasing labour force which is highly concentrated in agriculture and rural areas. In this respect, a two-pronged strategy has evolved. One the one hand, increase the labour absorption in agriculture itself by increasing the land and labour productivity through technology and infrastructure such as irrigation. On the other, diversification/shift of labour force from agriculture to non-agriculture, but that is through developing rural non-farm sector along with the urban industry. Although the rural to urban migration proceeds in response to urban-rural difference in expected earning the urban employment rate acts as an equilibrating force on such migration (Hariss and Todaro, 1970). Thus, urban employment rate along with urban-rural difference in expected earning act as a limiting factor for urban migration and hence labour absorption in urban industry.

With respect to the labour absorption in rural non-farm sector, expansion and growth of this sector is seen as crucial for such absorption. There are many studies that examined the determinant factors in expansion of rural non-farm sector and its impact on rural employment (for instance see Mellor, 1972; Vaidyanathan, 1986; Hazell and Haggablade, 1991; Lanjouw and Lanjouw, 2001)[2]. Herein a stream of thought, however, argued for agriculture growth/ development is a precondition for the expansion of rural non-farm sector wherein inter-sectoral linkages (both forward and backward) play critical role (Mellor, 1972). Such a strategy is referred to as agriculture growth-led expansion of rural non-farm sector (ibid.). Another hypothesis was also drawn (residual sector hypothesis) saying distress in agriculture pushing the labour out of agriculture and into non-farm activities wherein non-farm sector is residual sector absorbing such labourers who are pushed out of agriculture (Vaidyanathan, 1986; also see Murthy, 2005).

However, in the Indian context on the progress in rural non-farm employment it is observed that the pace is very slow and causing delay in structural transformation of employment in the country (Jha, 2013; Binswanger, 2012). The recent study examining the progress and factors in slow pace of progress in rural non-farm sector observed that lacunae in policy, inadequate investment in rural infrastructure, lack of appropriate technology, inadequate human capita and entrepreneurship, lack of access to credit market etc., are significant ones (Chadha, 2003).

Labour Absorption in Agriculture

In the backdrop of Malthusian theory based pessimistic catastrophe of population explosion, Boserup (1965) has shown an optimistic way of growth in agriculture output meeting food security of the increasing population. In this respect, it is said that change in land-man ratio is the result of historical adaptations of different cultivation systems to change in population pressure (Boserup, 1965; also see Vaidyanathan and Jose, 1977). It involves a transition from extensive cultivation (bringing virgin and fallow lands to cultivation with little other inputs) to intensive cultivation involves increasing labour inputs, irrigation, multiple cropping, technology etc. In the process the land-man ratio too increases along with increasing agricultural output. In the Asian context, Ishikawa (1967) has shown a strong positive

[2] Also see Basant and Kumar (1989) for a Review of literature till late 1980s. Also see Murthy (2005) further review of literature.

relationship between output per unit area and human labour inputs per unit area (see Vaidynathan and Jose, 1977). It is said that intensive use human labour as such may not be able to increase the output but it is possible if it is accompanied by capital and other inputs (Ishikawa, 1967). In this context, the failure of two-sector model as strategy for absorbing the increasing labour force, both the policy and research interests have turned towards such an alternative strategy through agriculture development.

In respect of labour absorption in agriculture many studies examined determinant factors in such labor absorption. With the emerging technological advancements in agriculture, the impact of agriculture growth/development on labour use in this sector was the research interest especially during 1970s and 1980s. There are number of research studies in this respect in Asian as well as Indian context (for instance see Vaidyanathan and Jose, 1977; Ishikawa, 1978; Bardhan *et al*., 1978; IRRI, 1978; Rao, 1975; Shiela Bhalla, 1989&1991)[3]. It is observed that most important factors involved with labour use/absorption in agriculture are: soil-climatic conditions, changes in net sown area, cropping intensity/changes in gross cropped area, irrigation, technology involving (seeds, chemical fertilizers and mechanization), institutional factors such as tenancy, and finally agricultural wage rate itself.

When agriculture output growth is due to expansion of net sown area it accompanies the increase in labour absorption. Output growth due to increase in gross cropped area consequent upon increasing crop-intensity, would also increase in the labour use in agriculture. Irrigation is considered to be critical factor in agriculture (Ishikawa, 1967). It increases the cropping intensity, stabilizes the crop production and increases the yield. In this respect, irrigation increases the labour absorption (Bardhan, 1978; Ishikawa, 1978). Crop-intensity along with irrigation improves the output per unit area (hectares/acre). Technology involving modern varieties of seeds and biochemical inputs increase yield rates. Technology such as mechanization places factor substitution which displaces labour (Rao, 1975; Barker and Cordova, 1978: Binswanger, 1978). Thus, different dimensions of technology in agriculture have different impact on labour use (for review see Basant, 1987). In the context of technological change, when it is non-neutral technology and is in favour of labour saving, the factor substitution is adverse to labour and hence result in decline in labour absorption

[3] Also see Basant (1987) and Bhiravamurthy (2010) for a Review of literature on studies conducted till late 1980s.

(Shiela Bhalla, 1991). Therefore, impact of technology on labour use is differentiated by labour-saving and labour displacing components (ibid).

In their international perspective of agriculture development across countries, Hayami and Ruttan (1971) have shown different paths taken by different countries – developed and less developed ones. They have observed that some countries have achieved increase in their agriculture productivity through intensification of biochemical input involving labour intensification. Some other countries have achieved it through mechanical inputs. In this context, they related these paths to relative factor prices which in turn are related to relative factor scarcities in those countries (Hayami and Ruttan, 1971; Barker and Cordova, 1978). In the Asian context, a study has observed that introduction of modern variety seeds and irrigation have increased the output and thereby labour use per hectare but the mechanization has adverse effect in labour use (Barker and Cordova, 1978). Research studies[4] in the India context have further contributed to the understanding of the relationship between the agricultural output growth and labour use/absorption.

Initially, increase in cultivated area and growth of output through technology seen as potential factors in increasing the labour absorption. By mid 1970s, however, a bleak prospect in appreciable increase in cultivated area (i.e. net sown area), labour absorption through growth in productivity using technology has assumed greater significance (Tyagi, 1981). With the refinement of methodology, the understanding on the impact of technology on labour absorption has improved. The technology especially in the context of 'Green Revolution' has improved yield rate and productivity of land and labour. With respect to the impact of agricultural productivity on labour absorption, it is observed the higher yield areas have used higher labour inputs (Alag *et al.*, 1978). Although irrigation while improving productivity of agriculture it improves the labour absorption but the physical properties of soil and quality of irrigation also matters (Vaidyanathan, 1978).

In respect of mechanization many studies have observed the displacement impact on labour use (see Rao, 1975; Binswanger, 1981). But when it is combined with other factors its displacement intensity can be reduced or nullified. It is argued that technological displacement of labour consequent upon the use of tractors is roughly compensated by the

[4] In the Indian context, there are many studies in respect of labour absorption in agriculture or with respect to the impact on labour use of agriculture growth/productivity. Most of these studies while using Farm Management Survey/Study (FMS) data and that of Comprehensive Scheme of Studying (CSS) Cost of Cultivation of Principal Crops in India, have made their observation.

positive employment effect of the changes in cropping pattern and intensity associated with tractor use (Rao, 1975; Krishna, 1975; also see Basant, 1987). When mechanization helped land augmentation which in turn increases cropping intensity, and timely operations, it may increase the labour inputs (Binswanger, 1981).

Studies based on state levels analysis have shown that there is inverted 'U' shaped path in increase in labour use per hectare in the process of agricultural growth (Shiela Bhalla, 1991). In the initial stage, agricultural growth in response to technology has increased the labour absorption and reaches peak in the growth process and subsequent increase in yield accompanies decline in labour use (Sheila Bhalla, 1991).

With respect to two components of labour such as family and hired labour, it is observed that impact of technology-led output growth on these two components of labour varies. Proliferation of small and uneconomic farms has become part of agriculture development in India. These farms operate mainly on the strength of family labour (Shiela Bhalla, 1991). Instigated argument of size-productivity debate[5] was that the productivity of farm increases with the decline of farm size-class, an inverse relationship (Sen, 1962&1964). One of the factors for such relationship is small farms use family labour intensely (ibid). But such relationship is questioned in the presence of technology wherein large size farm have the capacity of capital investment and advantage of mechanization. Herein it is observed that the share of family labour in the total would rise as and when labour displacing technology was adopted; it would fall in the face of rapid growth in yields combined with labour using technologies; and in the context of agricultural involution[6], family labour would gradually displaces hired labour (Sheila Bhalla, 1991).

It is also said that the increase in labour absorption using technology through dissemination of labour-intensive technology may not succeed because of the fact that there exist a transaction cost involved in employing labour due to the often hostile relationship between farmers and labourers (Hayami, 1981; Kalirajan and Shand, 1982). The influence of agrarian structure, labor market and the socio-political environment is such that it may offset the negative effects of technology such as mechanization on farm employment (Kalirajan and Shand, 1982). A micro level study in Tamil Nadu has shown strong labour union opposition towards mechanization of farming activity (see Kalirajan and Shand, 1982). Institutional

[5] See Gaurav and Mishra (2011) for review of literature.
[6] Where labour inputs per hectare increase significantly over time despite long-term stagnation in yields.

factors such as tenancy and institutional wage that sans bargaining power of hired workers, have a depressant effect on labour use (Bardhan, 1978). Thus, labour requirements in agriculture depend on the type of technology used, distribution of landownership, socio-economic-institutional and political conditions (Kalirajan and Shand, 1982).

Studies based on disaggregate analysis observed that labour inputs in crop production vary significantly from crop to crop and for the same crop across regions (Tyagi, 1981). Also, it is observed when the male and female labour use in crop production varies by operations, mechanization of certain operations have differential impact; operations such as weeding and harvesting are mostly female labour-intensive ones and when they are being mechanized, females labour is the most affected one with it (see Agarwal, 1981).

Having said what one finds is a lacuna of continued research on this phenomenon. Such an intensive research on the relationship between agriculture output growth and labour absorption conducted during 1970s and 80s gradually become sporadic. In fact, the 1990s and the later period that witnessed significant changes in respect of economic reforms and growth of economy. Indian economy is integrated with the World economy and became part of globalization. Consequent upon the globalization, Indian economy is witnessed both pains and gains of global changes. During 1990s, agriculture in particular experienced setback in respect of public investment and extension services. The changing global level prices of agricultural commodities have also shown their impact on agricultural prices in India. This is also a period wherein the productivity gains of green revolutions in agriculture tapered-off. It is observed that there is almost a technological stagnation in the Indian agriculture (Bhalla and Singh, 2012). Although there is such a technological stagnation with respect to inputs such as seeds, chemical fertilizers, there is spreading technology all over India in respect of mechanization.

Moreover, the period of last two decades (1990s and 2000s) witnessed deceleration of growth in agriculture workforce in many Indian states. Some of the states experienced negative growth. Andhra Pradesh is one of those Indian states which experienced a decline in agriculture workforce during the last decade i.e. 2000s (see Venkatanarayana, 2013). Possible explanations for the decline could be increasing absorption non-farm employment and increasing mechanization of agriculture relieving surplus labour to non-farm sector. But the trend indicates that there is a decline in overall work participation rate (WPR) which is beyond the explanation of compensating increase in school attendance rate. One can locate

the decline participate rate consequence of decline in workforce in agriculture. As such decline in workforce in agriculture and decline in WPR is mostly observed for females, one has to examine the factor behind such a phenomenon. It could be due to rise in male workers may pull out female agriculture labourers who are otherwise disparately participation to meet family livelihood. On other hand, it could be increasingly spreading mechanization of female-intensive agricultural operations pushing them out. Herein, we contextualize our study.

III Rice Cultivation in Andhra Pradesh

Although there is an increasing crop diversification in Andhra Pradesh, the area under rice cultivation seems to be increasing marginally. Around 30% of state's total cropped area is under rice cultivation - around 4.0 million hectares (including both Khariff and Rabi seasons) of the state's total gross cropped area of 13 million hectares. Rice accounts for 60% of the total area under food grains in the state. Such is the importance of rice cultivation in the state.

Andhra has four rice agro-ecosystems: irrigated rice, rain-fed lowland and upland rice, and a flood-prone rice ecosystem. However, more rice cultivation in AP is water intensive and irrigated than elsewhere in India. Of the total irrigated area in the state, around two-thirds of it is under rice cultivation. Put differently, of the total area under rice cultivation in the state, around 95% of it is under irrigated conditions.

Table 3.1: Area, Production and Yield (APY) of Rice Andhra Pradesh

T E	A P Y (in Volume)			Growth (%)		
	Area	Production	Yield	Area	Production	Yield
1	***2***	***3***	***4***	***5***	***6***	***7***
1960-61	30.17	37.54	1244	-	-	-
1970-71	32.80	42.08	1283	0.8	1.1	0.3
1980-81	36.83	69.17	1878	1.2	5.1	3.9
1990-91	41.54	100.78	2426	1.2	3.8	2.6
2000-01	41.91	116.58	2781	0.1	1.5	1.4
2010-11	41.93	130.66	3116	0.0	1.1	1.1

Note: TE – Triennium Ending; Area is in lakh hectares and Production in lakh tonnes; and yield rate is Kgs per Hectare.

Source: Directorate of Economics and Statistics.

Rice cultivation in the state takes place in both the main seasons, about 60% in khariff and 40% in rabi. Very sporadically, in the third 'summer' season, rice is cultivated in some parts

of the state. While around 95% of the Khariff rice is irrigated (and the rest rain-fed), in Rabi and the small summer season it is all irrigated.

although the area under rice cultivation in the state has shown a steady increase, in terms of both yield and production, rice production underwent substantial growth owing to quantum 'green revolutionary' jumps in the yield rate with the advent of HYV seeds and rising application of other inputs – in which Andhra Pradesh was an early adopter. Currently more than 80% of Andhra Pradesh's rice cultivation uses HYV seeds. The state is now the second largest in India in terms of rice production, next only to West Bengal, with 120 – 140 lakh tonnes of rice in recent years, amounting to around 12-15% of the total rice production in India. Production and yield rates disaggregated by season show that the Kharif rate is lower than that of other seasons, while the Rabi season share in production is higher than its share in Andhra Pradesh's rice cultivation area.

However, since the 1990s, the yield rates of rice crop in India in general, and Andhra Pradesh in particular, are showing a deceleration in their growth rates. As the area under rice cultivation is almost stable, the deceleration in growth of yield rate has resulted in a slowing of growth in total rice production. Moreover, rice cultivation in the state has to fraught with several challenges. One of the problems with respect to rice cultivation in Andhra Pradesh increasing cultivation costs in general, and in rice in particular (GoAP, 2011, Laxminarayana *et al.*, 2011; Murthy, 2011). There are complaints by the farmers that the national level minimum support price (MSP) is also below the cost of cultivation experienced in the state. There have been widespread protests by the farmers and threats of a 'crop holiday' (GoAP, 2011, Laxminarayana *et al.*, 2011).

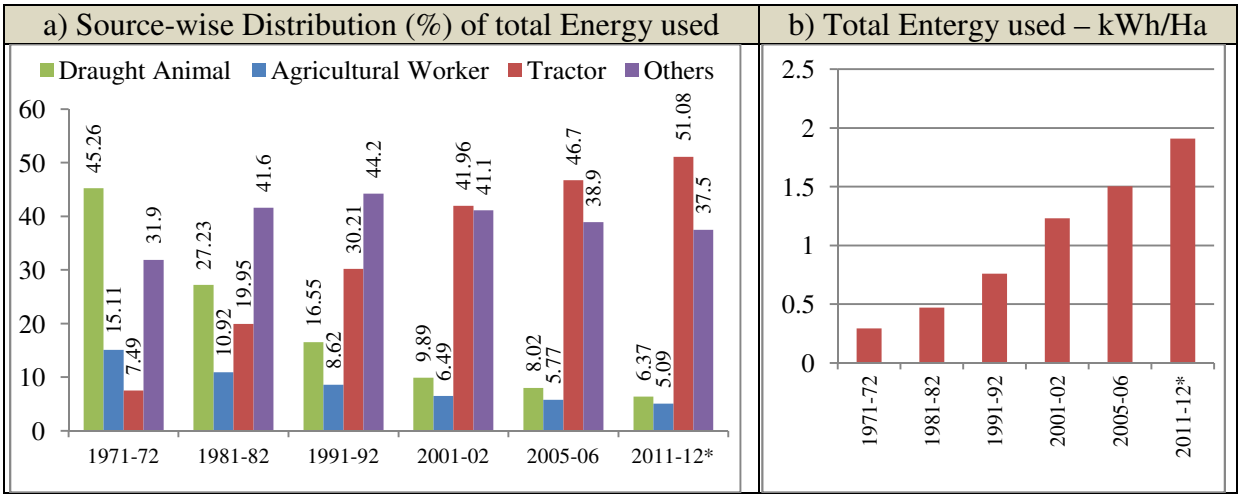
IV Declining Size of Labourforce engaged in Agriculture

Over time, in fact, the energy requirement for accomplishing the agriculture operations, is not declining rather it is increasing. Human labour is one of the energy sources required to execute agricultural operations. However, alternative sources of energy are substituted for human and animal sources of energy in order to accomplish increasingly intensified agricultural operations.

The national scenario is presenting declining share of human as well as animal labour in the agricultural operations. Correspondingly there is a sharp increase in the share of machine

(Tractor) labour (Figure 4.1a). These trends indicate the fast growing mechanization of agrarian economy of India. Despite the increasing total energy used in the agricultural operations per hectare (Figure 3.1b), the declining share of human and animal energy with a corresponding increasing in the share of tractors in the total energy used in Indian agriculture clearly indicates such a change (Figure 4.1a). Similarly, it might be the case of Andhra Pradesh. Although energy estimates are not available for the state, it can be observed from changing structure of rural workforce in the state.

Figure 4.1: Distribution of Total Energy used in the Indian Agriculture by Source



Note: 1. '*' Estimated; 2. Others including irrigation pump sets and machines using diesel or electricity.

Source: IASRI (2012) Agricultural Research Data Book.

Around half of the population in Andhra Pradesh is found to be working in one or the other economically gainful activity. Andhra Pradesh is one of those Indian states which have the highest (around 47.6% in 2009-10) work participation rate (WPR). This is partly due to a higher female work participation rate in the state; it is at around 36.8% (2009-10). It is also the second highest among the major Indian states next to Himachal Pradesh. Both the male female WPR in the state are higher than that of the national average.

However, the recent trend indicates a decline in WPR especially that of females in Andhra Pradesh and in the country as well (Table 4.1). Therefore, the decline in WPR has become a cause of concern not only in the state but also all over the country. The decline in WPR, especially for females is over and above the portion that could be explained with the decline in WPR of younger age groups due to their withdrawal from workforce which in turn is due to increasing attendance rate in educational institutions, indicating the increasing demand for

education. One may get a partial explanation from the proceeding analysis presented in the subsequent sections.

Table 4.1: Work Participation Rate (WPR) in Andhra Pradesh and India

Year	Andhra Pradesh					All-India				
	Total	Male	Female	Rural	Urban	Total	Male	Female	Rural	Urban
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1983	49.1	58.3	40.1	53.5	34.8	41.8	53.8	21.6	44.5	34.0
1993-94	52.0	60.8	43.3	57.6	37.5	42.0	54.5	28.6	44.4	34.7
2004-05	50.2	59.3	41.3	54.4	39.2	42.0	54.7	28.7	43.9	36.5
2009-10	47.6	58.2	36.8	52.1	36.4	39.2	54.6	22.8	40.8	35.0

Notes: 1. Figures presented are in percentages; 2. Usual Status - Principal and Subsidiary Status.

Source: NSS Employment and Unemployment Surveys.

Occupational distribution of workforce indicates there is a decline, although at a slow pace, in the proportion of workforce depending on agriculture in the state. Since early 1990s, there is also a decline in the size of workforce engaged in agriculture in Andhra Pradesh, hence the negative rate of growth of workforce involved in this sector (Table 4.2).

By the status of employment of those engaged in agriculture, the regular wage/salaried category is getting disappeared from the state agrarian economy wherein the size of this category is declining at a faster rate (Table 4.2). The increasing size of casual labour in the state's agriculture sector with a corresponding decline in regular wage/salaried indicates transformation the later in to the former one – i.e. casualisation of agricultural workforce. Even the recent trend for category of self-employed in agriculture shows that, there is a sharp decline in its size. In the Indian agriculture with large stakeholders of small and marginal farmers, the sharp distinction between cultivator and casual labourer in agriculture is rather elusive. There is a chance that depending on the prospects of self-cultivation in a particular year or period, a small/marginal farmer may become casual labour working for wages in the labour market and vice-versa. Sometimes a wage labour can lease-in land and become self-employed. This shift/diversification depends on the viability of cultivation especially for small and marginal farmers and land lease market.

There is a decline in the size of self-employed in agriculture is over and above the size of decline in workforce engaged overall agriculture in the state. Correspondingly there is a sharp increase in casual labour engaged in agriculture. These facts indicate that a major part of the decline in the self-employed could be due to change of their status of employment from self-

employed to wage labour. It is all about their perceived change in major source of income either from self-cultivation or wage labour.

Table 4.2: Growth of Agricultural Workforce in Andhra Pradesh

Sno	Details	Workforce in lakhs				Growth (%)		
		1983	1993-94	2004-05	2009-10	1983-94	1993-2005	2004-10
1	Total Labourforce	281.2	364.2	401.7	398.0	2.5	0.89	-0.18
2	Total Workforce	276.0	360.8	393.9	391.4	2.6	0.80	-0.13
3	Workforce Employed in Agriculture	190.5	242.1	225.7	206.4	2.3	-0.64	-1.8
4	Self-employed in Agriculture	87.4	106.4	101.8	77.2	1.9	-0.40	-5.4
5	Casual Labour in Agriculture	95.2	131.1	120.9	127.5	3.1	-0.73	1.1
6	Regular wage /salaried in Agriculture	7.9	4.7	3.0	1.7	-4.8	-3.9	-10.8

Note: 1. All those dependent on agriculture (incl. rural and urban); 2. Compound Annual Growth (CAGR) in %.
Source: Estimated using NSSO and Census data.

It will be clearer when we examine the change in rural labourforce in the state by gender wherein size of both the male and female labour/work force in the rural Andhra Pradesh declined between 2004-05 and 2009-10 (Table 4.2a). But the size of the workforce dependent on agriculture had begun to decline since early 2000s. Although decline is observed for both the male and females, it is higher for female particularly during later period i.e. between 2004-05 and 2009-10.

Self-employed are the main casualty for the drain of workforce within the agriculture. Although such drain, for both the male and females, had begun since early 2000s it is the largest during the later period between 2004-05 and 2009-10 and is the largest for females than their male counterparts by gender. The trend with respect to casual labour in agriculture is different, it had declined during early 2000s and increased latter period (between 2004-05 and 2009-10). Although both the male and female casual labour in agriculture in the state witnessed an increase its size during the later period, the rate of growth for male casual labour in agriculture had registered to be distinctively higher than that of females (Tables 4.2a). However, the long-term trend between 1993-94 and 2009-10 indicates that while the size of the male casual labour had increased the female casual labour had declined during the period. The observed phenomenon in the state would bring impasse against the hypothesis of feminization of casual labour in agriculture.

Table 4.2a: Gender-wise Growth of Agricultural Workforce in Andhra Pradesh

Sno	Details	Male Workforce			Female Workforce		
		1983-94	1993-2005	2004-10	1983-94	1993-2005	2004-10
1	Total Rural Labourforce	2.0	0.52	-0.08	2.6	0.30	-1.4
2	Total Rural Workforce	2.0	0.44	-0.03	2.6	0.22	-1.4
3	Workforce Employed in Agriculture	1.8	-0.74	-1.1	2.6	-0.36	-1.9
4	Self-employed in Agriculture	1.3	-0.52	-4.4	2.7	-0.34	-5.5
5	Casual Labour in Agriculture	3.2	-0.78	**2.2**	2.6	-0.39	**0.42**
6	Regular wage /salaried in Agriculture	-5.2	-3.5	-12.0	-10.2	3.3	-41.3

Note: 1. Rate of growth in % - Compound annual growth (CAGR); 2. For rural only.

Source: Estimated using NSSO and Census data.

It is interesting to note from the above analysis that overall decline in the workforce engaged in the state agriculture sector doesn't indicate the size of agricultural labourers working as a casual labourer for daily wages is declining. However, it does indicate that swelling casual labourer category at the cost of self-employed in agriculture. One may also infer from the analysis that the contribution of family labour might be declining. It may also indicate that those who are self-employed in cultivation have to depend more on labour market – hiring casual labour.

On the whole, although the physical labour units of inputs in agriculture production process were increasing for some time, it is not in proportion to the overall increase in total energy requirement in the process. In fact the intensification of agricultural production in the context of Green Revolution and thereafter, has increased the energy requirement in the production process. But this increase was duly complemented by the increase in the machine labour. Thus, one has to say that although overall energy requirement in the production process is increasing, the contribution of labour inputs is declining.

V Declining Labour Use in Rice Cultivation

If one examines the distribution of the workforce engaged in agriculture by agricultural activities, most of the workforce (more than 90%) is engaged in crop production in Andhra Pradesh as well as in the country. Again, field crops in the state and the country accounts for 88% of the total workforce engaged in agriculture (Table 5.1). Among the field crops, food grains cultivation in the state engages 71% of its agricultural workforce. The percentage of agricultural workforce engaged in cultivation of food grains is considerably lower in the state

when compared to that of national average. Similarly, percentage of agricultural workforce engaged in horticulture (6%) in the state is also higher than that of the country average. It indicates the increasing diversification of crop production towards to non-food grains or commercial crops especially that of oilseeds and cotton, in the state.

Table 5.1: Distribution (%) of Rural Agricultural Workforce in Andhra Pradesh by Participating Sub-sectors, 2009-10

Sno	Activity	AP	India
1	**Field Crops** - Cereals and other crops	87.7	87.8
a	Food grain crops (cereals and pulses)	71.2	79.2
b	Oilseeds (incl. peanuts or soya beans)	6.4	2.3
c	Cotton and other fiber plants	8.9	3.7
2	Horticulture (incl. fruits & nuts, spices and vegetables)	5.9	3.9
3	Farming of Animals (incl. dairying)	3.8	6.2
4	Others	1.1	1.1
5	Forestry (inc. hunting) and logging	0.2	0.3
6	Fishing	1.2	0.6
Total		**100**	**100**

Note: Based on National Industrial Classification (NIC) 2004-05 codes.

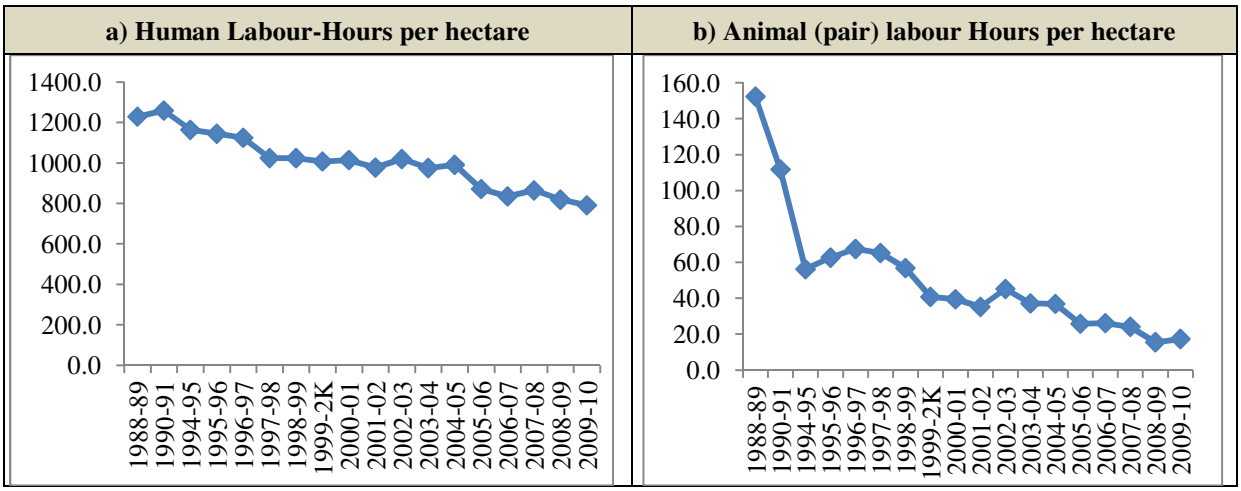
Source: Author's Estimates using NSSO 66th (2009-10) Round Employment and Unemployment Survey unit record data.

As it is observed from the above analysis a majority of the workforce engaged in agriculture in the state is involved in cultivation of food grains. Rice cultivation is the dominant crop among the food grains in the state. While all food grains cultivation occupies more than half of the total cropped area in the state, rice cultivation occupies 30% of it. It means that rice accounts for 60% of the total area under food grains. Moreover, rice is the only food grain crop that is being cultivated twice a year (both Khariff and Rabi) in many parts of the state. Therefore, one can say that a large portion of workforce engaged agriculture in the state might be involved in rice cultivation. Thus, the changes in the labour used for rice cultivation must be having a bearing on the overall labourforce engaged in agriculture.

There has been a fast growing mechanization in rice cultivation especially during the last two decades. Important operations of rice cultivation across states in India witness the increasing trend of mechanization. In case of Andhra Pradesh there is a declining trend with respect to human and animal labour involved in the rice cultivation, more so is the later (Figure 5.1). These trends indicate the fast growing mechanization of rice cultivation. But most of the mechanization (through tractors and harvesters) in rice cultivation, so far, is involved with the

ploughing / puddling and harvesting. Besides, the pumping water in case of those using ground water source of irrigation for the rice crop. The sharp declining trends in animal labour hours in rice cultivation in the state indicate the rapid mechanization in ploughing / puddling for rice cultivation. The other operations such as transplantation and weeding are still using human labour.

Figure 5.1: Declining Human and Animal Labour used in Rice Cultivation in AP



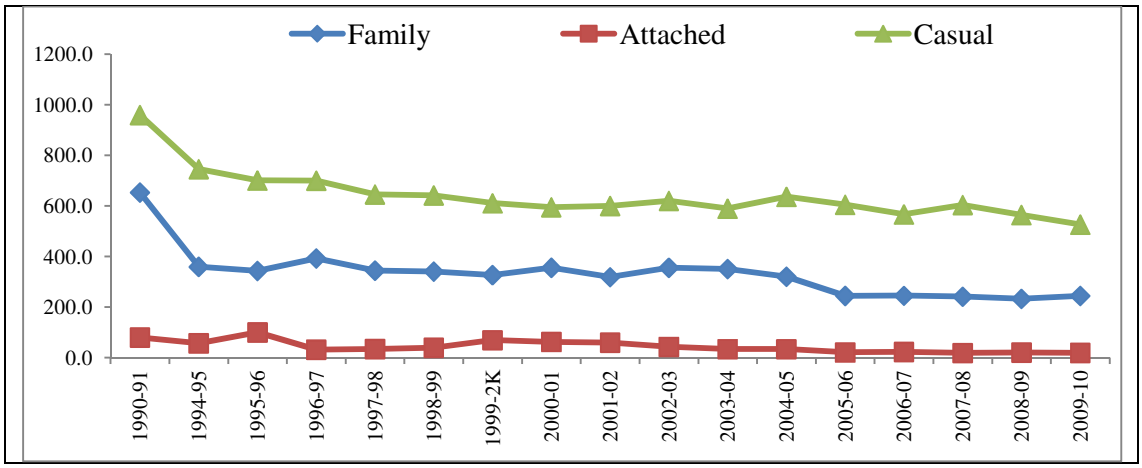
Note: 1. Based on Cost of Cultivation; 2. Labour hours used per hectare of rice cultivation.

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

The trend in three types/forms labour, i.e. family, casual and attached labour, used in rice cultivation in Andhra Pradesh indicates that all three types/forms of labour are declining. In fact the presence of attached labour/farm servant system is in any way disappearing in all types of agricultural operations, ever since the commencement of Abolition of Bonded Labour Act. The other two forms of labour labour, family and casual, labour used for per hectare of rice cultivation, also shown a declining trend in Andhra Pradesh during the last two decades.

Of the main sources/forms of labour use in rice cultivation, casual labour holds more than 60% of the total labour used for rice production. The proportion of attached labour is very negligible as mentioned above it is disappearing from the agricultural production. The rest of contribution is from the family labour. The recent trend especially for the last half-a-decade (i.e. between 2005 and 2010), indicate that the share of casual labour is increasing with a corresponding decline in the share of family labour.

Figure 5.2: Trends in Type of Human Labour used in Rice Cultivation in A. P.

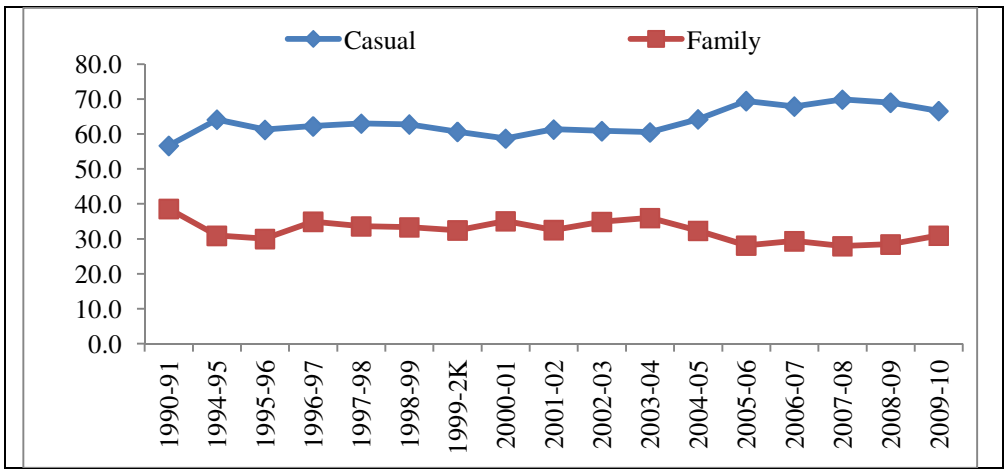


Note: Labour hours used per hectare of rice cultivation

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

Having said, if one examines the labour use per hectare of rice cultivation by size class of the holding, it is declining by size in Andhra Pradesh (Figure 5.4a). Whereas the share of casual labour in the total labour used in rice cultivation by size class of the holding indicates that it is increasing in the state (Figure 5.4b). However, still for about 70-75% of the total labour used in the rice cultivation of small and marginal farmers, they had to depend on casual labour. Family labour contribution for small and marginal farmers is around one-fourth of the total labour used (Figure 5.4b). For the large farmers their family labour use in rice cultivation is very low but they do use attached labour.

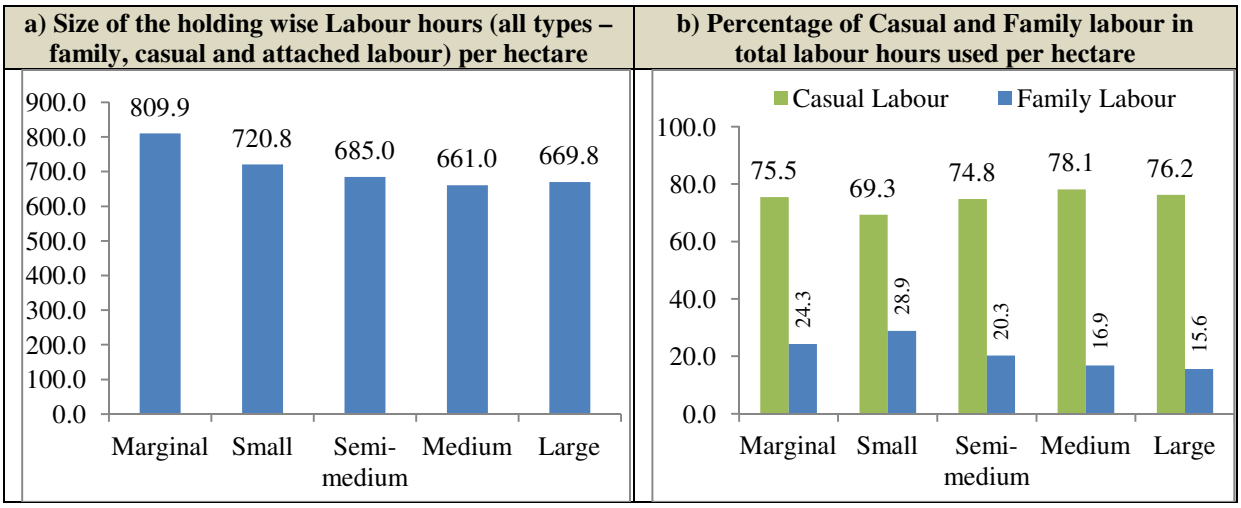
Figure 5.3: Percentage Share of Family and Casual Labour in the total Human Labour used in Rice Cultivation in Andhra Pradesh



Note: Labour hours used per hectare of rice cultivation.

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

Figure 5.4: Labour used per hectare in Rice Cultivation in Andhra Pradesh by Size Class of Holding, 2009-10



Note: 1. Labour hours per hectare.

Source: Estimated using Plot-wise raw data for Andhra Pradesh placed on Ministry of Agriculture Website.

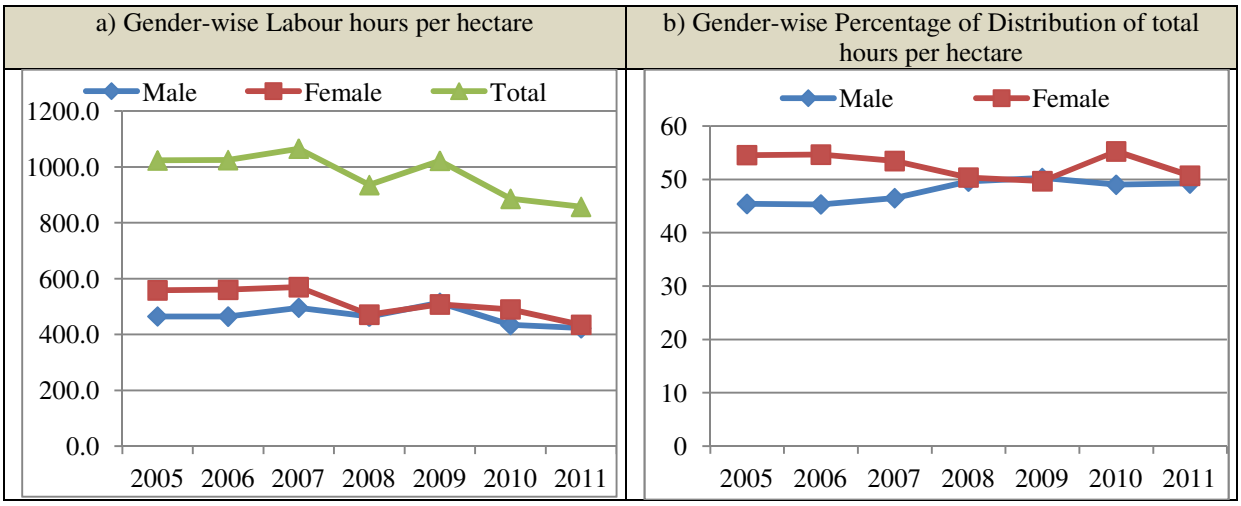
In the context of overall decline in labour used in rice cultivation, the above observed phenomenon is due to the decline in family labour is sharper than that of casual labour. The decline in family labour can be contextualized in the declining family size and increasing nuclear families, and to withdrawal of younger age family members from workforce in order to attend educational institutions.

Moreover, the high dependency of even small and marginal farmers on casual labour could be because of requirement in order to accomplish timely operations which may not be completed using family labour alone. Or it could be in order to relieve themselves to labour market operations to earn daily wages in the form of instant cash payments to bear the day to day household expenditure. Moreover, erstwhile convention of exchange labour especially in context of small and marginal farmers is monetized – paying daily wages has become mandatory. The convention of exchange labour is reduced to ensuring supply of fellow farmers' labour for accomplishing timely operations in farming (Reddy and Venkatanarayana, 2013).

By gender, female labour use is the most crucial part of the rice cultivation especially for the operation, transplanting, weeding and harvesting. The trend in gender-wise labour use in rice cultivation in Andhra Pradesh during the last half-a- decade or so period (between 2005 and 2011) indicate that both the male and female labour use is declining (Figure 5.5). However, the rate of decline is relatively faster with respect female labour than that of male counterpart.

As a result the share of male labour appears to be increasing in the total labour used per hectare of rice cultivation in the state (Figure 5.5b). Increasing mechanisation of female labour intense operations such as harvesting could be possible explanation for the declining share of female labour in rice cultivation.

Figure 5.5: Trend in gender-wise labour inputs used per hectare of Rice Cultivation in Andhra Pradesh

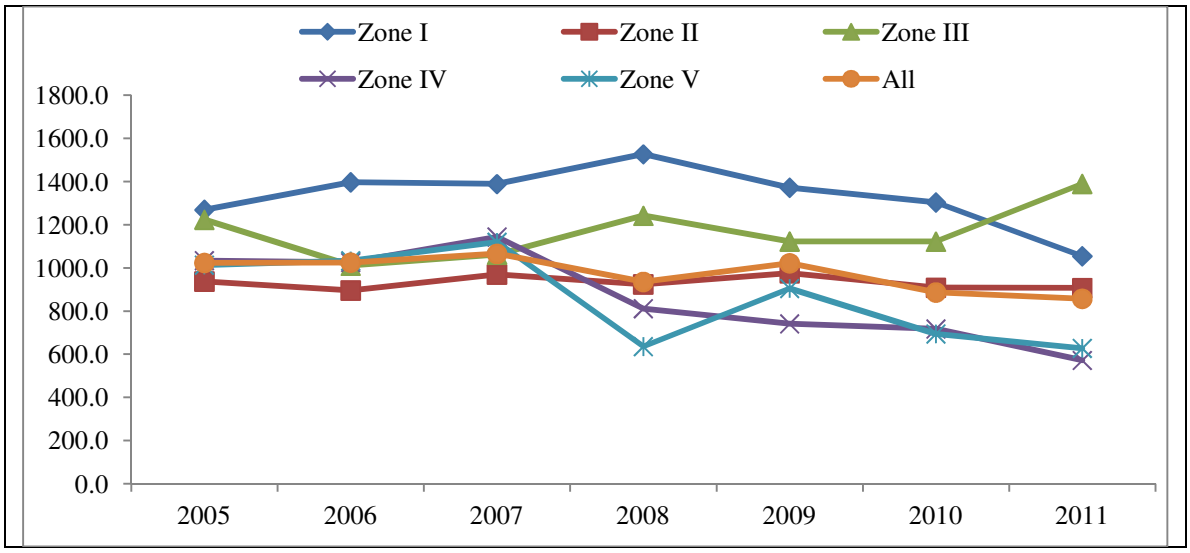


Note: 1. Labour hours per hectare.

Source: Computed using data obtained from State Agriculture University, Andhra Pradesh, Hyderabad.

Zone-wise analysis of labour use per hectare in rice cultivation in Andhra Pradesh shows that there exists a considerable variation in labour use for rice cultivation (Figure 5.6). It is relatively higher in Zone I followed by Zone III. The lowest is observed for Zone IV and V. The trend in labour use during last half-a-decade (between 2005 and 2011) indicates that it is increasing in Zone III and declining in Zone I, Zone IV and Zone V. But for the Zone II it is almost stable.

Figure 5.6: Zone-wise Labour use in Rice Cultivation in Andhra Pradesh



Note: **1**. Labour hours per hectare; **2**. A total of all operations in the production process.

3. The districts falling under each zone are: **Zone-1** (North coastal districts) viz., Srikakulam, Vizianagaram and Visakhapatnam; **Zone-2** (South coastal districts), viz., East Godavari, West Godavari, Krishna, Guntur, Prakasam and Nellore; **Zone-3** (Rayalaseema districts) viz., Chittoor, Kadapa, Kurnool and Ananthapur; **Zone-4** (Southern Telangana) covering Mahaboobnagar, Nalgonda, Rarnga Reddy and Khammam; and **Zone-5**, Northern Telanga which includes Medak, Warangal, Karimnagar, Nizamabad and Adilabad.

Source: Computed using data obtained from Agriculture University, Andhra Pradesh, Hyderabad.

The change in gender-wise labour used per hectare of rice cultivation across Zones in Andhra Pradesh shows that all the Zones have experienced decline in female labour used for rice cultivation. The rate of decline in female labour used for rice cultivation in the state is the highest in Zone IV followed by Zone I and Zone V (Table 5.2). The other two Zones experienced a marginal decline in female labour used. With respect to male labour units used in rice cultivation, there is an increase in this form of labour used in three Zones (I, II and II) and it declined in two other Zones (IV and V). However, due to the decline in male labour use for rice cultivation in these two Zones (IV and V) is predominant; the overall trend, at the state level, for the male labour inputs used in rice cultivation shows a decline. However, between the male and female labour inputs used for rice cultivation in the state, rate of decline for the female labour is faster than that of male labour (Table 5.2).

Table 5.2: Zone-wise Growth of Labour used in Rice Cultivation in Andhra Pradesh between 2005 and 2011

Zone	Male	Female	Both
Zone I	2.7	-5.8	-2.5
Zone II	0.2	-0.5	-0.4
Zone III	8.2	-0.5	3.1
Zone IV	-7.5	-8.6	-8.4
Zone V	-4.6	-3.5	-3.9
All	***-1.2***	***-3.7***	***-2.6***

Note: **1**. Growth rate is calculated for Labour hours per hectare; **2**. Growth is annual average during the period. **3**. See footnote 3 in above Figure 4.6 for Zone details.

Source: Computed using data obtained from Agriculture University, Andhra Pradesh, Hyderabad.

Labour Use in Rice Cultivation by Operation

Distribution of the total labour used in rice cultivation in the state by operation shows that at a glance the distribution appears to be either not changed or change is marginal for many of the operations especially during the last seven years i.e. between 2005 and 2011 (Table 5.3). If the distribution labour use in rice cultivation across operations remains constant in the context of declining total labour use in rice cultivation means that the decline is observed for all operations. But two operations that have shown a noticeable decline in their share during the period are harvesting and threshing/winnowing (Table 5.3).

Table 5.3: Distribution (%) of labour hours used in rice cultivation Andhra Pradesh by operation – Male and female combined

Sno	Operations	2005	2006	2007	2008	2009	2010	2011
1	Preparatory tillage	6.9	6.7	6.4	7.1	7.1	7.2	7.2
2	Sowing/planting	1.7	1.6	1.9	1.7	2.3	3.4	2.9
3	Transplanting	18.3	18.0	18.7	18.9	19.6	21.1	19.8
4	Plant protection	2.8	2.6	2.7	3.0	3.2	4.0	3.6
5	Manuring	4.6	4.2	4.0	4.1	3.9	3.3	4.4
6	Inter-culture	18.1	16.9	17.1	17.5	17.5	16.8	15.8
7	Irrigation	11.3	9.6	10.4	13.2	12.4	11.1	13.2
8	Harvesting	16.9	15.5	13.6	12.6	11.0	12.7	12.8
9	Threshing/winnowing	13.9	14.5	14.2	13.1	12.6	12.3	10.8
10	Transport on farm	4.1	3.8	4.2	5.0	3.8	4.8	4.2
11	Guarding	1.4	1.5	1.9	1.0	1.7	1.0	1.5
12	Others		5.0	4.8	2.7	4.9	2.4	3.7
Total		100	100	100	100	100	100	100

Source: Computed using data obtained from State Agriculture University, Andhra Pradesh, Hyderabad.

The growth of labour units used for rice cultivation by different operations in the rice production indicate that female labour units in most of the operations in rice cultivation experienced a decline between 2005 and 2011 (Table 5.4). Similarly for male labour the decline is observed for majority of operation. Interestingly, however, for transplanting operation while the male labour inputs per hectare have increased, the female labour inputs declined. A drastic decline in female labour units is observed for harvesting operation. Increasing mechanization of harvesting operation through the use combined harvester is having the impact on otherwise female labour used for the same operation.

Table 5.4: Growth of Labour in Rice Cultivation by Operation in Andhra Pradesh between 2005 and 2011

Sno	Operation	Male	Female	Both
1	Preparatory tillage	-1.6	-3.7	-2.3
2	Sowing/planting	4.2	15.9	9.1
3	Transplanting	5.7	-2.6	-1.5
4	Plant protection	2.6	2.8	1.9
5	Manuring	-0.3	-8.5	-2.7
6	Interculture/weeding	-1.9	-5.5	-5.1
7	Irrigation	2.7	-6.8	0.4
8	Harvesting	-0.6	-8.6	-7.2
9	Threshing/winnowing	-6.6	-6.2	-6.7
10	Transport on farm	1.3	-5.8	-1.3
11	Guarding	18.3	6.3	9.6
12	Others	9.1	2.4	5.3
Total		-0.2	-4.8	-2.9

Note: 1. Growth of Labour hours per hectare; 2. Growth is annual average during the period.

Source: Computed using data obtained from State Agriculture University, Andhra Pradesh, Hyderabad.

To sum up, above analysis indicates that there is a decline in the units of human labour used for rice cultivation in Andhra Pradesh. Of the three different forms of labour (family, casual and attached) used all three shows a declining trend. Attached labour used in rice cultivation becoming negligible. However, there is an increasing share of casual labour in the total units of labour inputs used in rice cultivation in the state with a corresponding decline in family labour share. Even for small and marginal farmers for about three-fourth of the labour inputs they had to depend on labour market for hiring casual labour.

By gender-wise labour inputs in rice cultivation, both male and female labour units used in rice cultivation is declining but it is faster for female labour and hence the share of male labour is increasing in the total labour units used in the rice cultivation. Zonal analysis

indicates that all the Zones have shown either declining or stable trend in labour use for rice cultivation. Moreover, decline in female labour units in rice is higher than that of male labour units across Zones.

The distribution of the total labour units used in rice cultivation in the state by operation appears to be not changed or marginal in change between 2005 and 2011. It means that change (increase/decline) in labour inputs used in rice cultivation across operations is in the same direction. However, two operations that have shown a noticeable decline in their share during the period are harvesting and threshing/winnowing. Female labour is the most affected as it has shown a significant decline, in all operations of rice cultivation in the state.

On the whole, the above analysis also gives an indication of declining usage of female labour inputs in agricultural operations particularly in rice which in turn is a dominant food grain grown in Andhra Pradesh and country as well. In fact, most of the female labourforce (80%) in the state as well as in the country as a whole is engaged agriculture. As it is observed from the above analysis most of those engaged in agriculture are involved in cultivation of foodgrains wherein rice is predominant food grain crop in the state as well as in the country. Therefore, the decline in female labour used in rice cultivation must be having a bearing on female labour engaged in agriculture. Along these lines, one may draw a kind of explanation for the declining female labour participation rates and there by declining size of female labour in Andhra Pradesh as well as in the country as a whole.

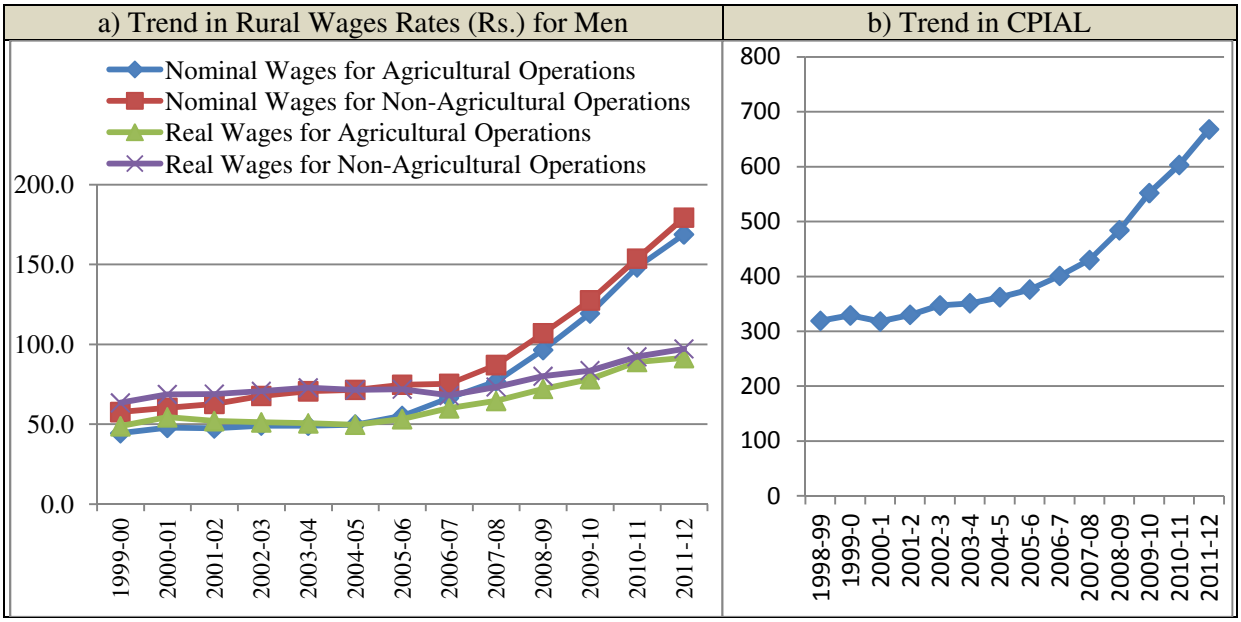
Moreover, the analysis of labour use in rice crop, wherein it is observed the decline in female labor and increase in male labour use, is also presenting a case against the hypothesis saying ***feminization of labour use in agriculture***; although it not sufficient at the moment to contest.

VI. Sharp Rise in Rural Wages and Cost of Labour in Rice Cultivation

In the all-India context, Andhra Pradesh appeared to be one of the lowest in terms of rural wages for a long time. The trend of low wages during 1960's to 1970s (Jose, 1981) continued during 1980s and 1990s. But there seems to be a dramatic change during the 2000s. The recent rural wage rate analysis indicates that Andhra Pradesh one of those states, which have shown a faster growth in rural wages (Jose, 2013).

The trend in rural average daily wage rates for men in Andhra Pradesh indicates a sharp rise during the last decade particularly between 2005 and 2010 (Figure 6.1a). But the sharp increase in wage rates for women engaged particularly in agriculture is not as sharp as that of men especially between 2005 and 2010. As a result there is increasing gap between and male and female wage rate during the period (Figure 6.2).

Figure 6.1: Trend in Rural Daily Wage Rates (Average) for Men and the CPIAL in AP



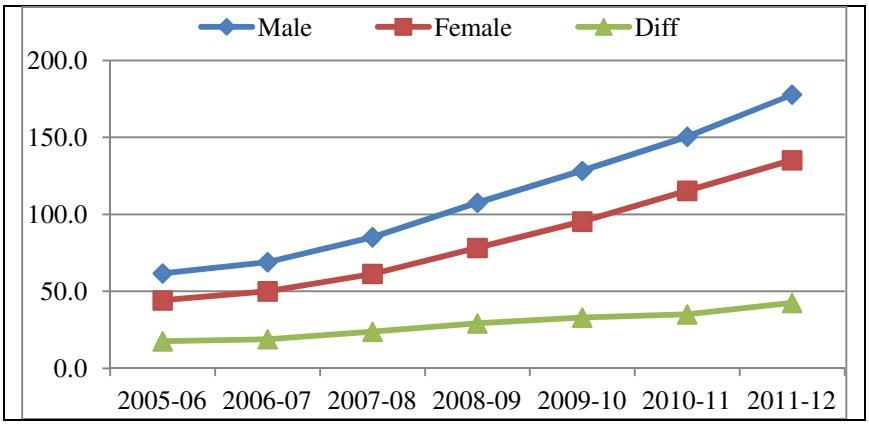
Note: 1. Daily Wage Rates; 2. CPIAL – Consumer Price Index for Agricultural Labourers; 3. Real Wages are in 2004-05 Prices.

Source: Computed using RBI data.

The sharp increase in nominal wages is being off-set by the similar steep rise in price index (6.1b). Due to unprecedented high inflation rate in the state as well as in the country as whole, the gains out of rise in wage rates accrued to wage earners might be lower than otherwise it would have been without such a high inflation. Still, even after discounting the high inflation the rise in wage rate especially for men is higher between 2005 and 2011 when compared the situation earlier. Andhra Pradesh is one of those state witnessed such a dramatic rise in wage rates during the period. Consequently, the state's relative position in all-India context has improved from one of the lowest in agricultural wage rate to the one of the highest. It must be noted that such a rise in wage rate coincide the implementation of Government of India's flagship programme, Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) in the state since 2005.

The increasing wage rates in agricultural operations in Andhra Pradesh as well as other parts of the country in turn increased the cost of cultivation in general and rice cultivation in particular. One can observe from the Figure 6.3a that there is a increasing trend in cost of human labour per hour but the trend is very sharp between 2004-5 and 2009-10 (Figure 5.3a). In the context of declining physical units of labour use in rice cultivation and the rising cost of labour unit, the share of labour in the total cost of rice cultivation in the state seems to be remained, almost, stable (Figure 6.3b).

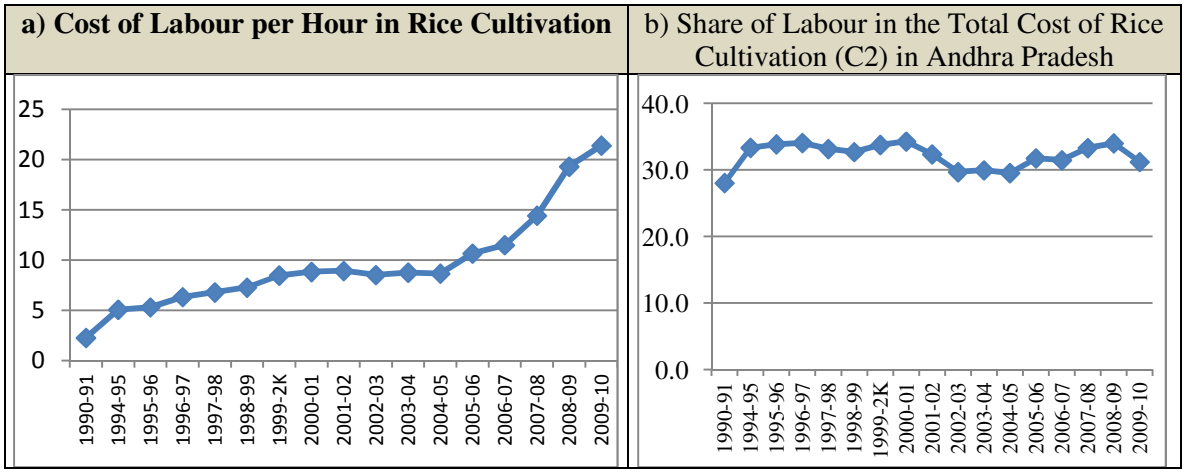
Figure 6.2: Male and Female Daily Average Wage Rates (Rs.) of Field Labour in Andhra Pradesh



Note: Nominal Wages – average per day.

Source: Labour Bureau.

Figure 6.3: Cost of Human Labour per Hour (Rs./Hr) in Rice Cultivation in Andhra Pradesh



Note: 1. Cost of labour – Rs. per hour.

Source: Ministry of Agriculture.

To sum up, Andhra Pradesh has witnessed a dramatic sharp rise in agricultural wages during last half-a-decade. However, despite the increase in wage rate is seen for both male and female labour, as the former is sharper than the latter. Thus, there is increasing gap between male and female wage rates. The sharpness in nominal wage rate is off-set to some extent by the equally sharp rise in commodity prices (price index – CPIAL). Due to rising inflation the gains of rural labour out of the sharp rise wages are marginal. Nevertheless, as the rise in agricultural wages is still sharper during later half of the 2000s than that of the past especially early 2000s. Such a rise in agricultural wages has increased the cost of labour in crop production in general and rice cultivation in particular. The rise in cost labour in rice cultivation might have implicated the drive towards mechanization.

Herein, it is to be noted that such a sharp rise in agricultural wage rate coincides with the implementation of MGNREGS in the state. Andhra Pradesh has, in fact, received accolades for its performance in implementation of the MGNREGS (for instance Reddy, 2012). In this context, there is a prevailing argument especially by the farmers, saying rise in agricultural wages and thereby the cost of cultivation is the impact of Scheme. It indicates that had it, the MGNREGS, not been implemented there would have not been such a rise in agricultural wages in the state.

To explore factors behind such a sharp rise in wages, it could be an indispensable outcome for a low base which can have higher chances for spurt or high growth than usual, if there is equally conducive environment. In this context, Andhra Pradesh having low base of agriculture wage rate for a long time, being one of the lowest in wage rate, the recent economic environment must conducive and facilitated such a rise in rural wages in general agricultural wages in particular. It could be implementation of MGNREGS that might have facilitated such an environment and/or it could recent performance of rural sector especially the agricultural growth. Also, the implementation process of MGNREGS facilitated awareness among the rural labour about minimum wage rates. Along with that it has facilitated a cushion for the rural labour to bargain for a higher wage rate and fall back on without performing agricultural operations, if denied the expected wage. However, it needs to be work out whether such a coincidence makes a sense of causal impact or it is a chance. There is a dearth of research studies in this respect.

The implications of rise in wage are also a matter of discussion. If one looks at the currently prevailing daily wage[7] for agricultural labourers especially for males in the state[8], at around Rs. 169/- during 2011-12, it is well above the Minimum Wage for agricultural operations fixed at Rs. 112/- (as on 1st April 2012) for Andhra Pradesh. On the other hand, if we go by the poverty measure, according to Planning Commission's estimates, poverty line for Andhra Pradesh in 2011-12 was around Rs.694/- for rural areas. It also means a minimum per capita expenditure per day required to stand above the poverty line in rural areas was Rs. 23/-. For the recent year, 2011-12, while taking in to account inflationary trend at 10% per annum, per capita expenditure per day to stand above the poverty line would be Rs. 28/-. If we consider a four-member family with a husband-wife and two children it would require at least Rs.112/- per day for a family of four member to live above poverty line for the year 2011-12.

Therefore, the prevailing wage rate for male agricultural labourers in Andhra Pradesh appears to be more than what it requires for a four member family of an agricultural labourer. The current wage rate, it can take care of six members of a family while standing above the poverty line. It indicates that current wage rate for an agricultural labour in the state after meeting minimum wage rate, it seems to be meeting even the norm of a 'living wage' or a 'family wage' which, if one defines it, is the wage of the main (male) bread-winner of a family must be able to meet the basic minimum consumption needs of the family members without looking for an additional earning hand from the family.

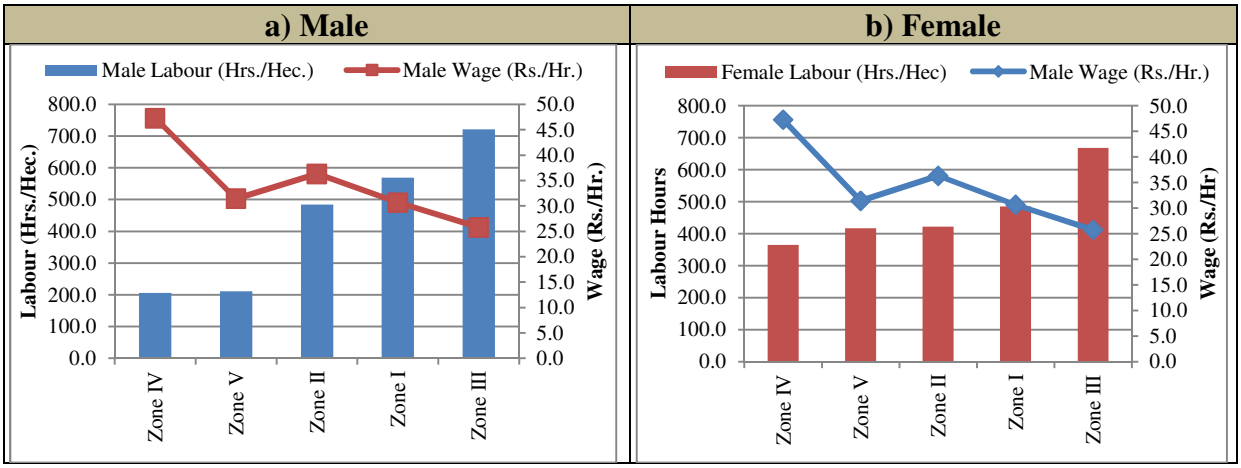
If it is the case as that is observed above, it is likely to preclude the participation of women and children whose participation is otherwise necessary. When a male bread-winner income is not sufficient to meet the basic consumption needs of the family, women's participation in labour force while carrying household duties, is invariably seen. It is considered as a double burden on women – working labour market and performing household chores. Once the male bread-winner's income is sufficient to meet such basic consumption needs of the family, women may have choice in participating in the labour force. It all depends on the intensity of her labour use in the household duties/chores including child care, and expected working conditions at the place of work. Given the choice, they may expect better working condition and not prefer a back-breaking labour, under the scorching sun, in agriculture.

[7] As Reported in Agricultural Wages in India (AWI) by Ministry of Agriculture, Government of India.
[8] Even the rural wage rate in Andhra Pradesh as reported by NSSO's employment and unemployment survey for the year 2011-12 is around Rs. 167.7/-.

Such a line of reasoning may explain the declining female labour use in agriculture in the state as well as in the country. But it may not necessarily stand on that line of reasoning alone. Because, from the producers point of view, advancement of mechanization process in order to not only to avoid the increasing cost of cultivation particularly cost of labour but also for accomplishment of timely operations which is indispensable in the context of intensive cultivation. It might have been pushing out the agricultural labour from agriculture[9]

In this respect, alternative explanation is that there is also a factor substitution in a production process, adverse to labour in response to rising wage rates (Shiela Bhall, 1991). The farmers' response to a rise in wages rates is to try to cut down labour costs by reducing labour inputs (ibid). In Andhra Pradesh, it is observed that rising cost of cultivation partly due to increased wage rates along with labour shortage in the context of MGNREGS, led to crop holiday particularly in rice cultivation (see, GoAP, 2011; Laxminarayana *et al.*, 2011). In this respect, when we examined the labour use per hectare and wage rate hour in rice cultivation across Zones in Andhra Pradesh, it confirms such a reasoning saying that the inverse relationship between labour inputs and wage rate (see Figure 6.4). Particularly the female labour inputs used per hectare are higher in Zones where male wage rate is higher and vice versa (see Figure 6.4b).

Figure 6.4: Labour Hours per Hectare and Wage Rate per Hours in Rice Cultivation across Zones of Andhra Pradesh, 2011



Note: 1. Labour hours are per hectare; Wage rate is per hour; 2. Zones are ordered based on the labour hours per hectare

Source: Computed using data obtained from State Agriculture University, Andhra Pradesh, Hyderabad.

[9] Our field experience wherein female labourers lamenting mechanization especially the harvesting operation in rice cultivation, support such a process (Reddy and Venkatanarayana, 2012).

Herein, one cannot carry any particular line of reason for declining female labour in agricultural operation. It needs further in-depth analysis which is not possible to be carried out in this paper itself.

VII. Mechanisation of Agriculture in Andhra Pradesh

Ever since the beginning of initiatives related to Intensive Area Cultivation and Green Revolution, the mechanization process in many of the agricultural operations in crop production, has commenced in many parts of the country. Despite the state of Andhra Pradesh was being early adopter and front runner in implementing the intensive cultivation and Green Revolution, it is not a leader in the mechanization process till 1990s. However there is increasing tendency towards mechanization of agricultural operations in the state.

There were only two tractors per 10,000 hectares of operated area in the state during the early 1960s and increased thereafter to 19; 55; and 85 by early 1980s, 1990s and 2000s (Table 6.1). However, Andhra Pradesh is still ranked at 10^{th} position among the 17 major Indian states with respect to availability of tractor per 10000 hectares of operated area, even in the early 2000s. As regards the power tiller the state position is even lower. Among Indian states, Punjab was having high density of tractors followed by Haryana, Uttar Pradesh, Gujarat and Rajasthan. Even the backward states like Rajasthan and Bihar are ahead and have shown a far high density of tractors than that of Andhra Pradesh.

On the other hand, the NSSO Survey on 'Cultivation Practices in India' in 1998 has shown that only half of the area under five major crops (AFMC) in Andhra Pradesh was tilled using Tractors. Of which 75% of area was tilled by hiring Tractors (Table 7.1). In this respect, percentage of area under five major crops cultivated/tilled by Tractor, Andhra Pradesh stands at 7^{th} position among 17 major states in India. Financial non-viability of owning a tractor especially in case of the small and marginal or even for the medium farmers, could be the reason why a majority of them had to depend on the hiring a tractor for cultivation.

Table 7.1: Relative Position of Andhra Pradesh in Mechanisation of Agriculture among Major Indian States

Major States		% of Tractor Tilled AFMC (1998)	% of Hired Tractors in Total Tractor Tilled AFMC (1998)	Number of Tractors per 10,000 Hectares of Operated Area)			
				1962	1982	1992	2003
1	**Andhra Pradesh**	**51 (7)**	**75 (7)**	**2**	**19**	**52**	**85**
2	Assam	11 (17)	64 (14)	3	1	3	5
3	Bihar	48 (8)	75 (7)	2	18	19	130
4	Gujarat	67 (5)	72 (13)	3	29	70	150
5	Haryana	94 (2)	57 (16)	7	170	444	549
6	Himachal Pradesh	15 (14)	93 (1)	0	16	45	130
7	Jammu & Kashmir	36 (10)	89 (3)	2	11	18	70
8	Karnataka	27 (12)	74 (11)	2	20	37	60
9	Kerala	15 (14)	73 (12)	2	6	9	10
10	Madhya Pradesh	36 (10)	63 (15)	1	13	24	130
11	Maharashtra	16 (13)	75 (7)	1	12	50	60
12	Orissa	12 (16)	75 (7)	1	2	4	28
13	Punjab	97 (1)	34 (17)	24	254	508	704
14	Rajasthan	89 (3)	79 (5)	3	35	90	184
15	Tamil Nadu	59 (6)	80 (4)	4	26	52	102
16	Uttar Pradesh	76 (4)	79 (5)	5	82	201	397
17	West Bengal	47 (9)	92 (2)	2	3	12	34
India		**54**	**72**	**3**	**37**	**86**	**167**

Note: 1 AFMC – Area under Five Major Crops; 2. Figures in parenthesis are ranks of the states.

Source: **1**. Singh (2009); **2**. Bhalla and Singh (2012); **3**. Cultivation Practice in India, NSS Report No. 451, 54th Round (Jan-June, 1998)

However, the growth in tractor population in the state during the last one decade indicates a surge in Tractors availability for agriculture and crop production in the state, there is five times increase in tractor population (Table 7.2). Similarly there is a quantum jump in the Harvester population in the state between 1992 and 2003. Although the latest figure for harvesters is not yet available but one can assume its growing number. Combined harvesters which are used for harvesting, threshing, winnowing, and even for packing at times have become most sought after in the state as well in the country. It is a common practice wherein, in peak harvesting season in the state, the machines in different sizes are hired from far-off places such as Karnataka, Tamil Nadu and from the neighboring regions with in the state.

There is also increasing tendency to use transplanters and weeders to perform transplanting and weeding. Moreover, the emerging system of rice intensification (often referred as SRI) increasing adoption of it in the state means, in principle, is reducing the labour inputs particularly in transplanting and weeding operations. Andhra Pradesh is considered as early

adopters of System of Rice Intensification and continued to spread such a system of rice cultivation (see Reddy and Venkatanarayana, 2013).

Table 7.2: Tractor and Harvester Population in Andhra Pradesh

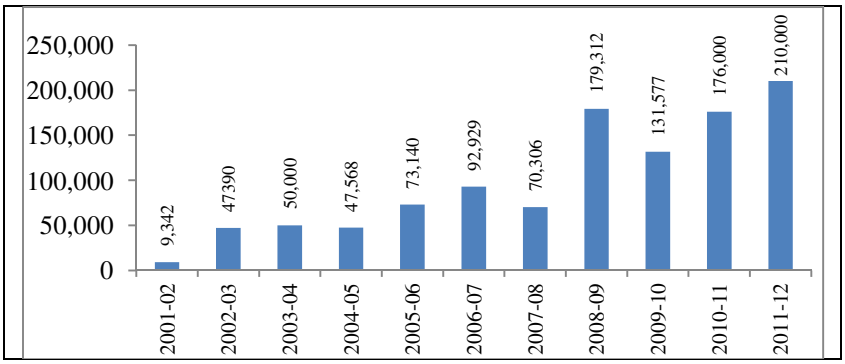
Tractors (Nos.)			Harvesters (Nos.)			
Year	Numbers		Year	Tractor-operated	Self-operated	Total
2003	102795		1992	1900	300	2200
2007	184441		2003	6000	22900	28900
2011	292427		2010	-	-	-

Note: 1. Number of Tractors and Harvesters; 2. Tractors considered here are those of non-transport purposes means agricultural use; 3. '-' Not available.

Source: 1. For Tractors – Statistical Abstract of Andhra Pradesh; 2. For Harvesters – Sukhpal Singh (2009).

Further, the Government of Andhra Pradesh has also been taken initiatives for the farm mechanization. Under these initiatives, farm equipment like land preparatory, sowing equipment, plant protection equipment, self-propelled machinery, power tillers, tractors, inter cultivation equipment etc, which are used in farming operations and post-harvest equipment are being supplied under subsidy. The number of beneficiaries under the farm mechanization initiative of the State Government, have been increasing (see Figure 6.1). Particularly, during 2011-12, the government of Andhra Pradesh has distributed 75 combined harvesters to Rythu Mitra Groups in the state under the farm mechanization programme associated with the Rashtriya Krishi Vikas Yojana (RKVY) scheme (GoAP).

Figure 7.1: Trend in Number of Beneficiaries under Farm Mechanisation Scheme in Andhra Pradesh



Note: Beneficiary Farmers.

Source: Socio-Economic Survey 2012-13: Andhra Pradesh, Planning Department, Government of Andhra Pradesh, Hyderabad.

In summary, Andhra Pradesh despite being front runner in implementing the intensive cultivation and Green Revolution, it is not a leader in the mechanization process till 1990s. However there is increasing tendency towards mechanization of agricultural operations in the state. There is still a large scope for mechanization of agricultural in general and rice cultivation in particular, in the state. The Government of Andhra Pradesh has also been taken initiatives for the farm mechanization. Under these initiatives, farm equipments are being supplied under subsidy. Further mechanization of agricultural operations would further reduce the labour units otherwise required to accomplish the crop production operations.

Undoubtedly increasing mechanization is helpful for precision farming and accomplishing timely operations. Thus, it increases the productivity and considered to be reducing the cost of cultivation. But its labour displacing impact is a cause of concern. However, for the emerging line of reasoning mechanization is a means to avoid labour shortage for timely operations and increasing labour component of cultivation costs. If the labour shortage in agriculture is due to increasing employment opportunities elsewhere especially in non-agriculture, it is a desirable phenomenon. Theoretically speaking, in the development process, the labourforce shift away from agriculture to non-agriculture is desirable and necessary but not to remain unemployed or not to away from labourforce itself.

VIII. Concluding Remarks

The above analysis has shown declining units of human labour input used in rice cultivation in Andhra Pradesh. All three forms of labour (family, casual and attached) have followed the same trend. Particularly, attached labour used in rice cultivation becoming negligible. But the share of casual labour in the total units of labour used in rice cultivation in the state is increasing with a corresponding decline in the share of family labour. Even the small and marginal farmers, for about three-fourth of the labour inputs, they had to depend on labour market while hiring casual labour. By gender, although both male and female labour units used in rice cultivation is declining, it is faster for female labour and hence the share of male labour is increasing. Zonal analysis indicates that all the Zones have shown similar declining trend for labour use in rice cultivation. Similar to the overall trend, the decline in female labour is higher than that of male labour across Zones. By operations, the distribution of the total labour units used in rice cultivation by operations appears to be not changed in the recent past for many of the operations, indicating change (decline) in labour inputs used in all

operations is in same direction. There is, however a noticeable decline in the share of harvesting and threshing/winnowing.

With respect to agricultural wage rate, there is a dramatic rise in the state during last decade. The sharp increase in rural wage in nominal terms is off-set by the equally sharp rise in commodity prices. Due to rising inflation the gains of rural labour out of the sharp rise wages are marginal. There is also an increasing gap between male and female wage rates. However, the rise in rural wage rates has increased the cost of labour in crop production in general and rice cultivation in particular. There observed to be a kind of inverse relationship between male wage rates and female inputs in rice cultivation. To confirm this relationship it needs further in-depth analysis which we could not carry out in this paper.

As regards the extent of mechanization, Andhra Pradesh despite being early adopter and front runner in implementing the intensive cultivation and Green Revolution, it is not a leader in the mechanization process till 1990s. However, there is increasing tendency towards mechanization of agricultural operations in the state. As there is a large scope for mechanization in the state, increasing mechanization of agricultural operation would further reduce the labour units otherwise required to accomplish the crop production operations.

Female labour is the most affected as it has shown a significant decline in all operations of rice cultivation in the state. The declining usage of female labour inputs in agricultural operations entice a kind of explanation for the declining female labour participation rates and there by declining size of female labour, in general, in Andhra Pradesh as well as in the country as a whole. Also the evidence is presenting a case against the hypothesis that there is a feminization of labour use in agriculture in India.

For the decline of female labour use in agriculture in general rice cultivation in particular, there are two lines of reasoning. One is the increasing in male wages to the extent it covers 'living' or 'family' wage might be having bearing on the participation of female in labourforce for whom it is otherwise necessary in distress conditions. The other one is mechanization process itself might be pushing the agricultural labourer especially the females out of labour force. It needs further in-depth analysis which is carried out in this paper.

* * *

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