Supply-Demand Gap Analysis of Agricultural Labour in Northern and Southern Dry Zone of Karnataka, India

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Abstract:

The study examined the labour supply-demand gap and farm mechanization as a coping mechanism to labour shortage in Northern and Southern Dry Zone of Karnataka, India. Based on the extent of net irrigated area under canal which is a proxy for greater degree of mechanization, Sindhanur taluk of Raichur district and Mandya taluk of Mandya district were selected for the study. The results revealed that the labour requirement was more in case of partially mechanized farm compared to that of mechanized farms. The mechanization of agricultural operations has saved labour use to a certain proportion compared to partially mechanized farm, which was around 20 per cent in paddy, 13-15 per cent in ragi, jowar and bengalgram. The labour demand exceeded labour supply during the months of July and December in Sindhanur taluk while it was during December and October in Mandya taluk highlighting the seriousness of labour scarcity. The results also indicated that the mechanization helps to cope-up with labour shortages particularly during the peak seasons.

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Keywords: Coping, Labour requirement, Labour supply,Mechanized farms, Supply-demand gap

Introduction

Agricultural labour is defined as any person who worked on another person's land only as labourer, without exercising any supervision in cultivation, for wage in cash or share such as share of produce (GoI, 2001). In India, the portion of agricultural workers to the total workers has been declining over the years, while the corresponding ratio in the secondary and tertiary sectors is on the rise (Prabakar *et al.* 2011). A comparison of agricultural labourer census between the period 2004-05 and 2011-12 showed that, there was an increase in the size of total workforce in the country. On the contrary, agricultural work force has decreased by 30.57 million people and that of their share in the total workforce declined from 57 per cent in 2004-05 to 49 per cent in 2011-12. This draws the conclusion that only fewer people are being added to the workforce in agriculture and highlights the net migration to other sectors.

Structural transformation of Indian agriculture has resulted in changes in the employment scenario of the agricultural labour. One of the serious problems concerning labour employment is

its seasonality which has caused under-utilization of available labour in some seasons and over-utilization in other periods (Hazarika, 2015). Among different factors of production, labourer is a vital one, but they are migrating to different parts in general and urban areas in particular for better livelihood, adding to the existing imbalance between labour demand and supply of labourers (Deshingkar and Start, 2003).

There are different kinds of implications associated with agricultural labour scarcity such as delay in crop establishment, no or untimely weeding, irrational use of fertilizers, insufficient irrigation to crops, poor crop growth etc. Given these implications, if the agricultural labour scarcity is not addressed at the right time may force the farmers to not take up crop and move to non-agricultural avenue for their livelihood (Baba *et al.* 2011). The research conducted by the Amusa and Adekanye (2000) found 88 per cent of the total labour-use on farms was hired labour thus indicating the significance of labour in agricultural activities. Scanty labour supply and rising wage rate have pronounced effect on the farm sector (Chand and Srivastava, 2014) and intern which are limiting or hindering the boosting of agricultural production (Devi, 2012). In response to rising wage rates, there is increased farm mechanization and shift in the cropping pattern from labour intensive to labour saving crops (Reddy *et al.* 2014).

The problem of labour shortage put the farmers to increased use of machine power in operations like field preparation, harvesting, winnowing and transportation. Use of efficient machines in agricultural mechanization improves the utilization efficiency of inputs like fertilizers and agro-chemicals and reduces negative impact on environment (Anonymous, 2016).

In the labour surplus country like India, impact of farm mechanization on labour employment has been a matter of concern and debate. There is a strong evidence to indicate that the technological parameters such as cultivated area, cropping intensity, higher use of inputs, etc. increased numbers/ quantities of labour while mechanization and use of herbicides significantly reduced employment opportunities in these parameters. The interplay of these factors resulted in net decline in the human labour requirements (Singh and Singh, 2006). As compared to the traditional farm, in mechanized farm, less number of labours per hectare is required to complete the production process. The major effect of mechanical power adoption is the significant reduction in the labour input requirements of mechanized farm for ploughing and threshing.

Family labour is mostly affected by the use of power tiller and thresher as these operations requires skilled labour (Rahman e*t al.* 2011).

Labour shortage has affected farmers, as it is difficult to find labours for timely agricultural operations such as weeding, harvesting and so on. To overcome such labour shortage, farmers are moving towards farm mechanization. Farm mechanization has been useful to bring about a significant improvement in agricultural productivity. Thus there is a strong need for mechanization of agricultural operations. In this study, an attempt is made to closely examine the labour supply-demand gap and farm mechanization as a coping mechanism to labour shortage.

Methodology

In this study, multistage random sampling technique was adopted for the selection of study area and sample respondents. The command area, Raichur (Northern Dry Zone) and Mandya districts (Southern Dry zone) of Karnataka were purposively selected as these districts have the largest area under irrigation and these are the major rice growing districts in Karnataka. In the first stage, Sindhanur taluk of Raichur district and Mandya taluk of Mandya district were selected based on the extent of net irrigated area under canal which is a proxy for greater degree of mechanization. In the next stage, 120 respondents each from the taluk were selected randomly.

The primary and secondary tillage operations in the study area were carried out by machineries for obtaining soil conditions ideal for seed germination, seedling establishment and growth of crops, irrespective of farmers. But the operations like sowing, harvesting and threshing were carried out manually as well mechanically. Hence, the sample respondents were post-stratified into different groups (Partially mechanized and mechanized) based on the degree of farm mechanization and the following crop wise distinctions were drawn.

Partially mechanized farms

a) Paddy: Harvesting of paddy crop through traditional method using human labours and threshing by threshers.

b) Ragi: Threshing operation was carried out by traditional method using human labour.

c) Bengalgram and Jowar: Sowing was done by traditional method using bullock pairs.

Mechanized farms

a) Paddy: Harvesting of paddy crop using combine harvester

b) Ragi: Threshing operation was carried out by using threshers.

c) Bengalgram and Jowar: Sowing was done by tractors using seed cum fertilizer drill.

Supply – Demand gap analysis

The crop-wise, operation-wise and month-wise labour requirement was worked out from the primary data collected from the study area and the corresponding values were multiplied with the total area under each crop in the study area to get the month-wise labour requirement per year. The month-wise supply of labour was assessed by considering the available agricultural labour force in the district (secondary data). An assumption was made that the available agriculture labour force was employed on an average for 20 mandays in a month (Prabakar *et al.,* 2011 and Gayathri *et al.,* 2015).

Results and Discussion

Human labour requirement for the major crops in Northern and Southern Dry zone of Karnataka

a) Northern Dry Zone (Sindhanur taluk) of Karnataka

The total human labour requirement for the major crops in Sindhanur taluk is presented in Table 1. The labour requirement for partially mechanized and mechanized crops was calculated separately. Among the major crops cultivated in the study area, the mandays per hectare per crop season were highest for partially mechanized cotton (89 mandays/ha). Paddy occupies next position with 83 and 65 mandays per hectare per season (*Kharif* and *Summer*) in partially mechanized and mechanized farms, respectively. Similarly, Gayathri (2013) reported that the paddy occupied the highest position among cereals in terms of labour required. The labour requirement for jowar and bengalgram was 28 and 32 mandays per hectare for partially mechanized farms. Whereas, these crops required 24 and 29 mandays per hectare per season for mechanized farms.

The saving of labour requirement between partially mechanized and mechanized crops showed that the mechanized cultivation of paddy saved 21.69 per cent of labour per hectare in both *kharif* and *summer* season. Whereas, due to mechanization, around 14 per cent of labour in jowar and 15 per cent of labour in bengalgram per hectare per season was saved. The results visibly indicate that the mechanization helps to cope-up with labour shortages. Mechanization of major operations in the crops was more labour saving and cost effective than traditional practices (Guyslain *et al.*, 2011).

Table 1: Human labour requirement for the major crops in Northern Dry Zone (Sindhanur taluk) of Karnataka

Sl. No.	Crops	Season	Duration	Partially Mechanized	Mechanized	Per cent of saving (mandays/ ha)
				Human labour requirement per crop season (mandays/ha)	Human labour requirement per crop season (mandays/ha)	
1	Paddy	*Kharif*	5-6 months	83	65	21.69
2	Paddy	*Summer*	3-4 months	83	65	21.69
3	Jowar	*Rabi*	3-4 months	28	24	14.29
4	Bengalgram	*Rabi*	3 months	34	29	14.71
5	Cotton	*Kharif*	5-6 months	89	-	-

b) Southern Dry Zone (Mandya taluk) of Karnataka

The sugarcane cultivation was partially mechanized and the labour required per hectare per crop season was 193 mandays. Partially mechanized cultivation of paddy required 79 mandays per hectare per season. While, the mechanized cultivation required 63 mandays per hectare per season, which was lower than that of partially mechanized cultivation. The other major crop of the study area is ragi, which required 58 manday and 50 mandays per hectare per season in the case of partially mechanized and mechanized cultivation, respectively (Table 2). Baba *et al.* 2011 reported that mechanization of farming operations could save time and labour and also farmers could complete farming operations in time.

The mechanization of agricultural operations has saved labour use to a certain proportion, which is clearly evident from Table 2 that the mechanized cultivation of paddy has saved 20.25 per cent of labour per hectare during *kharif* as well as *summer* season compared to that of partially mechanized cultivation. Whereas, the mechanized cultivation of ragi has saved 13.79 per cent of labour per hectare per season. Less number of labours per hectare is required to complete the production process by mechanized farm compared to traditional farm (Rahman *et al.* 2011).

Table 2: Human labour requirement for the major crops in Southern Dry Zone (Mandya taluk)

Sl. No	Crops	Season	Duration	Partially Mechanized	Mechanized	Per cent of saving (mandays/ ha)
				Human labour requirement per crop season (mandays/ha)	Human labour Requirement per crop season (mandays/ha)	
1	Paddy	*Kharif*	4 months	79	63	20.25
2	Paddy	*Summer*	3-4 months	79	63	20.25
3	Ragi	*Kharif*	4 months	58	50	13.79
4	Sugarcane	*Kharif*	10 months	193	-	-

Agricultural labour supply-demand for major crops in Northern and Southern Dry zone of Karnataka

a) Northern Dry Zone (Sindhanur taluk) of Karnataka

It is evident from the Table 3 that for partially mechanized crops, the highest demand for labour was in the months of December (17.46 %) and July (13.87 %) followed by April (9.64 %), May (9.64 %), August (9.24 %), September (8.29 %), November (8.08 %), October (7.91 %), February (7.71 %), January (6.29 %) and least in the months of June (4.79 %) and March (3.08 %). The supply of agricultural labourers per year was worked out by assuming that the available agricultural labour force was employed on an average for 20 mandays in a month (Prabakar *et al*., 2011 and Gayathri *et al.,* 2015). The supply of agricultural labour was estimated at 10,13,240 mandays per month by considering the total agricultural labour force in the district

as 50,662 (District statistical office data, Raichur, 2015-16, as per 2011 census). The results of supply demand gap of agriculture labour revealed that the labour demand exceeded labour supply during the months of July and December, indicating the magnitude of labour scarcity prevailing in the study area during these months. The demand for labour exceeded labour supply only during the month of July, in case of mechanized crops (Table 4).

The highest labour requirement for paddy (*kharif*) was in the month of December (30.12 %) and July (24.10 %), where the harvesting, threshing and sowing operations were carried out. The least labour requirement was noted in the month of June (6.02 %), when the land preparation operations were carried out. Whereas the labour requirement for *summer* paddy was highest in the month April (30.12 %) as it coincided with weeding, fertilizer application and chemical spraying and also in the month May (30.12 %) for harvesting and threshing (Table 3). If the harvesting is completely mechanized, then the labour requirement in the month of December for *kharif* paddy and in the month of May for *summer* paddy required only 12.31 per cent of the total labour requirement (Table 4).

Jowar (*rabi*) required maximum labourers in the month of January (42.86 %) for harvesting and threshing followed by November (28.57 %) for chemical spraying, fertilizer application and irrigation. Similarly, for bengalgram the labour required was highest in November (38.24) for land preparation, sowing and fertilizer application followed by January (35.29 %) month for harvesting and threshing operations (Table 3). The mechanization of sowing of jowar and bengalgram by tractor using seed drill had reduced the meager proportion of labour required in the study area compared to partially mechanization.

Cotton was the major commercial crop grown in the study area and it requires 89 mandays per hectare per season. The crop was partially mechanized and the labour requirement was highest during the month of August (24.72 %), where the operation like weeding and earthing-up was carried out. The sowing operation required 19.10 per cent of the total labour requirement during the month of July. Whereas, the crop required around 10 to 14 per cent of the total labour during the months of June, September, December and January (Table 3). The human labour requirement was higher for cotton crop and the hired labour accounted for 9 to 11 percent of the total labour requirements (Khan *et al.* 2009).

Table 3: Month-wise agricultural labour supply-demand for major crops in Sindhanur taluk (Partially mechanized)

Crop	Area(ha)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
Paddy (*Kharif*)	42412						212060 (06.02)	848240 (24.10)	424120 (12.05)	508944 (14.46)	127236 (03.61)	339296 (09.64)	1060300 (30.12)	3520196
Paddy (*Summer*)	29798	148990 (06.02)	595960 (24.10)	238384 (09.64)	744950 (30.12)	744950 (30.12)								2473234
Jowar (*Rabi*)	3350	40200 (42.86)									20100 (21.43)	26800 (28.57)	6700 (07.14)	93800
Bengalgram (*Rabi*)	13800	165600 (35.29)										179400 (38.24)	124200 (26.47)	469200
Cotton	13173	131730 (11.24)					158076 (13.48)	223941 (19.10)	289806 (24.72)	131730 (11.24)		79038 (06.74)	158076 (13.48)	1172397
Demand (D)		486520 (06.29)	595960 (07.71)	238384 (03.08)	744950 (09.64)	744950 (09.64)	370136 (04.79)	1072181 (13.87)	713926 (09.24)	640674 (08.29)	147336 (07.91)	624534 (08.08)	1349276 (17.46)	7728827
Supply (S)	50662*×20**=1013240													
S-D Gap		526720	417280	774856	268290	268290	643104	-58941	299314	372566	865904	388706	-336036	

Note: Figures in parentheses indicate percentage values to total

*Total agricultural labour population in the district (as per 2011census) [Assumed to remain constant throughout the year]

** Number of mandays employed per month taken as 20 (Prabhakar *et al*., 2011 and Gayathri *et al.,* 2015)

Table 4: Month-wise agricultural labour supply-demand for major crops in Sindhanur taluk (Mechanized)

Crop	Area(ha)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
Paddy (*Kharif*)	42412						212060 (07.69)	848240 (30.77)	424120 (15.38)	466532 (16.92)	127236 (04.62)	339296 (12.31)	339296 (12.31)	2756780
Paddy (*summer*)	29798	148990 (07.69)	595960 (30.77)	238384 (12.31)	715152 (36.92)	238384 (12.31)								1936870
Jowar (*Rabi*)	3350	40200 (50.00)									13400 (16.67)	20100 (25.00)	6700 (08.33)	80400
Bengalgram (*Rabi*)	13800	165600 (41.38)										138000 (34.48)	96600 (24.14)	400200
Cotton[@]	13173	131730 (11.24)					158076 (13.48)	223941 (19.10)	289806 (24.72)	131730 (11.24)		79038 (6.74)	158076 (13.48)	1172397
Demand (D)		486520 (07.67)	595960 (09.39)	238384 (03.76)	715152 (11.27)	238384 (03.76)	370136 (05.83)	1072181 (16.89)	713926 (11.25)	598262 (09.43)	140636 (02.22)	576434 (09.08)	600672 (09.46)	6346647
Supply (S)	50662*×20**=1013240													
S-D Gap		526720	417280	774856	298088	774856	643104	-58941	299314	414978	872604	436806	412568	

Note: Figures in parentheses indicate percentage values to total

*Total agricultural labour population in the district (as per 2011census) [Assumed to remain constant throughout the year]

** Number of mandays employed per month taken as 20 (Prabhakar *et al*., 2011 and Gayathri *et al.*, 2015)

@ Labour considered under partially mechanization

b) Southern Dry Zone (Mandya taluk) of Karnataka

Month-wise agricultural labour supply-demand for major crops in Mandya taluk is presented in Table 5. The major crops occupied around 75 per cent of the total cropped area. Considering the total agricultural labour force in the taluk as 26,443 (District Statistical office data, Mandya, 2015-16, as per 2011 census), the supply of labour came to 5,28,860 mandays per month. The analysis revealed that the highest demand for labour, of the total year-wise demand, was in the months of December (16.25 %) and October (15.33 %) followed by the months of July (13.63 %), August (10.67 %), September (10.07 %), April (09.31 %) , May (07.29 %), June (05.63 %), March (05.18 %), November (03.92 %), February (01.98 %), and least was in the month of January (00.72 %) . It was observed that the demand for farm labourers was more than the supply in the months of December and October, revealing the depth of the labour scarcity.

The highest labour required was in the month of October for *kharif* paddy and in the month of May for *summer* paddy to the tune of 31.65 per cent, when the harvesting and threshing operations were carried out. If the harvesting is completely mechanized, then the labour required for harvesting and threshing was only 15.87 per cent of the total labour requirement (Table 6). Mechanical harvester ensured rapid harvesting and assisted farmers in overcoming labour shortages during peak harvesting period (Basavarajappa *et al.* 2013). The least labour required was in the month of June (10.13 %) for *kharif* paddy cultivation, when the land preparation operations were carried out. Similarly for *summer* paddy the least labour required was in the month of January (10.13 %).

Ragi was pre-dominantly grown in the Mandya district. The labour required for ragi cultivation was highest in the month of October (44.83 %), when the harvesting, threshing and cleaning operations were carried out. Manual harvesting and threshing process required more human power which involves inflexibility to the production (Jacob *et al.* 2012). The farmer has saved around eight per cent of labour by going for mechanized threshing (Table 6).

Table 5: Month-wise agricultural labour supply-demand for major crops in Mandya taluk (Partially mechanized)

Crop	Area (ha)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
Paddy (*Kharif*)	12536						100288 (10.13)	275792 (27.85)	175504 (17.72)	125360 (12.66)	313400 (31.65)			990344
Paddy (*Summer*)	3133	25064 (10.13)	68926 (27.85)	43862 (17.72)	31330 (12.66)	78325 (31.65)								247507
Ragi	6232						37392 (10.34)	62320 (17.24)	49856 (13.79)	49856 (13.79)	162032 (44.83)			361456
Sugarcane	9760			136640 (07.25)	292800 (15.54)	175680 (09.33)	58560 (03.11)	136640 (07.25)	146400 (07.77)	175680 (09.33)	58560 (03.11)	136640 (07.25)	566080 (30.05)	1883680
Demand (D)		25064 (00.72)	68926 (01.98)	180502 (05.18)	324130 (09.31)	254005 (07.29)	196240 (05.63)	474752 (13.63)	371760 (10.67)	350896 (10.07)	533992 (15.33)	136640 (03.92)	566080 (16.25)	3482987
Supply (S)	26443*×20**=528860													
S-D Gap		503796	459934	348358	204730	274855	332620	54108	157100	177964	-5132	392220	-37220	

Note: Figures in parentheses indicate percentage value to total

*Total agricultural labour population in the district (as per 2011census) [Assumed to remain constant throughout the year]

** Number of mandays employed per month taken as 20 (Prabhakar *et al*., 2011 and Gayathri *et al.*, 2015)

Table 6: Month-wise agricultural labour supply-demand for major crops in Mandya taluk (Mechanized)

Crop	Area (ha)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
Paddy (*Kharif*)	12536						100288 (12.70)	275792 (34.92)	175504 (22.22)	112824 (14.29)	125360 (15.87)			789768
Paddy (*Summer*)	3133	25064 (12.70)	68926 (34.92)	43862 (22.22)	28197 (14.29)	31330 (15.87)								197379
Ragi	6232						37392 (12.00)	62320 (20.00)	49856 (16.00)	49856 (16.00)	112176 (36.00)			311600
Sugarcane[@]	9760			136640 (07.25)	292800 (15.54)	175680 (09.33)	58560 (03.11)	136640 (07.25)	146400 (07.77)	175680 (09.33)	58560 (03.11)	136640 (07.25)	566080 (30.05)	1883680
Demand (D)		25064 (00.79)	68926 (02.17)	180502 (05.67)	320997 (10.09)	207010 (06.50)	196240 (06.17)	474752 (14.92)	371760 (11.68)	338360 (10.63)	296096 (09.30)	136640 (04.29)	566080 (17.79)	3182427
Supply (S)	26443*20=528860													
S-D Gap		503796	459934	348358	207863	321850	332620	54108	157100	190500	232764	392220	-37220	

Note: Figures in parentheses indicate percentage value to total

*Total agricultural labour population in the district (as per 2011census) [Assumed to remain constant throughout the year]

** Number of mandays employed per month taken as 20 (Prabhakar *et al*., 2011 and Gayathri *et al.,* 2015)

@ Labour considered under partially mechanization

Sugarcane which is a long duration crop and this crop was partially mechanized in the study area. The labour requirement was highest during the month of December (30.05 %) when the harvesting operation was usually carried out. Cultural operations for sugarcane production are very arduous especially planting, intercultural, plant protection and harvesting (Yadav *et al.* 2003). The least labour requirement was in the month of June and October. The crop normally required around seven to ten per cent of the total labour requirement during the months of March, April, May, July, August, September and November.

Conclusion

Though India is known to be a labour surplus country but still problem of labour shortage is prevailing at field level. Several studies have proven the existence of labour scarcity in agriculture in India (Prabakar *et al.* 2011; Baba *et al.* 2011 and Gayathri *et al.* 2015). However, in the study areas the results of supply demand analysis of agricultural labour portrayed the labour shortage during the months of July and December in Sindhanur taluk and during October and December in Mandya taluk. The results also indicated that the mechanization helps to cope-up with labour shortages. Non-timely operation of activities in the farm led by labour scarcity during important stages of the crop resulting in inefficiency at field level as expressed by most of the farmers. Therefore, Farm mechanization must be encouraged, particularly during the peak seasons to ward off labour supply demand gap. Further extending custom hiring services would help in addressing labour problem in the study areas.

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