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Rapporteur's Report on Labour Scarcity in Agriculture and Farm Mechanisation

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I

INTRODUCTION

The term mechanisation needs to be viewed for its broader purpose, namely, enhancing safe and sustainable productivity of land and labour. Actually, an agricultural mechanisation strategy should be part of an agricultural technology strategy which in turn should be a part of an overall agricultural development strategy. The introduction of machinery to substitute for labour (labour saving) is a common phenomenon associated with the release of labour for employment in other sectors of the economy or to facilitate cultivation of a larger area with the same labour force. The purpose of mechanisation is also to produce more from the existing land, using machinery as a complementary input, required to achieve higher land productivity, for example, through the introduction of pump sets, or faster turn-around-times to achieve higher cropping intensity. Besides, use of a machine may lower production costs or offset increased costs of draft animals or labour. For sustainable/conservation agriculture, solutions to environmental problems/resource conserving techniques in agriculture require (improved) agricultural tools and machinery, for example for soil tillage and pesticide application, the latter also addressing health concerns. Similarly, machines are required to assist with post-harvest loss reduction and on-farm processing. Additional benefits may be associated with a reduction in the drudgery of farm work, greater leisure, or reduction of risk, etc. Indian agriculture contributes about 15 per cent of gross domestic product (GDP) and employs 52 per cent of working population. Gradual increase in farm mechanisation will also help release agricultural labour for other emerging and valued sectors, thus contributing more towards GDP.

During recent years, a continuous shift of rural population towards services sector for better working conditions, increasing urbanisation and migration of villagers in search of greater opportunities, rise of rural entrepreneurs, etc. has resulted into the shortage of agricultural labour. The implementation of MGNREGA scheme in 2006 by Government of India has further aggravated the problem of labour scarcity in rural areas. The 2011 Census points towards the movement of labour away from agriculture in recent decades. The result that has attracted the most attention is that

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the farmer population has shrunk by nine million between 2001 and 2011. Reports from various government sources highlighted that the agricultural sector is on the verge of losing four million workers in the Twelfth Plan period. Experts believe agriculture needs infusion of technologies, including mechanisation, as there is scarcity of labour to undertake activities such as weeding/harvesting in corn cultivation, manual transplantation in rice cultivation, manual cotton picking and sugarcane harvesting etc.

The future of agriculture is dependent on penetration of scale-neutral technologies; trend of which has already begun in some ways. According to the Department of Agriculture, the share of agricultural workers and draught animals (farm power sources in agriculture) has come down from 63.5 per cent in 1971-72 to 13.67 per cent in 2009-10, whereas the share of tractors, power tillers, and motors has gone up from 36.51 per cent to 86.33 per cent during the same period. With newer farm techniques such as combined harvester, irrigation equipments (sprinklers/drip), plant protection equipments (high clearance self-propelled sprayer, blast/aero sprayer), crop/operation specific machines (rice planter, pre-germinated-paddy seeders, cotton pickers, sugarcane harvesters, wheat straw reaper/loader, paddy straw bailers, maize planter/dehusker/thresher, etc), resource conserving technologies (zero-till-drill, raised-bed planter, laser leveller, happy seeders, etc), the dependence on farm mechanisation has increased. Sub-Mission on Agricultural Mechanisation has been proposed for the Twelfth Plan, which includes custom-hiring facilities for agricultural machinery as one of its major components. Its focus is on increasing the reach of farm mechanisation to small and marginal farmers and to the regions where availability of farm power is low. Union Minister of Agriculture recently showed concern that in order to attain the projected demand of 280 mt of food grains by 2020-21; farm power availability in the country has to be scaled up from 1.7 Kw/ha at present to at least 2.0 Kw/ha by the end of the Twelfth Plan.

In all, 25 research papers were submitted under this theme covering various issues related to agricultural labour and farm mechanisation. Of which, three are recommended as full length papers and seventeen in summary form. For better understanding, these papers were divided into three categories: (i) Scenario of labour use and farm mechanisation in Indian agriculture, (ii) MGNREGA and its impact on farm labour availability, and (iii) Farm mechanisation and its impact on labour saving, crop productivity and cost of production. A brief findings of these papers are given below.

II

SCENARIO OF LABOUR USE AND FARM MECHANISATION IN INDIAN AGRICULTURE

Consequent upon the transformation of agriculture in terms of technological advancements, change in cropping pattern, cropping intensity and mechanisation of field operations, the employment of human labour has undergone various structural

changes in Indian agriculture. Though, India has abundant labour force in agriculture, non-availability of manpower during peak crop season is a growing problem. One of the serious problems concerning labour employment is its seasonality which has caused under-utilisation of the available labour in some seasons and over-utilisation in other periods. The peak and troughs are pronounced more in recent years due to specialised kind of cropping pattern especially in green revolution belt of the country. To cover up the gap between supply and demand of farm labour in a specific season, migration from labour abundant (Bihar, Uttar Pradesh etc.) to labour scarce states (Punjab, Haryana, etc.) is a common phenomenon. The women and child labour participation has also been increasing. Indian agriculture is dominated by small and marginal farmers. Smallholding is one of the major constraints in adopting farm mechanisation. In this context, establishing custom hiring or farm service centers facilitated use of farm machines in few select locations more specifically in north-west India. Need for efficient but less costly agricultural tools and equipment suitable for small farmers coupled with government assistance in the form of subsidies, easy/soft credit availability, trainings and awareness has seriously been realised. Technological change in agriculture has made significant impacts on labour absorption, notably since green revolution. Moloy Kanti Roy has analysed the shift in labour use and farm mechanisation in Tripura agriculture based on secondary data. Emphasis was laid to study the shift in labour use pattern along with cropping pattern, work participation rate, growth of agricultural workforce and level of farm mechanisation in Tripura from 1980-81 to 2012-13. The study revealed that agricultural labourers and cultivators had declined over time. Resultantly, the cropping pattern shifted from food grain to high value horticulture and plantation crops like rubber due to their low labour requirements. Farm mechanisation in the state was found to be extremely inadequate. Hence, the shortage of labour in agriculture, inadequate farm mechanisation and the resultant high wages were the major reasons for withdrawing by the cultivators from farming activities in the state. A.K. Gauraha *et al.*, in their study on labour utilisation and farm mechanisation in rice farms of Chhattisgarh examined the labour utilisation, availability and scarcity in crop production and farm mechanisation. The percentage share in the cost of cultivation of per hectare of paddy for human labour, bullock and machine power were 38.37, 0.05 and 18.68 per cent in *kharif* paddy and 28.52, 0.25 and 24.44 per cent in summer paddy, respectively. The use of machine power was found to be increasing in field preparation, harvesting, winnowing operations and transportation due to labour shortage and high wage rate for these farm operations in paddy crop. Employment of machine power ensured timeliness in field operations and reduced turnaround time for next crops as well as it improved the quality of the work. The major constraints in adoption of farm mechanisation were observed to be high cost of machine. It was inferred that the farm mechanisation should be promoted through custom hiring of machinery and by encouraging the co-operative management.

N. Lalitha *et al.*, examined the dimensions of labour scarcity in Nilgiri tea plantations. It was seen that tea plantations had been providing both permanent and temporary employment to millions of workers and women constituted a majority of the labour force. But fluctuations in price and productivity issues in tea plantations had impacted the employment. The low wages in tea plantations, lack of promotional opportunities in industries and facilities in urban areas made tea plantation jobs least attractive for potential workers. Since the labour shortage interfered with the labour intensive operations such as plucking, pruning and replantation, which were essential to maintain the quality of tea. Mechanisation of harvesting led to the decline in the quality of tea and thereby prices. Also, the difficult hilly terrain and the vegetation in the plantation restricted the use of machines. Thus, there was a vicious cycle of labour dynamics in tea plantations which affected the mechanisation process, maintenance of the bushes and quality of tea produced and which were reflected on the prices earned by the tea plantations. The ageing workforce and potential new entrants were put off to the low wages, arduous work. Overall, it was evident that more mechanical harvesting was likely in the Niligiris tea plantations in the coming years, though the quality and aroma could decline. The issue could be overcome by resorting to production of value added tea. Further, it was stated that if the state government agreed to share part of the social costs such as health and housing which was long pending issue from the tea plantation managements, the wages could increase.

Deepak Shah in his paper has analysed the impact of farm mechanisation on draught animal power availability in Maharashtra state. The changes in size, composition and availability of draught animal power in relation to mechanical power were studied to understand the extent of mechanisation of agriculture in Maharashtra state. Although the estimates revealed an increase in the intensity of mechanisation in Maharashtra, but this did not seem to have contributed to any significant displacement of work animals per hectare of net sown area. The impact of tractorisation in respect of displacement of work animals was also very low. Since the rate of mechanisation of irrigation was faster than mechanisation of tillage, the overall effect of mechanisation in terms of displacement of work animals has been very slow in the state. It was inferred that since the use of animals for draught purpose had shown no significant growth, farmers should resort to modern techniques of tilling as substitute to animal power in the face of growing farming activities.

Women labour participation in agriculture has been increasing over time resulting in generation of new employment opportunities among rural poor. Hargovind Bhargawa *et al.*, studied the pattern of employment and participation of women in agricultural activities in rural area in Uttar Pradesh. The study was based on data collected from 240 NGOs involved in the informal group formation and its related activities. The improvement in women's participation due to group activities was quantified through the comparison of different parameters in pre and post-group formation situations. The enterprise combination of women revealed that as a result

of group formation, women were able to diversify their activities by undertaking non-farm and animal husbandry activities. Likewise, child labour plays an important role in undertaking various agricultural related functions. Tarannum Bano *et al.*, examined the magnitude and distribution of child labour in various states of India. The sector-wise distribution of child labour in all over India revealed that approximately 79 per cent child labour was engaged in agriculture, 6 per cent in livestock, 3 per cent in household and 8 per cent in manufacturing. In agricultural sector, child labour was involved in various kinds of work such as ploughing transplanting, sowing, manuring, irrigation, weeding, threshing, harvesting, etc. The distributional pattern of the female child workers was more or less the same as that of male. Most of the female child workers got absorbed in agricultural sector while large numbers of female child workers were also engaged in casual work. Though, these two papers have highlighted the increasing farm- work participation of both women as well as children, yet could not link the scenario with agricultural labour – scarce situation in the country.

III

MGNREGA AND ITS IMPACT ON FARM LABOUR AVAILABILITY

The most important national rural development programme at present is Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) serving as a key social protection measure for the poor and vulnerable rural people. MGNREGA has multiple purposes encompassing creation of durable assets in rural areas, strengthening the natural resource base, improving farm productivity through better management of soil and water resources, etc. Some controversies have also been emerged with the implementation of this programme. MGNREGA wages are providing choice of work to casual labour in rural areas and employment provided under this scheme has resulted in agricultural labour scarcity.

Mrutyunjay Swain *et al.*, assessed the impact of MGNREGA on the availability of farm labour, agricultural wage rate and rural-urban migration, standard of living in rural Rajasthan. The MGNREGA implementation had led to shortage of farm labour during both *kharif* and *rabi* seasons. The most difficult months for farm labour availability were October followed by February, September and November. The scheme had positively affected the agricultural and non-agricultural wage rates and checked to some extent the level of out migration in rural Rajasthan. It was suggested that the MGNREGA works need to be properly planned so that agricultural activities during peak seasons did not suffer. It was inferred that MGNREGA needs to have provisions to include agricultural activities during peak periods (few specific months) by sharing the wages on 50-50 basis between employers and the Government. P. Seenath and A. Prema have studied MGNREGS induced labour scarcity in agriculture in Kerala which revealed that there was labour scarcity in agriculture sector due to introduction of MGNREGS. Wage rate of woman agricultural labourers

increased in tune with the increase in the MGNREGS wage rate. The farmers adopted machine operations wherever feasible and this has resulted into lower labour use in paddy cultivation. Labour bank system for ensuring timely and sufficient labour - force in paddy cultivation has emerged in the study area. It was inferred that the preparation of MGNREGS calendar of operation in consultation with concerned stakeholder group and scheduling of MGNREGS works avoiding the peak agricultural seasons was needed. A. Narayanmoorthy *et al.*, attempted to find out the relationship among farm mechanisation, MGNREGS, labour supply and other factors using state-wise panel data pertaining to paddy and wheat crops covering period from 2000-01 to 2010-11. It was observed that the machine labour cost (which is used as a proxy variable to reflect the level of farm mechanisation) incurred for cultivating both paddy and wheat had increased considerably during post-MGNREGS period in almost all the states considered for the analysis. The machine labour cost incurred for cultivating paddy had increased substantially in states like Andhra Pradesh, Tamil Nadu, Karnataka and Madhya Pradesh after implementing MGNREGS, while the same increase was found very high in Madhya Pradesh, Himachal Pradesh, Uttar Pradesh and Punjab in wheat cultivation. In most states where machine labour cost has increased substantially, the use of human labour in man hours has declined sharply in both paddy and wheat, confirming the fact that farm machineries are used to substitute the human labour especially after implementing MGNREGS. The dummy variable for MGNREGS was used to capture its impact on farm mechanisation and it turned out to be positive and significant in both paddy and wheat cultivation, suggesting that the level of farm mechanisation has increased after the implementation of national rural employment guarantee scheme. The increased farm mechanisation is a desperate attempt of farmers to tackle the labour scarcity that occurred after implementing MGNREGS.

M.M. Rajput *et al.*, in their study on implementation of MGNREGA during Eleventh Plan in Uttar Pradesh concluded that despite making provision of 100 days of employment in a year, the actual employment generation was much below than 100 days in a year in almost all the districts of Uttar Pradesh. Works undertaken were mainly relating to rural irrigation, water conservation and harvesting, draught, proofing, land development and water bodies. The scheme had been successful in terms of asset creation, watershed development, prevention of drought, large scale administration of rural public work and reduction in large scale migration. Only 34 per cent households registered under MGNREGA received job cards. The wages offered were low in several districts, which were due to improper methods of measurement of productivity. K. Madhubabu studied the impact of MGNREGA on supply of labour to agriculture sector in Andhra Pradesh and found that MGNREGA had a major impact on the agriculture of Andhra Pradesh at the time of its introduction in 2006. Andhra Pradesh was under severe agrarian crisis at that time and many farmers had committed suicides. The workers who had left agriculture and joined MGNREGA constituted only 27.67 per cent of the sample population, out of

which 30 per cent workers were in the age group of 50-70 years. This provides a fairly good idea that MGNREGA was not responsible for the shifting of labour from agricultural sector rather it had only supported those who had given up agriculture owing to their age. It was emphasised that MGNREGA projects should be planned as to utilise the period of off-season for agricultural labourers and such a planning would provide off season employment to labourers. Initially, in 2006, when agriculture sector faced severe crises, introduction of the scheme saw a massive movement of labour from the agricultural sector to the MGNREGA because of its higher wages. Agriculture sector had been on a recovering path and there existed a high market wage for labourers, higher than MGNREGA wages. This higher market wage had resulted in a reverse movement of workers back to their basic occupations. Among the workers of MGNREGA, those who had left agriculture and joined MGNREGA formed a very small number and even among that group, a considerable number of workers were higher age group who had retired and thus could be sustained under MGNREGA. It was seen that under the prevailing situation of Andhra Pradesh, MGNREGA does not hold much of the potential for agricultural labourers. Majority of the workers in MGNREGA were women, because women got a wage equivalent to a male worker.

Some of the studies clearly highlighted that the implementation of MGNREGA has caused agricultural labour scarcity resulting into the wage hikes that has led to the intensive adoption of farm mechanisation while few studies on the other hand brought out that due to improper implementation of this scheme, MGNREGA was not responsible for the shifting of labour from agricultural sector rather it had only supported those who had given up agriculture owing to their age or women folk because of their better wage rate.

IV

FARM MECHANISATION AND ITS IMPACT ON LABOUR SAVING, CROP PRODUCTIVITIES AND COST OF PRODUCTION

High economic growth, fast infrastructure development and more wages are pushing farm labourers to migrate to urban areas or find alternative job opportunities. The labour scarcity in rural areas is leading to increase in farm wages and adding to the cost of production of agricultural commodities. Though the country has been witnessing considerable progress in farm mechanisation, its spread across the country still remains uneven. Introduction and adoption of agricultural machinery in the recent past has mainly been confined to the northern states of India. However, with the increase in the irrigation facilities and modernization of the cropping practices, the demand for agricultural machinery has shown an increasing trend in the southern and western parts of the country. The eastern and the north-eastern states have been less responsive to adoption of agricultural machinery. While the farm power availability of Punjab has reached to over 3.5 Kw/ha, it is still less than 0.90 Kw/ha,

in many states like Odisha, Rajasthan, Himachal Pradesh, Jammu & Kashmir, Chhattisgarh, Jharkhand, Gujarat, Assam, Madhya Pradesh and Maharashtra. Tractors are mainly used in the states like Uttar Pradesh, Punjab, Rajasthan, Madhya Pradesh, Haryana and Gujarat. These six States together account for around 80 per cent of the total tractor population of the country. Punjab has the highest density of tractors in terms of gross cropped area. Empirical data reaffirm that availability of farm power has a direct correlation to agricultural productivity. Literature based experience of few crop/operation specific machines shown that modern sugarcane machinery and labour saving devices like sugarcane planters, weeding machinery and imported harvesters have been proved successful in states like Tamil Nadu in reducing dependence on human labour to a great extent. Paddy transplanting is highly labour intensive operation and shortage of manual labour led to introduction of paddy transplanters in Punjab. Around 550 transplanters of different type i.e. single wheel riding type walk behind type and 4 wheel drive transplanter were purchased by farmers and cooperative societies on subsidy. Despite the availability, farmers could not successfully adopt mechanical transplanting due to failure of mat type nursery/improper operation of machines in the absence of proper training to raise mat type nursery. Similarly, manual harvesting/picking of cotton is quite a labour intensive operation. Mechanical harvesting of cotton is widely used in USA, USSR and Egypt, etc. Machines used for cotton harvesting i.e. stripper or picker were evaluated and not found successful due to varietal performance and field conditions as the machines require cotton variety with compact and synchronised boll opening.

Venu Babu and B. Sambasiva Rao in their study on mechanised farming being answer to food shortages in Andhra Pradesh highlighted that cultural operations for sugarcane production were arduous especially planting, irrigation and harvesting. It was observed that labour scarcity coupled with high labour wage rate greatly affected the irrigation and harvesting of the crop in time. It had reduced sugarcane area from 3.91 lakh ha to 3.14 lakh ha during the period 2006-07 to 2009-10 in Andhra Pradesh. Modern sugarcane machinery and labour saving devices were introduced at large scale to reduce the dependency of labour and complete the farm operations in time. Mechanical operations proved that it was superior to manual operations. It reduced cost of production and enabled efficient utilisation of resources with better work output. It was inferred that modern sugarcane machinery could be used, which being available in the country like sugarcane planters, weeding machinery and imported harvesters as their initial cost is very high but advantages accrued in their use being much more. R Ramakrishna *et al.*, in their study on labour scarcity in agriculture and farm mechanisation examined that sugarcane production being highly labour intensive requires about 3300 man-hours for conducting different operations and shortage of labour was a serious constraint in sugarcane cultivation. It was inferred that if labour scarcity continued, the cropping pattern would get a shift towards horticultural crops, which being comparatively less labour intensive. The reasons identified for the labour scarcity included higher wages in other locally available

jobs, seasonal nature of agricultural job and presumption of agricultural job as a low-esteem one. The analysis had further revealed that the available labour saving implements and technologies could have positive impact on the productivity levels of crops, if adopted. The reasons identified for the non-adoption of technologies included higher cost, lack of skill and small size of holdings. Among others the study had also suggested a community level approach to encourage farmers for adoption of expensive technologies. A.K. Sharma and Brahm Prakash attempted to estimate the demand for labour use of sugarcane and other competing crops and to quantify the changes over time in the labour use in major sugarcane growing states of India. The paper highlighted that the cultivation of sugarcane is least mechanised and most labour intensive in almost all major cane growing states in the country. All the operations suffered due to labour scarcity leading to increasing cost of sugarcane cultivation and depleting the profit margins. This led to decline in sugarcane area in Haryana and yield decline in Maharashtra. IISR- developed sugarcane cutter, planter and ratoon management device had made inroad in promoting mechanised sugarcane planting/ratoon interculturing in sub-tropical India by augmenting its extension capacity with the help of private manufacturers in PPP mode. On harvesting front, only imported harvesters were being used by some sugar mills and that too in labour scarce states like Tamil Nadu, Andhra Pradesh and Maharashtra. The role of sugar mills in popularising the mechanisation both in planting and harvesting was found to be quite vital. The study also pointed out that the tractorisation of farm operations could not be considered as mechanisation. In sugarcane, mechanisation was restricted to land preparation only while labour intensive operations of cane planting, interculturing and harvesting were performed manually and still awaits mechanisation. In order to cope up with the problem of labour scarcity in sugarcane cultivation, multipronged strategy was found to be the need of the hour. Cane planting required 35-40 person days to be completed in time as at this time the labour requirement being high for planting of other crops also which were less drudgery inducing. Although IISR has developed sugarcane cutter planters but it had been in limited use due to high costs and lack of expertise in operating the equipment. Ratoon crop which almost occupies 50 per cent area under the crop remains neglected in respect of timely intercultural operations. It was suggested to popularise ratoon management device developed by IISR which performed many functions in a single pass. The other area where mechanisation success could be achieved was the intercultural operations in sugarcane. It was inferred that the major challenge before sugar industry was mechanisation of harvesting operation. Although few countries had developed cane harvesters, it could not be popularised in India due to very high initial investment.

Asha Begum and Y. Surya Sowjaya have assessed the present status of agricultural mechanisation in different states with more emphasis on Andhra Pradesh and constraints thereof based on the published secondary data pertaining to 2000-2013. It was suggested that the technological inputs should be applied wisely and

economically to bring about the desired increased outputs of production. Mechanisation being one of the critical inputs of production followed by preservation of food crops could increase yields through the improvement of water control and better soil preparation. It was inferred that by taking the option of mechanised transplanting and field care it would give the farmer ample time for other farm activities to be undertaken. However, total mechanisation of rice production from seed bed preparation to threshing would deprive the peasant masses of their source of livelihood. Sarba Naratan Mishra and H.N. Atibudhi attempted to assess the impact of labour scarcity on agricultural productivity in Cuttack district of Odisha based on primary data collected from 100 farming households and forty agricultural labourers pertaining to the year 2012-13. The study had revealed that the prevalence of acute labour shortage had affected productivity levels of paddy, sugarcane, groundnut and forced some farmers to shift for less labour intensive farm forestry. The level of adoption of labour saving implements and technologies by the farmers was very low for the reasons of higher cost, hesitation for adoption due to fear of failure, complacent attitude and small size of holding. It was suggested that the Farmer's service centres should be encouraged in more numbers to provide implements to the farmers at affordable prices on custom hiring basis.

Arun Kumar Nandi and Dipika Basu measured the effective and efficient labour use in Indian agriculture in the context of farm mechanisation. The paper has explored the rationality of labour use in paddy production across states with the help of Stochastic Frontier Production Function based on plot level data under the cost of cultivation scheme during 2009-10. It also examined impact of machine use on production, productivity, cost and profitability in paddy production in India based on aggregated and disaggregated data. It was observed that there is no rational use of human labour in Indian agriculture (i.e. the present study rejects the hypothesis of equality between marginal productivity of labour and average wage rate). Further it was seen that machine use in agricultural production resulted into viable profitability making in farming in India. A. Amarendra Reddy in his study on labour scarcity and farm mechanisation have analysed the trends in cost of cultivation, profitability, labour use and machine use for five major crops, i.e., paddy, wheat, cotton, sugarcane and chickpea across the major states based data collected from 'Comprehensive Scheme for Studying the Cost of Cultivation of Principal Crops in India' for the period 1997 to 2010. The analysis revealed that farm mechanisation had speeded up replacing both human and bullock capital. This transformation started in Punjab and Haryana and spread to other states. It increased labour productivity significantly when compared to land productivity and increased share of casual labour in states like Andhra Pradesh, Karnataka, Tamil Nadu, Bihar, Maharashtra, Punjab, Gujarat and Haryana. However, in most of the crops in Odisha, West Bengal and in some crops in Uttar Pradesh, Madhya Pradesh and Rajasthan still share of family labour was high with low level of farm mechanisation and less labour productivity which reflects the prevalence of subsistence agriculture. The positive association among

farm mechanisation, displacement of family labour and increased use of casual labour were observed across many states and crops. There existed a huge labour productivity gap across the states with Punjab and Haryana at the top and Madhya Pradesh and Odisha at bottom.

F.A. Shaheen and Mudasir Ali in their paper on economic efficiency and potential for mechanisation in temperate fruit crops of Jammu and Kashmir found that growing labour scarcity and increasing wage rates in the state were further pushing farmers towards worse off situation. The state had come with its own solutions for farm mechanisation problems. It was in this backdrop that machines were designed and fabricated by the SKUAST-K to meet mechanised solutions for some major fruit crops. The designed machines, viz., Motorised Walnut Dehuller, Motorised Almond Dehuller, Manual Almond Dehuller and Apricot Harvester were evaluated at field conditions and found cost effective with high output capacity. The potential cost minimisations on part of the designed machines were significant. It was suggested that the farmer groups may own and operate these machines on collective basis and may also provide them on custom hiring basis to other farmers who may not afford to purchase. The labour shortage had created a potentially vast opportunity for farm equipment makers. Population dynamics and labour shifts had led to changing farm landscape. As more people would move towards cities and towns in near future, foreseeable scenario predicted more of the small holdings would get combined into larger holdings, making mechanisation more attractive and effective. In order to make farming profitable by effectively minimising the cost of operations on one hand and relieving the labour force to a considerable extent for more productive gains on the other hand. Farm mechanisation had to go a long way in identifying, designing, and manufacturing and up scaling of the specially designed machines suitable to local topography and crop structure in consideration with social and environmental factors. Mundinamani *et al.*, in their study on farm mechanisation being an alternative for labour scarcity in agriculture sector found that one of the major hurdles growing pulse crops by the farmers in North Karnataka was due to the lack of mechanisation of various farming operations especially harvesting. The paper assessed the benefits and constraints in mechanical harvesting of chickpea. The cost incurred per acre of chickpea harvesting engaging labour was found to be Rs. 1256 and the cost of threshing with machine was Rs. 1111. The total cost of harvesting and threshing per acre was Rs. 2366. The cost incurred for harvesting of chickpea with machine was Rs.1050. The per acre net returns realised by mechanical harvesting of chickpea was around Rs. 1300. The major constraints in adoption was in terms of non-availability of suitable varieties and machines on time which needed to be looked upon seriously to save cost on labour and enhance efficiency in timely harvesting of chickpea crop.

In view of the papers submitted for the conference, the following issues/themes have been drawn up for discussion in the session.

- One of the serious problems concerning labour employment is its seasonality which has caused under-utilisation of the available labour in some seasons and over-utilisation in other periods. The peak and troughs are pronounced more in recent years due to monoculture/specialised kind of cropping pattern especially in green revolution belt of the country. What scope a diversified crop plan has, to tackle acute farm labour scarcity?
- How far employment provided under MGNREGA has resulted in agricultural labour scarcity? What is the coping strategy practised by the farmers in the event of non-availability of labour? Is there any evidence of changing production pattern in the event of labour non-availability? Which crops/farm operations are the most adversely affected, calling for their mechanical solutions?
- Is there any instance where farm mechanisation has resulted into unemployment/underemployment among workers in rural areas?
- How have the dynamics of land ownership affected the availability of agricultural labour and potential for mechanisation?
- What has been the role of custom hiring system on co-operative basis/ owned and operated by co-operative societies or private agro- service centers etc in the adoption of farm mechanisation especially among small and marginal farmers?
- Despite the availability of many labour saving devices like rice planters and cotton harvesters, these could not be successfully adopted for want of compatible mat type rice nursery and compact/synchronized cotton varieties. Whether such incompatibilities been experienced calling for appropriate research and development efforts in terms of various crops – specific agronomic practices/evolving suitable new crop (s) varieties for mechanical – friendly operations?
- How organised sector is entering the farm mechanisation and how effective impact they are making in promoting farm mechanisation? What sort of support is needed from the government to promote smallholder-friendly farm mechanisation? Can the public – private partnership model be supportive to promote inclusive farm mechanisation in the country?
- Has the government assistance in the form of direct/indirect subsidies for the purchase of selective agricultural machineries/ awareness creation/ imparting requisite trainings, etc been helpful for effective/profitable adoption of agricultural mechanisation in various technological, agro-economical, sociological environments/ agro-climatic zone of the country?