

## Changing Employment Pattern amongst Coffee Plantation Workers in Karnataka, India \*

Molly Chattopadhyay

*Economic Analysis Unit, Indian Statistical Institute, Bangalore Centre, 8th Mile Mysore Road,  
RVCE Post, Bangalore 560 059, Karnataka, India  
E-mail: molly@isibang.ac.in, cmolly2001@yahoo.co.in*

**KEYWORDS** Coffee. Female Worker. Land Area. Mechanisation. NSSO

**ABSTRACT** This paper studies the impact of mechanisation on employment patterns in coffee plantations in the Indian state of Karnataka. This study attempts to highlight the fact that farm employment in developing countries decreases with agricultural mechanisation, particularly for women workers. To measure the impact of technology on coffee workers in Karnataka, unit level data from employment-unemployment survey was collected from National Sample Survey Office (NSSO) for two time points of 1999-2000 and 2011-2012 based on the usual principal status of employment. Changes in the division of labour in plantations occurred due to the introduction of mechanical dryers. The latest technological component, mechanical dryers, coupled with other factors reduce female employment by fifty-four percent whereas the number of male workers increased by seventy percent due to increased numbers of male actors in the value chain. Technical efficiency was achieved at the expense of unequal employment opportunities for coffee plantation workers of India.

### INTRODUCTION

Gender relations pervade the operational structures in the context of the diversity of involvement of female workers in the production process. However, the nature of women's employment within this sector needs serious assessment in light of current concerns about declining female worker participation rates in the coffee sector. Barbara Harriss-White (2004: 60) termed it "masculinisation of the markets and the post-harvest system for rice" when "men dominate control over commercial assets and technological change that displaces female labour disproportionately". The impact of technical change in the perspective of restructuring of the Coffee Board on such institutional arrangements will be explored in the case of the coffee industry of Karnataka. With mechanisation of agriculture and technological change, another pattern in gender division of labour emerged termed as 'productive deprivation' by Ester Boserup (1989: 5), who shows convincingly that "women are progressively marginalised from wage work in factories and that female activity rates decline with development" (1989: 192). Boserup (1989: 139-40) reaches an

effective conclusion, "If women are hired at all... it is usually for the unskilled, low-wage jobs, with men holding skilled jobs. Thus the roles assigned to men and women even in the modern sector indicate a widening difference between the productivity and earnings of each". In the case of coffee plantations of Karnataka, the role of mechanisation and changes in land character will be explored for the declining female labour force.

### Review of Literature

The onset of globalisation also had implications for the coffee sector in India. The activities of the Coffee Board, broadly aimed earlier at compulsorily pooling coffee from all growers, were replaced by amendments to the Coffee Act of 1942. Free Sale Quota was introduced in 1992, whereby thirty percent of coffee that was produced could be retained by the growers for sale under the Free Sale Quota (FSQ). Subsequently, another two amendments were introduced. First, in 1994, FSQ was increased to fifty percent followed by the final amendment in 1996 that raised FSQ to one hundred percent allowing coffee growers to market their produce without delivering coffee to the Coffee Board. "Due to restructuring of the Coffee Board, Indian coffee planters are also going through one of the most

\*Present article is an offshoot of the project "Gender and Labour: A Study of Coffee Industry of Karnataka" funded by the Indian Statistical Institute.

trying periods due to declining coffee prices and exports. The export figures for coffee show that India's export to the world declined from USD 411 million in 1998-1999 to USD 225 million in 2004-2005. A world glut had pushed coffee producers into one of the industry's deepest crises with the growers being forced into debts, bankruptcy and worse" (National Productivity Council (NPC) 2006: 67).

According to Viswanathan (2016: 196) "the resultant dynamics in the labour market have been widely held in terms of a chronic dichotomy of labour shortage in the midst of labour abundance. Apparently, there emerged a situation of acute labour shortage for performing the traditional farm operations, despite higher wage rates". This is because the total employment in coffee plantations had declined by forty-two percent between 1994 and 2014 at an all India level, and male workers declined by forty percent as against forty-three percent of female workers (Government of India 2016). While in Karnataka, the other two coffee producing states, Kerala and Tamil Nadu, accounted for fifty-five percent decline in coffee labour employment, both for male and female workers for the same time period. The labour scarcity within the large estates had been due to the displacing of traditional coffee workers. Labour scarcity in the coffee small-holding sector, had become a major concern in recent years given that the expansion of coffee area by eighty-six percent from 2.2 lakh hectares to 4.1 lakh hectares between 1994 and 2016-2017 (Coffee Board 2017).

In view of the declining labour force in the coffee sector, particularly female coffee workers, planters opined that mechanisation was an option to address the problem of labour shortage (Uppendranath et al. 2016). "Labour being the most important single cost, plantation companies in South India had invested heavily in mechanisation to increase labour productivity, like in the tea estates in South India" (Neilson and Pritchard 2009: 71). A sum of INR 464.30 crore was spent by the Coffee Board on various components of the Scheme during the 12th Plan. The productivity of coffee had increased from 759kg/Ha in 1990-1991 to 876 kg/Ha in 2015-2016 (Coffee Board 2017).

Introduction of new technologies has contributed to the decline of women's employment opportunities. With the changes in the manual irrigation system

replaced by the bucket system, where women workers were very productive, with the tube well irrigation system, women workers became surplus (Kishwar and Vanita 1985). Usually mechanised jobs such as wheat grinding and machine operating go to men, and equipment producing factories rarely employed women. In India the ratio of 'not in labour force to population' for female agricultural labourers increased by 8.49 percent between 2004-2005 and 2011-2012. Increasing mechanisation in agriculture has resulted in the reduction of the demand for female agricultural labour (Swaniti Initiative 2018).

The study by Mencher and Saradamoni (1982) in Tamil Nadu, West Bengal and Kerala highlight that women are disallowed to do any transformation from traditional method to modern methods that includes adaptation of technology in paddy cultivation. Male workers has increased since female workers have been displaced in agriculturally developed villages of Hooghly District in West Bengal (Singha 1992).

Before the introduction of technology, natural manures such as neem seeds, dried neem leaves, cattle waste and so on were used largely and women's involvement was greater (Sundari and Gowri 2002). But the introduction of chemical fertilisers and pesticides has displaced the requirement for women's labour and promoted male domination in such operations. The hand sprayers that are widely used for applying fertilisers and pesticides weigh about 30-35 kilograms, which excludes female workers, since women due to the lack of physical strength cannot carry such equipment on their backs for five hours. With the economic development of an agricultural area, the participation of women in farm work declines. The economic development entails the introduction of machinery and the decline of female labour force in Punjab and Haryana (Billings and Singh 1970; Chakravarthy and Tiwari 1979).

Mies (1980) has recorded the removal of women from their means of production and from their productive function by the introduction of new technology in West Godawari district. The effect of modernisation in agriculture by transferring traditional farm operations to machines poses yet another threat to rural female workers (Duvvury 1988; Pant 1985). Due to mechanisation, there is a decline in employment. Chen (1989) and Sinha (1993) observed the displacement of women from agriculture, where the high yielding variety

**Table 1: Share of cereal and coffee in Karnataka between 1990-91 and 2015-16**

<i>Area (Hect)</i>	<i>1990-91</i>	<i>2015-16</i>	<i>Share of GCA*(%) 1990-91</i>	<i>Share of GCA(%) 2015-16</i>	<i>Annual rate of increase/ decline</i>
Rice	11.7	10.89			
Maize	2.5	11.97			
<i>Jowar</i>	21.55	10.95			
Cereal (total)	54.16	44.77	46.06	36.56	-1.44%
Total gross cropped area	117.59	122.47			
Coffee (Karnataka)	1.24	2.35	1.05	1.92	+7.46%
Coffee (India)	2.32	4.34			+7.5%

\*GCA= Gross cropped area

Source: Statistical Abstract of Karnataka and Coffee Board

package of inputs especially chemical fertilisers and weedicides and mechanisation are adopted. The technological development in the agriculture sector shows the removal of unskilled female labour, which brings progress with pauperisation.

The growing mechanisation in agriculture and rising capital intensity in manufacturing sectors together have limited the opportunity for females because of their low education and skill and due to other cultural constraints (Mehrotra and Parida 2017). Presently, technology has replaced those jobs which were traditionally done by women manually such as spraying of fertiliser, weeding, harvesting and sowing seedlings (Director of Research 2008). These technologies are affordable, often manufactured by locals, and therefore, their use has become widespread. Men largely appropriate the control and use of technology. Farm mechanisation, therefore, results in segregation with men performing tasks involving the use of technology, replacing a number of activities earlier performed by women, particularly displacing the labour of women (Mallaiiah 2009 cited in Santosh Mehrotra 2018:24). In Andhra Pradesh, increasing mechanisation of female labour intensive operations such as harvesting could be a possible explanation for the declining share of female labour in rice cultivation (Reddy and Motkur<sup>1</sup> 2013).

Kashio (2020) in her study on rice cultivation shows that combine harvesters displaced women from family farming while male workers are controlling the use of machine operations. “The first casualties of the mechanisation of agriculture were women, both because they occupied lower-skill jobs and because of social norms that perceived operating heavy machinery to be a ‘man’s job’” (International Labour Organisation 2018: 36).

Abovementioned review of literature illustrates that the existing literature on coffee plantations showing decreasing female workers is rather scant. Most of the studies are engaged with the role of labour market institutions and labour relations in the plantation sector.

## Background

To begin with, an examination of the present status of the coffee cultivation and its profile is imperative to understand the relative implication of the crop in the local economy of Karnataka. It is clear from Table 1, Karnataka’s agriculture sector has undergone tremendous transformation over time, characterised by a major alteration in land use. Between 1990-1991 and 2015-2016, total land used for cultivation of cereals, mainly rice and jowar, declined annually by two percent whereas the share of gross cropped area (GCA) by coffee plantations increased annually by seven percent. Share of coffee cultivation increased from one percent to two percent of total GCA whereas the share of cereal cultivation declined from forty-six percent to thirty-seven percent of total GCA between 1990-1991 and 2015-2016 (Government of Karnataka 2011). During the same time period, cultivable area of coffee increased by eight percent annually, both for the state of Karnataka and India.

From Table 2 it is evident that between 2000-01 and 2016-17 in all the three districts of Karnataka, namely Chikmagalur, Hassan and Kodagu area under coffee cultivation has increased drastically occupying a leading position in the cropping pattern. At the state level, though coffee occupied only two percent of the gross cropped area<sup>1</sup> its share in production at the all India level is seventy-one percent. Regarding area under cultivation and

**Table 2: Growth in area and production of coffee between 2000-01 and 2016-17 in Karnataka**

Districts	2000-01 (area in Hect)	2016-17 (area in Hect)	Growth between 2000-01 & 2016-17	Share of production in India (2016-17)
Chikmagalur	86130	97417	13.10%	22.54
Hassan	32070	40279	25.60%	9.71
Kodagu	81350	107089	31.64%	39.20
Karnataka	199550	244785	22.67%	71.46
India	346716	449357	30.0%	

Source: Coffee Board, 2000-01 and 2016-17

production of coffee, southern region of Karnataka encompassing three districts namely Chikmagalur, Hassan and Kodagu dominates over other coffee producing areas (Table 3). Kodagu occupies twenty-four percent of the coffee area of India, and produces thirty-eight percent of total production in 2016-2017. The development suggests that the rate of growth of coffee area and production are increasingly replacing principal crops like paddy. One important observation is that the development of plantation areas is relatively high in all the three districts with the highest in Kodagu (24%) followed by Chikmagalur (22%) and Hassan (9%).

**Table 3: Coffee area and production in three districts of Karnataka in 2016-17**

Districts	Coffee area (In hect)	% to total	Coffee production (in Metric Tonne)	% to total
Chikmagalur	97417	21.7	71010	22.8
Hassan	40279	9.0	30875	38.4
Kodagu	107089	23.8	119860	9.9
Karnataka	244785	54.5	221745	71.1
India (Total)	449357		312000	

Source: Coffee Board, 2017-18

in Karnataka. On the other hand, the large scale plantation sector had grown by one percent in India as against fifteen percent in Karnataka for the same time period. Overall, the number of holdings increased by ninety-eight percent at the all India level and by twenty-four percent in Karnataka between 2000-2001 and 2016-2017.

Average daily employment in the coffee plantations in India grew by eighteen percent between 2001 and 2017, by twelve percent within the state of Karnataka, and by three hundred and fifty-eight percent in the non-traditional areas. But on closer scrutiny it appeared that the employment rate

**Table 4: Distribution of coffee landholding pattern between 2000-01 and 2016-17**

	Karnataka			India		
	2000-01	2016-17	Growth	2000-01	2016-17	Growth
Small holders (<10 hec.)	62015	76960	24.09	175475	349783	99.33
Large holders (>10 Hec.)	1918	2201	14.75%	2833	2861	0.98
Total	63933	79161	23.8%	178308	352644	97.77

Source: Coffee Board, 2002-03 and 2017-18

Coffee in India is grown mostly by small growers. Land holding pattern reveals that ninety-eight percent holdings are below 10 hectare, which is the official classification of small growers. Table 4 presents some macro-level indicators of the smallholder coffee sector. Growth of smallholders increased by ninety-nine percent at the all India level, whereas it had grown by twenty-four percent

proportionate to all India employment decreased in the traditional areas, namely Karnataka (5%), Kerala (2%) and Tamil Nadu (1%), but increased by seven percent in non-traditional areas for the same period (Table 5) (Coffee Board 2017). Therefore, it can be said that the problem of plantation labour shortage will be widely spread across all traditional regions, as an increase in employment

**Table 5: Distribution of coffee plantation workers between 2000-01 and 2016-17**

States	2000-01	(% to India)	2016-17	% to India	Increase/ Decline	% to state
Karnataka	459837	83.34	514695	78.74	-4.60%	12
Kerala	47985	8.70	44186	6.76	-1.94%	-9
Tamilnadu	29660	5.38	29339	4.49	-0.89%	-1
Non-traditional	14295	2.59	65427	10.01	7.42%	358
India	551777	100.00	653647	100.00	18.46%	

Source: Coffee Board, 2002-03 and 2016-17

**Table 6: Male-female distribution of coffee workers between 2000 and 2014**

States	2000			2014			Increase/Decline	F % per annum
	Male	Female	Total	Male	Female	Total		
Karnataka	7111	7794	14905	2822	4235	7057	-52.65	-3.8
Kerala	974	1317	2291	686	942	1628	-75.64	-6.2
Tamilnadu	7185	4868	12053	2394	3151	5545	-54.0	-2.9
India	15270	13979	29249	5441	7719	13160	-55.0	-3.7

Source: Labour Bureau

in non-traditional areas has led to an all India growth pattern.

Since the Coffee Board did not provide data on the gender-wise distribution of employment, data from the Labour Bureau is presented (Table 6). As per the Labour Bureau (Govt. of India 2000 and 2014), it is evident that employment in the coffee sector declined by fifty-five percent at the all India level. In Karnataka, there has been a fifty-three percent drop in total employment between 2000 and 2014, while the fall has been of the order of four percent per annum for women's employment. Similarly, employment in Kerala and Tamil Nadu reported decreased between five to six percent for the same period (Table 6).

### Objectives

In this perspective, this paper will explore whether the decreasing female labour force in the coffee plantations in Karnataka is due to the changing landscape of Karnataka or due to the introduction of labour displacing technology, or combination of both the factors.

### METHODOLOGY

Regarding coffee plantations, the Labour Bureau of the provincial government collects statistics on employment under the Plantations Labour Act (PLA), 1951 based on the submission of returns. The coverage is incomplete, since PLA is applicable only to those estates whose size is more than five hectares and employing

more than 15 employees. As stated earlier, land size of eighty-three percent of coffee growers is less than four hectares and the Coffee Board did not provide gender wise data on employment.

Due to these factors, this paper analyses unit level data from employment-unemployment surveys collected by the National Sample Survey Office (NSSO) for two time points 1999-2000 and 2011-2012 for the state of Karnataka. Gender disaggregated data on the size of employment was analysed using National Industrial Classification (NIC) five digit industry codes, that is, NIC 2008 for 2011-2012<sup>ii</sup> and NIC 1998 for 1999-2000<sup>iii</sup>. Gender disaggregated data on size of employment was tabulated using usual principal status<sup>iv</sup> employment.

## RESULTS

### Employment Pattern

At the all India level, there has been a decline by forty-six percent in average daily total employment in coffee plantations from 8,28,411 in 1999-2000 to 4,45,207 in 2011-2012 (Table 7). There has been a seventy percent fall (6% per annum) in the average daily employment of women as against thirty percent decrease for male plantation workers. Compared to all India plantation workers, in Karnataka, there is fifteen percent increase in total plantation workers while for male workers, the increase is seventy percent, accompanied by decline of fifty-four percent of female workers. Consistent decline of

**Table 7: Distribution of employment pattern by sex in coffee plantation in Karnataka**

State	Coffee plantation											Growth/ Decline		
	1999-2000					2011-12								
	M	F	T	%	F%	M	F	T	M%	F%	M	F	T	
Karnataka	163362	130546	293908	29.3	23.4	277306	59665	336971	68.9	15.3	+70	-54	+15	
India	490233	338177	828411	49.0	51.0	344293	100914	445207	80.4	19.5	-30	-70	-46	

Source: NSSO Employment and Unemployment Survey, 1999-2000 & 2011-12

**Table 8: Division of labour in coffee plantation\*\*\***

<i>Plantation operation</i>	<i>Male/Female</i>	<i>Time/Manual</i>	<i>Male/Female</i>	<i>Time/Machine</i>
Weeding	F	15 (A*) 12(R**) labour 1 acre	M (mechanical) M (chemical)	2 labour 1 day 1 acre 3 labour 1 day 1 acre
Pruning	M+F	22 labour A 1 acre 11 labour R 1 acre	M-Telescopic pruning knives F – traditional scissor	No significant time saving, but quality improvement
Harvesting	M+F	42 labour A 55 labour R 1 acre 10Kg	M+F	100 kg per day
Drying	M + F	3 labour 100 kg 12 hours	M	2+2 labour 8 tons 32 hrs
Pulping	M	1 labour 1 hour 1 ton	M	3 labour 9 tons 3 hours
Sorting	F	1 labour 200 kg	1M	1 Ton per hour

\*A=Arabica coffee bean, \*\*R=Robusta coffee bean, \*\*\*This Table includes only those activities which are affected by mechanization.

Source: Author's interview with Sri K. Srinivasan, Manager, Ossoor Coffee Estate, Sakleshpura.

female employment accompanied by an increase of male employment in coffee plantations in Karnataka needs serious assessment. To understand the employment dynamics, the division of labour and the role of mechanisation in the production process in coffee plantations needs elaboration.

### Production Processes and Division of Labour

To understand the presence and nature of employment of women in the coffee plantation, it is important to briefly describe the production processes and locate women's work therein. Within the plantations, steps towards coffee cultivation assume the following sequences (Winston et al. 2005):

1. Nursery
2. Transplantation
3. Weeding
4. Watering
5. Land preparation
6. Pruning
7. Shade lopping
8. Harvesting
9. Processing
10. Storage

Among the above mentioned activities in coffee plantations, women are involved in weeding, drying of cherries, applying fertilisers, tending of seedlings, watering of plantation fields, and harvesting as cherry pickers on the plantation (Table 8). Pruning and trimming of bushes are done by both men and women. Where mechanised scissors are used for pruning men do it, while women work only with traditional scissors. Similarly, mechanised weeding

is done by men, but traditional methods are used by women only. In small hulling units, women work as helpers and cleaners, while men operate the huller machine. In common pulping units, machine operation is done by men and cleaning by women. Male and female workers in the plantations took part equally in the traditional dry method. In the wet method, predominantly male workers participate while the minor presence of female workers was also found.

Women have traditionally been contributing more heavily to coffee plantations than men particularly in plucking and sowing. Even in the late 1990s, Karnataka coffee was cultivated and harvested by women through manual labour. Women were also completely responsible for picking and pruning.

### Reasons for Changes in Employment Pattern

How does one explain the increase of male workers accompanied by declining female workers in coffee plantations? Two possible reasons can explain this, firstly the increase of coffee land and secondly, mechanisation.

### Increase of Coffee Land

Coffee land area increased by twenty-three percent in Karnataka between 2000-2001 and 2016-2017, indicating an increase of smallholders by twenty-four percent accompanied by a fifteen percent increase in large landholders. In general, in the coffee production process, male-female division of labour is not strictly segregated, though harvesting and pruning are predominantly female

jobs. In case of marginal landholders, most of the functions related to coffee growing are performed by male members of the household (Chattopadhyay and Pais 2017). Therefore, increase of coffee land area, primarily by small landholders, absorbs male labour and land entitlements are mostly registered in the name of a male member of the household. Data from land records (Government of Karnataka 2015) shows that seventy-five percent of smallholding is in the name of male members as against nineteen percent for female members. As a result, the NSSO survey records an increasing number of male workers on coffee plantations from 1999-2000 to 2011-2012.

As per the interview with Dr. Ashwini Kumar of the Indian Institute of Plantation Management, Bangalore (Personal Communication, July 13, 2017), about ten percent of coffee production was passing through small huller mills (the “Lewis Grant huller”, adapted in the early 20th century from a coffee grinder). Huller mills were growing at ten percent every year, operating within rice mills because hulling results in a low quality coffee, since it results in higher numbers of damaged beans, as the machines used are very simple (Kodigehalli 2011). By hiding their activity behind rice mills, the job of hulling coffee beans remains invisible. Those huller mills had been operated through men who supervised a team of two to three women working as helpers and cleaners on a casual basis and women workers remained invisible. The result is data collecting agencies record more male workers engaged in coffee, while the female workers associated with coffee hulling are not reported. Additionally, collection of dried coffee beans from the farm gate of smallholders by agents has become a seasonal occupation of a sizable number of males. Trade reform with subsequent dismantling of the Coffee Board, whose job was to pool coffee beans from growers, produced a number of intermediaries in the value chain. The different actors from coffee to cup include producers, hullers, agents, curers, exporters, roasters and retailers and finally consumers (Kodigehalli 2011). Excepting consumers, all other actors in the value chain are mostly male. Overall, the increasing number of small landholders has resulted in an increasing numbers of male workers, while female helpers remain invisible.

## DISCUSSION

Asking how the use of labour change due to mechanisation impacted coffee production, the researchers found that given the costs of investment in implementing technology, only large estates are able to implement mechanisation. The nature of mechanisation is limited to the dryer, sprayer, pulper and irrigation. Below the researchers examine how masculinisation and/or productive deprivation for female workers occurred in the coffee industry.

By task, a significant reduction of female involvement was recorded for drying and irrigation because of mechanisation. Labour input in weeding, cleaning, manuring, pruning and harvesting including seedbed preparation and transplanting, remained unchanged. Though there is availability of mechanised harvesters in large estates, usually it is not used since manual harvesting selects only ripe coffee beans, whereas the harvester picks ripe, green as well as rotten beans. Not much change is noticed in preparation of seedbed, weeding, transplantation and harvesting. A slight decrease was recorded in labour use for irrigation. Irrigation of the coffee plantation required 25 labour for 70 acres of land with a 25 HP pump. Now, the same area needs 2 days by 2-4 labour with a 60 HP pump. Overall, for a hundred hectares of estate (supposed to be a large estate), with increasing HP, person days are reduced by three times. Irrigation of coffee estates remains a male job.

A major decrease in labour input (for both male and female workers) occurred for drying of coffee beans with the introduction of dryers. The latest technological component, mechanical dryers, reduces the processing from 12 hours for 100 kg of beans by 3 labourers to 32 hours by 4 labourers to produce 8 tons of dried beans (Table 9). Manual drying of coffee beans is usually carried out by both male and female workers, but machine drying is done by men only.

For a 25 hectare of coffee estate<sup>vi</sup> production of coffee beans is estimated to be 26,125 Kg (on an average 1,045 kg of coffee bean is produced per hectare). Manual drying requires 1,188 person days while machine drying requires 52 person days. Manual drying requires 23 times higher labour than machine drying. In the production

**Table 9: Person days\* required for drying of coffee beans manually and by machine**

<i>Drying of coffee beans</i>	<i>Time (in hrs.)</i>	<i>No. of worker</i>	<i>Production (in Kg)</i>	<i>Production (in Kg.) per person day</i>
Manual	12	3	100	22
Machine	32	4	8000	500

\*Person days = 1 person for 7 hrs of work

Source: Author's interview with Sri K. Srinivasan, Manager, Ossoor Coffee Estate, Sakleshpura.

process, harvesting, pruning and drying employ both male and female labour, but the drying of coffee beans absorbs more female labour. Most large estates had undertaken mechanized drying. If it is assumed that 50 percent of person days involve female workers then manual drying for 25 hectare of estate requires 594 female person day; that is reduced to 26 female person days for one large estate. Therefore, only one large estate is able to reduce female person days by 96 percent for only one job, drying of coffee beans.

The findings corroborate the broader literature on the effects of technological change on female labour. Using National Sample Survey data, Afridi et al. (2020) found 22 percent overall reduction in women's labour use in agriculture during 1999-2011. This decline is driven by the adoption of machines in tilling operation that specializes in weeding. Mechanisation accompanied by the introduction of high yielding crop varieties, modern means of irrigation, pesticides and use of electric power enhancing the productivity of labour (particularly male labour force) reduces the demand for female labour in the agriculture sector. Mechanisation of agriculture causes a decline in the demand for female labour force, as males are preferred over females to work with farm machinery (Singh and Garces-Ozanneb 2017). In Japan, "the gains of farm mechanisation in terms of farm management, such as the reduction of working hours and enlargement of farm size, came at the cost of women's involvement in agriculture" (Kashio 2019). With the arrival of riding-type transplanter, transplanting work – in which women were experts, disappeared. Women were downgraded to unskilled labourers and were not provided opportunities to learn new skills to operate the machines. Men became machine operators, while women were made to engage in more physically demanding labour. Similarly,

in Nigeria, introduction of tractor tilling greater expanses of land with less labour rendered the male labourers displaced. But, more significant, is the exploitation of women that tractors provoke. The strict separation of tasks between men (tilling) and women (weeding and harvesting) precludes the possibility of reallocating to men the extra harvesting labour that tractor-tilled fields create, so that tractors actually have a harmful, exploitative effect on female labourers (Shani and Musa 2021). The findings of the present study coincides with the study by FAO (2022) that adaptation of new technology in agriculture gives rise to gender inequalities (P 46), consequently resulting in low-pay and low-status of female centric occupations.

## CONCLUSION

The present study has discussed the changing composition of the labour force in coffee plantations over the period from 1999-2000 to 2011-2012 based on NSSO employment-unemployment data in Karnataka. Both male and female workers became redundant with the introduction of the mechanised dryer of coffee beans. Given the higher number of female workers engaged in drying of coffee beans, due to mechanisation of the dryer, female jobs got reduced by ninety-five percent. Male jobs are also reduced within the estate. But an increase of male coffee workers emerged in other areas, like an increase in coffee land area is recorded in the name of male members, and the liberalisation process has opened up a number of actors at the village level that emerged in the value chain (village level consolidators, agents, traders, hullers, roasters, curers, retailers) who are male workers only. There is considerable fear that the mechanisation of coffee plantations can result in major displacement of labour, aggravating the local employment problem. The initial steps towards mechanisation with the introduction of the new drying machine have reduced female labour requirements accompanied by increased labour requirements for expansion of coffee land that resulted in an increased male labour force in coffee plantations. Trade reform in the coffee sector has a consequence upon unequal employment patterns by gender under the influence of two opposing forces, that is, the



reduction of female labour inputs per unit of land due to mechanisation and the expansion of coffee land area with increasing male actors in the value chain.

### RECOMMENDATIONS

This study illustrates an understanding of the potential reasons for the decline in women's workforce participation in coffee plantations in Karnataka. Due to cultural norms, technological change may undervalue women's agency, thereby intensifying inequities in the coffee plantations. Policymakers ought to be cognisant of the potential gendered impacts that such technological change might have on the use of labour in the coffee plantations that includes wage earnings of women vis-à-vis men. Hence, it is recommended that to maintain gender equality in coffee plantations, policymakers should aim to provide equal opportunities in terms of reskilling female coffee plantation workers that may be critical to stemming any decline in women's labour force participation due to technological change.

### LIMITATIONS

This study focussed mainly on the large coffee estates having more than 25 hectares of plantation area and employing more than one hundred workers per day that includes both male and female workers. Planters selected for interview were determined on the basis of introduction of new technology. Obtaining data from small and marginal planters might have improved the validity of the data. Future studies should consider including such data to improve the scope of their research.

### DECLARATION OF CONFLICTING INTERESTS

The author declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

### FUNDING

The author received financial support for the research from the Indian Statistical Institute.

### NOTES

- i. Total planted coffee area in Karnataka is 2.44 lakh hectare and total bearing area in Karnataka is 2.26 lakh hectare in 2016-2017 (Coffee Board 2017).
- ii. As per NIC-2008, the code for coffee growers was 01272.
- iii. As per NIC 1998, the code for coffee growers was 01131.
- iv. A person is considered in the labour force on usual principal status (UPS) if they spent relatively longer time (major time criterion) on economic activity during 365 days preceding the date of survey.
- v. Since coffee is a perennial plant, nursery, transplantation and land preparation are not taken up every year.
- vi. A large estate consists of more than 10 Ha (criteria fixed by Coffee Board Karnataka), while an area size of 25 hectare is taken as an average.

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Paper received for publication in July, 2022  
 Paper accepted for publication in August, 2022