Transition from Agriculture to Non-Agriculture Occupations in West Bengal, India: Causes and Way Forward

Apurba Kumar Chattopadhyay[1] and Raj Kumar Kundu[2]

[1]Department of Economics and Politics, Visva-Bharati, West Bengal, India
[2]Sarat Centenary College, The University of Burdwan, West Bengal, India

Asian Journal of Agriculture and Development (AJAD) Vol. 20 No. 2 December 2023 complete lineup

ABSTRACT

This empirical study reveals that agriculture in West Bengal, a major state in India, is nonviable as a primary source of occupation for most agricultural households who have been distressed to diversify to the nonfarm sector. However, the underdeveloped rural nonfarm sector does not leave enough economic space for the distressed farmers to have a smooth and remunerative transition from agricultural to nonagricultural employment. Therefore, most farmers end up clinging precariously to the agriculture sector while engaging in nonremunerative activities in the rural nonfarm sector for sustenance. This article identifies several statistically significant drivers of employment diversification through a logit model and revisited the age-old farm-size agricultural productivity debate in India to conclude that agricultural production is not scale-neutral. Therefore, to make agriculture viable and sustainable, the average operational landholdings need to increase through reverse tenancy and/or cooperative farming and through creating gainful employment opportunities in the rural nonfarm sector. This will help farm-dependent, semi-marginal, and marginal agricultural households to transition from agricultural to nonagricultural occupations.

Keywords: farm viability, semi-marginal and marginal farmers, employment diversification, logit model
JEL codes: Q12, J210, J62

Contact A.K. Chattopadhyay apurbak.chattopadhyay@gmail.com https://doi.org/10.37801/ajad2023.20.2.4

INTRODUCTION

Agriculture continues to be a very crucial sector in India due to the inability of the country to shift the rural labor force to better-remunerated activities. However, the share of agriculture in India's GDP has been declining steadily over the years.[1] This may be reflected on the structural changes taking place in the Indian economy, which can be seen in the higher concentration of operational holdings in the hands of marginal and small farmers and in diversification in favor of high-value commodities (Joshi et al. 2004; Kundu and Chattopadhyay 2018).

Accordingly, instability and crisis in agriculture are key issues in the Indian economy (Nadkarni 2018; Deshpande and Arora 2010). Low agricultural productivity, unfavorable terms in agricultural trade, low level of capital formation, and higher incidence of indebtedness among the farm households have all contributed to the current agricultural crisis. This crisis and the resulting distress of farmers have increased the incidence of suicides (Suri 2006; Bhoi and Dadhich 2019). Farm nonviability and farmer suicides are highly linked with small and marginal farmers in several states of India (Manjaunatah and Ramappa 2017). This distress in farming has also led both cultivators and farm laborers to move from farm to nonfarm activities in search of diversified income sources (Basant 1994; Suri 2006; Bhaumik 2007; Viswanathan et al. 2012; Mathew 2012; Jatav and Sen 2013).

However, scholars have differing opinions on the causes of diversification of farm households. Some view diversification as a deliberate household strategy, whereas others consider it an involuntary response to crisis (Bhaumik 2007). Nadkarni (2018) found that employment opportunities in nonfarm sectors are not growing fast enough, and this has been the main reason behind the crisis in Indian agriculture. Using unit-level data from the *National Sample Survey* for the period 1993–2010, Jatav and Sen (2013) found a declining trend in self-employment in the farm sector, which is compensated heavily by increased casualization in the farm and the nonfarm sectors. Further, the casual wage of male workers in the nonfarm sector was lower than the wage labor in the agriculture sector. As such, there is dispossession of land-based livelihoods, and farmers' diversification from the agriculture to the non-agriculture sector is distress-driven.

Based on a primary survey in two districts of West Bengal, India, Bhaumik (2007) found two types of nonfarm activities: low labor productivity activities and high labor productivity activities. The former serves as a residual source of employment and income to some rural households. Therefore, most farmers belonging to the semi-marginal and marginal size classes of landholdings are under "compulsion to access employment opportunities in the nonfarm sector." On the other hand, farmers with higher land size can augment their income by accessing "high labor productivity activities" in the nonfarm sector.

The main workforce participation rate in agriculture (both cultivators and farm laborers) in India has declined from 69.8 percent in 1971 to 49.8 percent in 2011. In West Bengal, the decline is more pronounced from 73.8 percent to 40.4 percent during 1981–2011. Meanwhile, the share of agriculture in the net state domestic product declined from about 34.6 percent to 19 percent in the period 1993–2015 (GOWB 2018).

Meanwhile, farm households in West Bengal have the lowest monthly net receipts from cultivation (i.e., INR 979) among all the major states in India; it is about 10 percent of the net receipts of farm households in Punjab. Further, West Bengal farmers' monthly income (INR 3,980) from all sources is not sufficient to cover their monthly consumption expenditure (INR 5,888). Other states where the farm households' average monthly total income from all sources is less than their average monthly consumption expenditure include Bihar, Orissa, Rajasthan, and Uttar Pradesh (NSSO 2016a). Furthermore, 96.2 percent of West Bengal farm households belong

1 The share of agriculture in India's GDP has declined from over 60 percent in the 1950s to 18–14 percent at present.

to the marginal (>1 ha) and small farmers (1–2 ha) category, and these farmers cultivate about 80 percent of the operated land (DES-M/o Agriculture & FW 2019).

As mentioned, several researchers have found that the rural workforce has diversified from farm to nonfarm activities (Bhalla 2002; Lanjouw and Shariff 2004; Bhaumik 2007; Kumar 2009; and Reddy et al. 2014). However, few studies have tried to examine the nature and causes of employment diversification in the agricultural households of West Bengal. Further, more than 60 percent (50% in India) of the main workers in rural areas are engaged in other farm activities in West Bengal (and India) (GOI 2011).

Thus, examining the causes of rural employment diversification is different from examining the causes of farmers' employment diversification. In this empirical study, our main objective is to examine farm viability in terms of the capability of farm income to support farm households' consumption expenditures along with average cost of cultivation. We also aim to identify the significant factors pushing the farmers to take nonagricultural jobs or to migrate to urban areas either within or outside the state.

METHODOLOGY

For the data collection for this study, we purposively selected the following five central districts in West Bengal: Birbhum, Burdwan, Hoogly, Murshidabad, and Nadia. These districts cover 35.2 percent of the net sown area, 36.8 percent of the total food grain production, 31.7 percent of the workforce participation in agriculture, 64.0 percent of the canal irrigated area, and 59.6 percent of deep tubewells (GOWB 2013). The districts are more advanced than others in terms of the above five parameters, and, thus, any major changes in these district clusters will significantly affect the entire state.

We adopted a three-stage stratified random sampling method to select the household respondents. This selection process comprises community development blocks as the first stage-sampling unit, village as the second-stage unit, and operational holding as the third stage unit.

In the first stage, we calculated the composite ranks (CR) of all the blocks (111 blocks) in the five districts vis-à-vis the three area-invariant parameters, namely: (1) productivity of paddy, jute, mustard, and potato;[2] (2) ratio of gross irrigated area to gross cropped area; and (3) workforce participation rate in agriculture.[3] We categorized all the blocks using three benchmarks, namely: blocks with high CR, medium CR, and low CR. Thereafter, we selected two blocks from each category.

After selecting the blocks, we consulted block-level and village-level government officials in the selection of the gram panchayats and villages for our primary survey. Based on the outcome of our discussion with the officials, we selected two villages from each block such that one village is agriculturally developed while the other is agriculturally backward. Thereafter, we randomly selected 50 farm households from each selected village. Thus, the total number of sample households or the sample size is 600. This sample size is accepted at less than 5 percent level of significance following Yamane (1967).

For the analysis, we examine the household monthly consumption expenditure in relation to the definition provided by the NSSO (2016b). We also examine the variations in farm productivity,[4] asset holding,[5] crop diversification (transformed

2 These four crops covered about 76–96.5 percent of the gross cropped area in these five districts during the period 2000–2014 (GOWB 2014). Here, we use productivity instead of area of cultivation and production because productivity is an important factor of farm viability, and rising productivity is associated with the increasing probability of making a farm viable (Singh, Bullar, and Joshi 2009).

3 Our aim is to identify farmers' economic condition; the farmers' participation rate in cultivation constitutes a significant factor in selecting the appropriate blocks for the primary survey. As such, we used 2011 census data for this purpose.

4 We incorporate monsoon and summer paddy as these crops cover 71.86 percent of the gross cropped area.

5 Both household assets (e.g., TV, cable line, stove, liquefied petroleum gas, cooker, cycle, motorcycle, etc.) and agricultural assets (e.g., pump set, tractor,

Herfindahl index), cropping intensity, and farm viability among different landholder categories by using Fisher's *t*-test statistics. The reasons for these variations are then determined by using different statistical tools and techniques. Accordingly, the categories of landholdings are as follows: *semi-marginal* (<0.5 ha), *marginal* (0.51–1.0ha), *small* (1.01–2.0 ha), *semi-medium* (2.01–4 ha), *medium* (4.01–10.0ha), and *large* (>10 ha). Note that a farm is considered viable only if the net profit earned from cultivation is greater than the sum of family consumption expenditure and average cost of cultivation (Nadkarni 2018).

In our study area, only about 19 percent of semi-marginal, 21 percent of marginal, 34 percent of small, 26 percent of semi-medium, and 27 percent of medium farmers are engaged in agriculture. Thus, most farmers have diversified into nonfarm activities while still engaging in farm activities, which may indicate insufficient return from agriculture for livelihood sustenance.

We subsequently examine the reasons for this diversification from farm to nonfarm activities by using a logit model.[6] The model includes seven quantitative variables and six qualitative variables:

X^{CD} = crop diversification

X^{ED} = educational level of the head of the household

X^{AFM} = total adult earning member in the family

X^{CEAI} = proportion of household consumption expenditure met with agricultural income

X^{DNFFI} = difference of nonfarm income from farm income (in '000 INR)

X^{REGSI} = total MGNREGS[7] income of the household (in '000 INR)

X^{AP} = average productivity of paddy per hectare

$D^{SEMR\&MR}$ = dummy variable for households with semi-marginal and marginal land size; $D^{SEMR\&MR}$ = 1 when landholder is in *SEMR & MR* category, and $DS^{EMR\&MR}$ = 0 for other categories

$D^{SEMD\&MD}$ = dummy variable for households with semi-medium and medium land size; $D^{SEMD\&MD}$ = 1 when landholder is in *SEMD & MD* category, and 0 otherwise

D^{DV} = distance of village from the nearest city; D^{DV} = 1 when it is nearer to the city and 0 otherwise

D^{AS} = agriculture status of selected village; D^{AS} = 1 for agriculturally developed village and 0 otherwise

D^{CTGEN} = farmer's caste category: general; D^{CTGEN} = 1 for general categories of farmers and 0 otherwise

$D^{CTSC\&ST}$ = caste types of farmers: scheduled caste and scheduled tribes (*SC & ST*) or otherwise

The logit model may be written as

$$Y_i = \begin{cases} 1, & Y_i^* \geq 0 \\ 0, & Y_i^* < 0 \end{cases}$$

where, $Y_i^* = \beta X_i + u_i$, Y_i^* is a latent variable or an unobservable utility index, i.e., it can take any value between $(-\infty, +\infty)$; i = 1, 2, ………, 600.

Therefore, $Pi = Pr(Yi = 1) = Pr(ui \leq \beta X)$.

In the logit model, we assume that the probability distribution of u_i follows the logistic probability distribution. Therefore,

$$P_i = \frac{1}{1 + e^{-Y_i^*}} \text{ for } Y_i = 1$$ (probability of accepting both farm and nonfarm activities) and

power tiller, and thresher) are considered based on the definition of NSSO (2016a).

6 We use a logit model instead of a probit model due to the following reasons: (1) the binary outcome is not normally distributed based on the results of the Shapiro-Wilk and Shapiro-Francia normality tests that we conducted, and (2) some studies (Lanjouw and Shariff 2004; Kumar 2009) used this model to examine the reasons for rural employment diversification.

7 The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) is a government-guaranteed employment scheme.

$$1-P_i=\frac{1}{1+e^{Y_i^*}} \text{ for } Y_i=0$$ (probability of accepting only farm activities).

To create the model linear in *Xs* and in the coefficients, we use a simple transformation to show the probability of a farmer accepting both farm and nonfarm activities against the probability of a farmer accepting only farm activities (odds ratio). This can be expressed as

$$\frac{P_i}{1-P_i}=e^{Y_i^*}.$$

Now, the multivariate logistic regression equation is

$$L_i=\ln\left(\frac{P_i}{1-P_i}\right)=Y_i^*=\beta X_i+u_i. \quad (1)$$

That is,

$$Y_{ile}^*=\gamma_{ile}+\delta_{ijle}\{\textstyle\sum_{k=1}^{8}X_{ile}^{k}+\sum_{n=1}^{4}D_{ile}^{n}\}+u_{ile}.$$

where:

- Y = dummy variable (Y = 1 for farm households engaged in both farm and nonfarm activities, and Y = 0 for farm households engaged in only farm activities);
- i = number of observations (total farmers = 600; *SEMR & MR* = 461; *small* = 76, and *SEMD & MD* = 63);
- l = types of landholding (all types of farmers, i.e., *SEMR & MR*, small, and *SEMD & MD*);
- e = number of equations in model 1 (1a, 1b, 1c and 1d};
- j = slope parameters (1, 2, …., 12);
- k = number of quantitative variables; and
- n = number of dummy variables.

To avoid the problems of multicollinearity and simultaneity, we have derived five separate equations in model 1 to identify the impacts of the independent variables on the respective dependent variables (Bhaumik 2007; Kundu and Chattopadhyay 2020).

DISCUSSION

Farm Viability

In our survey area, we find that the smallholders composed of semi-marginal, marginal, and small farmers operate about 89 percent (58.7%, 18%, and 12.7%, respectively) of the total landholdings. On the other hand, semi-medium, medium, and large farmers operate only about 11 percent of the land. It is also revealed that in most farmers (about 78%) with both farm and nonfarm incomes, farm income constitutes only 35 percent of their total income; the combined share of nonfarm and migration income is about 65 percent.

Farming is said to be viable if the farm income can meet the consumption expenditure of a farm household. According to Nadkarni (2018), the income from a sufficiently viable farmholding should be able to meet the expenses for the current input costs while meeting the family's consumption needs. It should also be able to protect itself from any production shock.

To examine farm viability, we will discuss the *difference of farmers' income* and the *consumption expenditure* of different landholder categories with respect to the (1) *farmer group who earn mostly from cultivation* and (2) *farmer group who earn mostly from nonfarm sources and from cultivation*.

Farmers with Major Earnings from Cultivation

Only about 22 percent of farm households in our sample earn mostly from agriculture. They supplement their earnings by working under the government-guaranteed employment scheme (MGNREGS) for a number of days. Some also earn by working as laborers on others' farms. However, they do not have any nonfarm income source or migratory income. On the other hand, most farm households (78%) earn from nonfarm activities within the village and/or by migrating outside the village.

Table 1. Average annual income and expenditure across different categories of landholders (without nonfarm and migrated income)

Landholder Types	Share of Average Annual Income from Several Sources (%)			Annual Income from All Sources (INR)	Annual Consumption Expenditure (INR)	Consumption Expenditure Met by Farm Income (%)	Annual Saving Potential (INR)	Average Cultivation Cost #(INR)	Sample Households (%)
	Cultivation	MGNREGS	Farm Labor						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Semi-marginal	77.11	16.31	6.58	55,835	54,714	78.69	1,121.05	9,909	18.75
Marginal	86.73	10.83	2.44	62,247	60,901	88.65	1,346.07	18,435	21.30
Small	89.99	10.01	0	77,203	57,500	120.83	19,702.77	29,885	34.21
Semi-medium	97.80	2.20	0	135,753	103,082	128.79	32,671.52	85,269	25.58
Medium	92.25	7.75	0	191,886	119,525	148.10	72,360.58	118,308	30.00

Notes:

(1) # average cost of cultivation is derived by dividing annual cost of cultivation by cropping intensity of the respective size class.

(2) MGNREGS = Mahatma Gandhi National Rural Employment Guarantee Scheme

We first examine the viability of farm households without any nonfarm income. Table 1 presents empirical data on the difference of *average annual income* and *expenditure* across the different landholder categories.

Our findings show that *income from cultivation* alone cannot meet the *annual consumption expenditure requirements*. Only about 79 percent and 89 percent of annual consumption expenditures are met from the farm income of the *semi-marginal* and *marginal* farm households, respectively. These farmers' subsistence depends on their earnings from schemes under the MGNREGS and from their wages as farm laborers. Thus, for *marginal* and *semi-marginal* farm households, farming is not considered viable. However, since the *annual farm income* of the other farmer groups is higher than their respective *consumption expenditure*, being *small*, *medium*, and *semi-medium* farmers appear to be viable if one narrowly defines viability in terms of meeting family's consumption expenditure only (Table 1). Therefore, under this definition, the size of landholding is positively related to farm viability. Deshpande and Prabhu (2005), Bhaumik (2007), and Mathew (2012) also had similar findings.

Our study also seems to indicate that the minimum farm size required for sustainable agriculture is 1 ha (i.e., small farm). Therefore, for about 77 percent of the farm households belonging to *semi-marginal* and *marginal* groups (land size < 1 ha), agriculture is deemed unviable.

However, if we define the farm viability in terms of earning an income from cultivation that is sufficient to cover not only the annual consumption expenditure but also the average cost of cultivation, then none of the farm households under consideration can be termed as viable. Even when we add the incomes coming from all sources, the potential savings of each farmer group would still fall short of their respective average cost of cultivation. As such, resorting to agricultural credit or incurring net dissavings are the only options for these farmers to be able to continue their agricultural pursuit.

The *National Sample Survey Reports* (NSSO 1987; 1998; 2005; 2016b) have revealed that the incidence of indebtedness of cultivators in the rural area has been gradually increasing from 22.3 percent in 1981 to 35 percent in 2012. This may be one of the reasons why farm households diversify into the rural non-agriculture sector or migrate outside the village for alternative income sources.

Farmers with Major Earnings from Nonfarm Sources

In this section, we examine the difference between annual income and consumption expenditure of the different landholder groups.

In our study, we call the income from nonfarm activities outside the respondents' village *migration income*. Table 2 presents the results of our survey on the difference of the annual income and expenditure of the different landholder groups, whose income is derived from *nonfarm activities*, *cultivation*, *MGNREGS*, and wages from working as *farm laborers* (wherever applicable).

Accordingly, we find that income from *cultivation* alone comprises only 25–39 percent of the average annual income of the farm households. In the *small* farmer group, even when the incomes from *MGNREGS* and from *cultivation* are combined, their income shares increase only to about 44 percent; in all the other farmer groups, the corresponding shares are even less.

Income from *cultivation* can cover about 78 percent and 71 percent of the consumption expenditures of the *semi-medium landholders* and *medium landholders*, respectively. However, for most farm households, income from cultivation covers less than 45 percent of the respective consumption expenditures (column 7, Table 2). The supplementary income from *MGNREGS* and *farm wages* do not make the picture substantially better. Therefore, agriculture is nonviable for all the farmers surveyed (78% of the households surveyed) regardless of the size of their farmholding. The nonviability of the agriculture sector to sustain their livelihoods may be one of the most important reasons for shifting to nonfarm activities.

Interestingly, except for the *semi-medium* and *medium* farm households, the other farmer groups in this study do not earn enough from nonfarm activities to cover their respective annual consumption expenditures (column 8, Table 2). This implies that the nature of available work in the nonfarm sector for the *semi-marginal*, *marginal,* and *small* farm households are not remunerative enough to induce them to leave farm activities altogether in favor of nonfarm activities. Otherwise, this would have allowed workers to successfully transition in line with the classical model of economic development.

It appears that farm households are diversifying from farm to nonfarm employment as a coping mechanism when farming is a nonviable option. This diversification strategy may have also led to the decreasing overall growth rate of cropping intensity (*CI*) and crop diversity (*CD*), which, in turn, contributes to the decreasing

Table 2. Variations in the average annual income and expenditure of the different landholder categories (farmers with nonfarm and migrated income)

Landholder Type	Share of Average Annual Income from Several Sources (%)				Annual Income from All Sources (INR)	Consumption Expenditure Covered by Different Sources (%)		Annual Consumption Expenditure (INR)	Annual Saving Potentiality (INR)	Average Cost of Cultivation (INR)
	Cultivation	MGNREGS	Farm Labor	Nonfarm* & Migration		Cultivation	Nonfarm* & Migration			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Semi-marginal	24.87	7.21	1.51	66.42	78,327	31.01	82.82	62,818	15,509	12,719
Marginal	35.80	6.38	0.98	56.84	90,319	44.56	70.75	72,564	17,755	23,831
Small	39.01	4.51	0.00	56.48	126,625	59.57	86.24	82,926	43,699	42,950
Semi-medium	37.80	1.57	0.00	60.63	259,772	78.36	125.68	125,314	134,458	77,607
Medium	37.09	2.69	0.00	60.22	338,868	71.09	115.43	176,795	162,073	129,964

Notes: * Nonfarm income consists of small or big business (ownership or partnership), self-employment, service (government or private), assets income, and casual labor in nonfarm sectors, etc.

Table 3. Differences in cropping intensity and crop diversification of different landholder categories

Landholder Types	CD of All Farm HH	CD of Farm HH with Nonfarm and Migrated Income	CD of Farm HH without Nonfarm and Migrated Income	CI of All Farm HH (%)	CI of Farmer Group with Nonfarm and Migrated Income (%)	CI of Farm HH without Nonfarm and Migrated Income (%)
Semi-marginal	0.38	0.36	0.48	155.46	151.87	170.56
Marginal	0.43	0.40	0.53	148.67	144.49	164.12
Small	0.43	0.42	0.46	152.14	150.66	154.99
Semi-medium	0.41	0.39	0.48	163.52	161.78	168.59
Medium	0.45	0.41	0.55	146.38	138.50	164.78
Average of all types of landholders	0.42	0.40	0.50	153.23	149.46	164.61

Notes: CD = crop diversity (%); CI = crop intensity Index

agricultural growth. Table 3 clearly shows that the *CI*s of all farm household groups without any nonfarm income source are higher than the farm households with nonfarm earnings as the main income source. The average *CI* of the group without nonfarm income sources is 164.61 percent while it is 149.46 percent in the other group of farmers. This is also true for *CD*.

These observed features may have adversely affected the overall cropping intensity, annual growth rate of production, and yield rate of total food grain in the study area. During the period 1990–2001, the compounded annual growth rate of cropping intensity in West Bengal was 0.97 percent; it reduced to 0.45 percent in the period 2000–11. Similarly, the annual compounded growth rate of production of total food grain decreased from 2.1 percent to 1.2 percent, and the yield rate decreased from 2.5 percent to 1.8 percent during the same period (GOWB 2013).[8]

Determinants of Farmer Employment Diversification from Farm to Nonfarm Activities

The existing literature has revealed that low returns from agriculture, high poverty rate, and mismatch between income from cultivation and consumption expenditures are some of the reasons for the employment diversification from farm to the nonfarm sectors in the rural area of India (Lanjouw and Shariff 2004; Bhaumik 2007; and Reddy et al. 2014). Accordingly, we find that about 78 percent of farmers in West Bengal engage in nonfarm activities in addition to farm activities.

We now examine the reasons for the high rate of farmer employment diversification by using a logit model (Table 4). The results of Fisher's *t*-test reveal that the mean value of *Y* is not significantly different between *SEMR & MR* farmers (0.64) and *SEMD & MD* farmers (0.72); we consider them jointly.

Thus, we derive four separate logit models (all farmers, semi-marginal and marginal farmers combined, small farmers, and semi-medium and medium farmers combined) to identify the specific determinants of the high diversification rate of the different farmer groups in West Bengal.

Table 4 reveals that *level of education of the head of the household* (X^{ED})*, household with SEMR & MR land size* ($D^{SEMR\&MR}$)*, total number of adults earning members* (X^{AFM})*, and difference of nonfarm and migrated income from agriculture income* (X^{DNFFI}) have positive and statistically significant impact on diversification.

Note that X^{ED} is the proxy of the educational level of the respective family members, and it may indicate the "skill level" of the head of the household and those of the other family members. Therefore, the higher the educational level, the greater the intention would be to move toward

8 As per the availability of the secondary data

nonfarm activities to get higher and less uncertain income source compared with the income earned from farm activities. The marginal effect is lowest (0.05) in the *SEMR & MR* farmers since this group has the lowest average educational level.

Further, the marginal effect of households with *SEMR & MR* land size is 0.11, which is significant and positive; the marginal effect of households with *SEMD & MD* land size is positive (0.08) albeit not significant (rows 2 and 3 in Table 4). This implies that the diversification rate of the farmers belonging to the *SEMR & MR* farm size is higher than that belonging to the *SEMD & MD* size class.

On the other hand, the *proportion of household consumption expenditure met with agricultural income*

Table 4. Mean value and marginal effect corresponding to logit model (equation 1#)

Sl. No.	Explained and Explanatory Variables	Mean Value				Marginal Effect (dy/dx)			
		All Farmers	SEMR and MR	Small	SEMD and MD	All Farmers	SEMR and MR	Small	SEMD and MD
		(1)	(2)	(3)	(4)	(1-A)	(2-A)	(3-A)	(4-A)
	Y = dummy dependent variable	0.77	0.80	0.66	0.73				
1	Education level of head of HH (XED)	3.02	2.91	3.05	3.74	0.07* (0.02)	0.05* (0.02)	0.12** (0.05)	0.11* (0.03)
2	HH with SEMR & MR land size (DSEMR&MR)	0.768	@	@	@	0.11* (0.04)	@	@	@
3	HH with SEMD & MD land size (DSEMD&MD)	0.072	@	@	@	0.08 (0.07)	@	@	@
4	Total earning adult member in the family (XAFM)	2.60	2.71	2.20	2.29	0.06* (0.02)	0.08* (0.02)	0.05 (0.07)	–0.01 (0.05)
5	Average productivity of paddy per hectare in quintal (XAP)	1.40	1.39	1.40	1.44	–0.31* (0.06)	–0.29* (0.06)	–0.24 (0.20)	–0.43** (0.21)
6	Distance of village (DDV)	0.50	0.50	0.45	0.57	–0.02 (0.03)	–0.02 (0.03)	–0.16 (0.26)	0.07 (0.12)
7	Crop diversification (XCD)	0.40	0.39	0.43	0.42	–0.23* (0.07)	–0.14** (0.06)	–0.65 (0.52)	–0.31 (0.23)
8	Proportion (%) of HH consumption expenditure met with agricultural income (XCEAI)	47.98	36.61	70.87	103.61	–0.005* (0.001)	–0.006* (0.001)	–0.03* (0.01)	–0.002* (0.001)
9	Caste types: General (DCTGEN)	0.63	0.58	0.74	0.83	–0.01 (0.04)	–0.02 (0.03)	0.40 (0.29)	–0.06 (0.20)
10	Agriculture status of selected village (DAS)	0.50	0.50	0.54	0.52	0.001 (0.02)	–0.02 (0.01)	0.21 (0.11)	0.01 (0.06)
11	Difference of nonfarm and migrated income from agriculture income	32.72	28.82	25.09	70.46	0.003* (0.0003)	0.002* (0.001)	0.005* (0.002)	0.001* (0.0003)
12	in ‘000 INR (XDNFFI)	0.16	0.20	0.09	@	0.02 (0.05)	0.02 (0.05)	–0.22 (0.17)	@
13	Caste types: SC & ST (DCTSCST)	5.84	6.01	5.71	4.73	–0.01* (0.003)	–0.017* (0.003)	–0.018*** (0.01)	0.004 (0.005)
	No. of observations	600	461	76	63	600	461	76	63

Notes: (1) "@" means that there is no change in the respective value of variable in the respective model.

(2) *, **, and *** indicate that the value is significant at the 1 percent, 5 percent. and 10 percent levels, respectively.

(3) Values in parentheses represent robust standard errors.

(4) HH = household

SC & ST = scheduled cast and scheduled tribes caste type; SEMR & MR = semi-marginal and marginal farmers; SEMD & MD = semi-medium and medium farmers

(X^{CEAI}) of the *SEMR & MR* landholders is lower than that of the *SEMD & MD* landholders (Table 2). Accordingly, the marginal effect of X^{CEAI} (row 8, Table4) is negative and significant; this value is higher in the *SEMR & MR* landholders (−0.006*) than in the SEMD & MD (−0.002*). Therefore, the diversification of the farmers belonging to the *SEMR & MR* farm size from farm to nonfarm employment is distress-driven; however, this is not true in the *SEMD & MD* landholders.

The marginal effect of *total adult earning members in the family* (X^{AFM}) in *all types of farmers* is significant and positive (0.06*). This implies that the higher the number of earning members in the household, the greater the possibility would be that the household will have employment diversification. Bhaumik (2007) also found a similar relationship.

The marginal effect of X^{AFM} is higher and statistically significant (0.08*) in *SEMR & MR* farmers, while it is not significant in the other two farmer groups (row 3, Table 4). This may be because the very small and unviable size of landholdings induces workers to seek work in the nonfarm sector to supplement their farm income for their sustenance.

The *total number of earning adult members* is higher in the *SEMR & MR* farm households (2.71) than in the *small* (2.20) and *SEMD & MD* farmers (2.29). Further, about one-third of the farmers looking for nonfarm employment have to go outside their village (to other districts and even to other states) for employment because the local rural nonfarm sector can no longer absorb those surplus farm laborers. Our results show that the proportion of laborers out-migrating is higher in the marginal, semi-marginal, and small landholding classes than in the other landholding classes (25% in the semi-medium and 7% in the medium). The former group is mainly employed as casual or contractual laborers in the construction sector, hotels, mills, wholesale or retail shops, jewelry shops, etc., whereas the latter worker group is mostly engaged in the formal services sector.

Another statistically significant factor leading to diversification toward nonfarm sector is the *difference of nonfarm and migrated income from agriculture income* (X^{DNFFI}). The optimizing behavior of the farm households lead them to get nonfarm activities wherever available to maximize their utility.[9]

Assuming that farmers behave rationally, they would accept having higher remunerative source of income. The contribution of nonfarm income is higher than that of farm income in all types of farmers having both sources of income (Table 2). Thus, the marginal effect of the difference of nonfarm and migrated income from agriculture income (X^{DNFFI}) is positive and significant (Table 4). Note that the marginal effect of X^{DNFFI} is highest in the *small farmer* group (0.005*) followed by the *SEMR & MR* (0.002*), and then *SEMD & MD* (0.001**).

Further, if we calculate the corresponding elasticities of employment diversification with respect to X^{DNFFI}, then it will be 0.19 percent in the *small farmers*, followed by 0.1 percent and 0.07 percent in the *SEMD & MD* and *SEMR & MR* farmers, respectively. The reason small farmers are relatively more responsive may be due to their indebtedness and the quality of their engagement in the nonfarm sector vis-à-vis other groups of farmers. Although more than 63 percent of *small farmers* are in debt, less than 50 percent of *SEMD & MD* farmers are indebted; the corresponding figure is about 41 percent in the *SEMR& MR* farmers. Further, the income earned by the *SEMR*

9 Let us assume that $U = f(C, W)$ and $C = f(YNF, YF) = W$; where U is the utility or the satisfaction obtained by farm households from their level of consumption expenditure (C) and weighted sum of asset holding (W). Note that C is a short-term factor and W is long-term factor. The levels of C and W are determined by the income obtained from farm (YF) and nonfarm (YNF) activities.

In our study, we find that $\log C = 1.62 + 0.52 \log YNF + 0.17 \log YF$ and $\text{Log} W = -2.75 + 0.67 \log YNF + 0.20 \log YF$. This implies that nonfarm income is more important for maintaining the standard of living of farm households (we consider only those farmers who have both types of income sources; the total number of observations is 465). For C, we find $R^2 = 0.62$, Adj $R^2 = 0.61$, and the *SE* of *YNF*, *YF*, and the constant term are 0.02, 0.01, and 0.12 respectively. For W, we find $R^2 = 0.49$, Adj $R^2 = 0.49$, and the *SE* of *YNF*, *YF*, and the constant term are 0.04, 0.02., and 0.19 respectively.

& MR farmers from nonfarm sources are mostly casual and non-remunerative in nature,[10] whereas the income earned by *small* and *SEMD & MD* farmers from nonfarm sources are steady and dependable since most of them are engaged in the formal sector.

Our model reveals another four significant factors having negative (inverse) impacts on the employment diversification (*ED*) of farmers. These are *average productivity of paddy per hectare* (X^{AP}),[11] *crop diversification* (X^{CD}), *proportion of household consumption expenditure met with agricultural income* (X^{CEAI}), and *total household MGNREGS income* (X^{REGSI}).

The *Farm Management Studies* data revealed an inverse relationship between farm size and average agricultural productivity in India, which consequently led to intense debates on the possible explanation of the observed phenomenon in the 1960s and 1970s. Based on the observed relationship, many scholars (Sen 1962, 1964; Mazumdar 1965; Saini 1971; Bardhan 1973; Chand, Prasanna, and Singh 2011) argued in favor of institutional reforms to support smallholders because they are more efficient. However, some scholars (Rao 1975 and Subbarao 1982) found a positive relationship between farm size and productivity. They explained the phenomenon in terms of more intensive use of fertilizer and other inputs on large farms. In our study, we find that paddy productivity is largest in the *SEMD & MD* farmers (1.44 q/ha) followed by *small* (1.40q/ha) and *SEMR & MR* (1.39 q/ha) farmers, i.e., productivity is directly related to landholding size (Table 4).

We then employ an OLS regression model to quantify the farm–size productivity relationship (Table 5). Our results reveal that in the *SEMD & MD* farmers, both *monsoon and summer* paddy productivity are positive and statistically significant (5.56* and 5.52*, respectively). This implies that paddy productivities in both seasons are directly related to the size of the operated landholding. However, in the *SEMR & MR* farmers, this relationship is negative and statistically insignificant.

This finding may be explained by the difference of the different farmer groups in their adoption of new technology and planting of high-yielding varieties (HYV). We find that crop loss during postharvest is least when farmers harvest crops with machinery rather than through manual labor. About 72.3 percent of the semi-medium and medium farmers use mechanical harvesters, whereas 46.7 percent of small farmers and only 39.6 percent of semi-marginal and marginal farmers use such mechanical harvesters. Further, although about 68.6 percent of semi-medium and medium farmers use HYV seeds, the corresponding figures are only 48.4 percent and 45.2 percent in the small farmers and marginal and semi-marginal farmers, respectively.

Thus, the value of the regression coefficient of *cost of seed* (X^{SC}) is significantly higher and positive in the *SEMD & MD* farmers (0.43* and 0.29* for *monsoon paddy* and *summer paddy*, respectively) than in the *SEMR & MR* landholders (0.37* and 0.11) (Table 5, row 3). Further, the coefficients of fertilizer costs are higher in both seasons in the *SEMD & MD* than in the *SEMR & MR* group (Table 5, row 4). This indicates that the former use fertilizer more intensively, thereby resulting in higher productivity. The same reasoning can be given in the case of *use of pesticide* (X^{PC}) (Table 5, row 5).

Although there is not much difference in the access to irrigation (63–67%) among all farmer categories, some differences can be found in the timely availability of irrigation water, whose main source is groundwater. Thus, about 78 percent of medium and semi-medium farmers have timely

10 *SEMR & MR* farmers' involvement in nonfarm activities include casual or contractual labor in construction sites, hotel, factory, etc.; in the informal sector (or self-employment), they earn income as hawkers, etc.

11 We use only paddy productivity to examine impact of crop productivity on farmers' employment diversification due to the following reasons:

1. Paddy is the common crop in all households in West Bengal.
2. The area under paddy and paddy production constitutes about 86 percent and 89 percent of the total food grain area and production in West Bengal, respectively (GOWB 2018).
3. Paddy covers about 72 percent of the gross cropped area in our study area.

Table 5. Farm size and productivity: OLS regression results

Sl No.	Explanatory Variables	Monsoon Paddy			Summer Paddy		
		All Farmer	SEMR and MR	SEMD and MD	All Farmer	SEMR and MR	SEMD and MD
1	Dummy variable SEMR & MR ($D^{SEMR\ \&MR}$)	−0.170 (0.700)	@	@	−1.6900*** (1.0400)	@	@
2	Dummy variable SEMD & MD ($D^{SEMD\ \&MD}$)	5.560* (1.340)	@	@	5.5200* (1.3600)	@	@
3	Seed cost (X^{SC})	0.300* (0.030)	0.370* (0.070)	0.43* (0.12)	0.1500** (0.0600)	0.11000 (0.07000)	0.290* (0.060)
4	Fertilizer cost (X^{FC})	0.060* (0.020)	0.050** (0.020)	0.14** (0.08)	0.0700* (0.0200)	0.06000** (0.03000)	0.090* (0.030)
5	Pesticides cost (X^{PC})	0.060* (0.020)	0.360** (0.090)	0.47* (0.14)	0.0400 (0.0500)	0.04000 (0.07000)	0.060 (0.050)
6	Tractor and bullock cost ($X^{T\&BC}$)	0.430* (0.060)	−0.050 (0.030)	0.54** (0.22)	0.0400 (0.0300)	0.08000** (0.04000)	−0.070 (0.050)
7	Irrigation cost (X^{IC})	0.120* (0.030)	0.070* (0.020)	0.56* (0.11)	0.0800* (0.0300)	0.07000** (0.04000)	0.060** (0.020)
8	Total labor cost (X^{TLC})	0.004 (0.005)	0.005 (0.005)	0.07*** (0.04)	0.0001 (0.0060)	0.00001 (0.01000)	−0.002 (0.008)
9	Constant	19.420* (1.770)	20.670* (0.005)	−17.60*** (9.63)	24.2600* (2.6800)	23.05000* (3.05000)	28.170* (3.180)
	Number of observations	572	436	63	193	139	29
	F value	53.250*	15.640*	14.46*	14.9300*	3.31000*	9.930*
	R^2	0.540	0.310	0.65	0.3900	0.13000	0.820
	VIF	1.330	1.110	1.23	1.4900	1.27000	1.380

Notes: (1) Here, @ means no change in the respective value of the variable in the respective model.
(2) *, **, and *** indicate that the value is significant at the 1 percent, 5 percent, and 10 percent levels, respectively.
(3) Values in parentheses indicate robust standard errors.
(4) *SEMR & MR* = farmers with semi-marginal and marginal farm size
SEMD & MD = farmers with semi-medium and medium farm size
VIF = variance inflation factor

(4) Our regression model:

$$Y_{ijk}^{pp} = \alpha_k + \beta_k \sum_{ijk=1}^{n} D_{ijk}^{v} + \gamma_k \sum_{ijk}^{n} X_{ijk}^{v} + u_i$$

Here, Y^{pp} = paddy productivity is dependent variable; i = monsoon paddy, j = summer paddy, k = all farmer, *SEMR & MR* and *SEMD & MD*, ($i \neq j \neq k$); n = (572,436, & 63) and (193, 139, & 29) for all farmers, *SEMR & MR* farmers, and *SEMD & MD* farmers in case of monsoon paddy and summer paddy respectively; D^v = dummy variables; and X^v = explanatory variables.

access to irrigation as they own their pump sets or submersible pump sets. Meanwhile, only 37 percent and 24 percent of small and marginal and semi-marginal farmers, respectively, have timely access to irrigation.

Semi-marginal and marginal farmers purchase their water requirements from semi-medium and medium farmers during the summer season; thus, *SEMR & MR* farmers have higher irrigation cost (X^{IC}) coefficient during this season. However, during the monsoon, *SEMR & MR* farmers depend more on monsoon water, and thus their X^{IC} cost coefficient is lower. However, the availability of monsoon water is unreliable; thus, the productivity of *SEMR & MR* farmers is less than that of the *SEMD & MD* farmers.

These are some of the very important reasons for the direct relationship between farm size and productivity. This also shows that new agricultural techniques are not scale-neutral. As an explanatory factor of employment diversification, X^{AP} is statistically significant, and its marginal effect is largest in *SEMD & MD* farmers (−0.43**) followed by *SEMR & MR* (−0.29**) and then small (−0.24) farmers (Table 4).

Crop diversification (X^{CD}), another explanatory factor, is relatively high in the small farmers (0.43), followed by the *SEMD & MD* (0.42), and then the *SEMR & MR* farmers (0.39) (Table 4, row 7). This is because more than 80 percent of *SEMR & MR* farmers are engaged in nonfarm activities, whereas only about 66 percent of *small farmers* and about 73 percent of *SEMD & MD* farmers have nonfarm jobs.

The dearth of available family labor to work on the farm has resulted in low crop diversification in the *SEMR & MR* farmers. Further, the value of the marginal effect of *CD* on *ED* is significant and negative in *SEMR & MR* farmers (−0.14**). Interestingly, this negative value is substantially higher in the *small* and *SEMD & MD* farmers (−0.65 and −0.31, respectively), albeit they are not statistically significant.

We can cite the following reasons to explain the negative marginal effect of crop diversification:

1. Crop diversification increases profitability and productivity per unit of land.
2. Crop diversification reduces the probability of crop failure.
3. Crop diversification improves the soil quality of land.

All these indicate that when *CD* is higher, the return from farming is also higher. As a result, there will be lower diversification toward nonfarm activities. Furthermore, the marginal effect of *CD* is significant only in the *SEMR & MR* farmers (Table 4, row 7) because the *CD* of *SEMR & MR* farmers without nonfarm income is significantly higher (0.50) than that of the *SEMR & MR* farmers with nonfarm income (0.38). In the case of *small farmers*, these indices are 0.46 and 0.42; in the *SEMD & MD* farmers, these are 0.51 and 0.40 in the farmers without nonfarm income and with nonfarm income respectively (Table 3).

The *proportion of household consumption expenditure met with agricultural income* (X^{CEAI}) is another important determinant of employment diversification. It can also be an indicator for measuring farm viability and farmers' indebtedness. Justifiably, X^{CEAI} is inversely related to farmer employment diversification.

The NSSO (2016a) revealed that in West Bengal, the monthly agricultural income (INR 979) of farm households can meet only about 17 percent of the average monthly consumption expenditure. Meanwhile, the total income from all sources (INR 3,980) can support about 68 percent of consumption expenditure (INR 5,888) and only 52 percent of total expenditure (INR 7,707), which includes monthly expenditure for crop production.[12] Meanwhile, the comparable figures at the national level (i.e., all of India) are 50 percent, 103 percent, and 76.36 percent respectively. Accordingly, our field survey data reveal the corresponding data as 46 percent, 143 percent, and 89 percent, respectively. Moreover, the total income (from all sources) of about 38

12 The corresponding figures are about 28 percent, 78 percent, and 62 percent, respectively, in West Bengal in 2003. At the national level, the figures are about 34 percent, 76.35 percent, and 60.37 percent, respectively (NSSO 2003).

percent of the farmers surveyed are able to cover their total expenditure. This implies that about 62 percent of the farmers would make up their income shortfall to support their total expenditure by borrowing or by incurring dis-savings. Interestingly, our survey data reveal that about 51.6 percent of the farm households are in debt, which is similar to the figure (51.5%) arrived at by the NSSO (2016a) pertaining to West Bengal. The above figure clearly reveals the poor state of West Bengal agriculture, which cannot even provide subsistence to agricultural households.

The *total MGNREGS income* of agricultural household (X^{REGSI}) is another significant factor that negatively affects employment diversification. We find that X^{REGSI} is higher in *SEMR & MR* (−0.017*) than in the small farmers (−0.018***) and in the *SEMD & MD* farmers (0.004) (Table 4). Further, we also find that the values of the marginal effects of X^{REGSI} are quite similar in *SEMR & MR* and *small farmers*, whereas it is positive but not significant in *SEMD & MD* farmers. Therefore, except for *SEMD & MD* farmers, a higher income from MGNREGS will reduce employment diversification. This would then help farmers to continue and stick with farming regardless of it being nonviable.

CONCLUDING OBSERVATIONS

The present state of agriculture in West Bengal is nonviable as a main source of occupation for most farm households in the state, where only about one-fifth of the farm households have major earnings from agriculture. However, the majority of them (i.e., semi-marginal and marginal farm households) cannot support their consumption expenditure through their net income from cultivation. For their subsistence, they need additional income support from the employment guarantee scheme (MGNREGS) and from earning as farm laborers. These farmers constitute two-thirds of the agricultural households who do not have any nonfarm income source.

Hence, under this narrow definition of farm viability, only the small, semi-medium, and medium farm households, which consist of the remaining one-third of agricultural households, are viable. However, if viability would be defined broadly to include the average cost of cultivation plus total consumption expenditure, then none of the agricultural households, regardless of their landholding size class, would be viable even after considering the additional earnings from MGNREGS and wages earned as farm laborers. As such, resorting to agricultural credit and/or incurring net dis-savings is the only option that remains for these farmers without nonfarm income sources.

In our study, we have found that about 52 percent of farmers have taken loans either from formal or informal sources. On the other hand, the remaining agricultural households (about 78%) comprising all types of landholdings have diversified into the nonfarm sector. Their farm incomes range between 25 percent and 39 percent of the total income, which could support about 31–78 percent of their consumption requirements.

Thus, agriculture, as the main occupation, is nonviable for all agricultural households regardless of size class of farming. This nonviability of agriculture may have been the principal reason for diversifying into the nonfarm sector, thereby reflecting this diversification as a mere coping strategy. Further, the earnings from nonfarm employment reveal that only the semi-medium and medium farmers earn enough to support their consumption expenditure through their nonfarm earnings. These agricultural households constitute only about 10 percent of the total agricultural household diversifying into the nonfarm sector.

Our study then reveals that agriculture is nonviable for the semi-marginal and marginal farmers in West Bengal, (which comprises about 77 percent of agricultural households in the region), whether they have nonfarm source of income or not. The nature and quality of nonfarm employment opportunities for these agricultural households are not remunerative enough to push them to completely leave the nonviable agriculture sector for the nonfarm sector. Otherwise, this would have allowed for the successful transition of workers in line with the traditional model of economic development. Consequently, they take up nonfarm jobs to supplement the income they get from agriculture and from other sources for subsistence. Employment diversification for them, therefore, may be distress-driven.

However, the available data also indicate that, together with semi-medium and medium farmers, small farmers earn enough from the nonfarm sector; hence, creating a saving potential to meet their corresponding average cost of cultivation. Engaging in the nonfarm sector makes farming viable in the broader sense of the term. This includes meeting the total consumption expenditure plus average cost of cultivation for this group of farm households, who constitute about 21 percent of the agricultural households in the region. It also indicates that under existing conditions, small farm units (1–2 ha) are the minimum farm size required for sustainability.

About 78 percent of the agricultural households have undertaken employment diversification (*ED*) mostly as a coping strategy. Accordingly, we have tried to investigate the significant factors (apart from farm size) behind such a move. Our results show that the *level of education of the head of the household* (X^{ED}), *total adult earning member in the family* (X^{AFM}), and the *difference of nonfarm and migrated income from agricultural income* (X^{DNFFI}) are significant factors; they are positively associated with *ED*. On the other hand, *average productivity of paddy* (X^{AP}), *crop diversification* (X^{CD}), *proportion of household consumption expenditure met with agricultural income* (X^{CEAI}), and *total MGNREGS income of the household* (X^{REGSI}) are negatively associated with *ED*. We have also found that X^{CEAI}, X^{REGSI}, and X^{DNFFI} are the most crucial factors driving *ED*. If we will drop these variables from our analysis, then either Wald χ2 value will be insignificant or the R^2 value will be negligible in major cases of our logit model.

It is common to argue that the net income from cultivation can be increased by improving land productivity and by reducing cultivation cost. The former could be achieved by increasing both crop diversity and intensity; the latter through modern production techniques, agricultural credit, and agricultural infrastructure (e.g., storage capacity and marketing channels), particularly for the semi-marginal, marginal, and small farmers.

The prevailing policy of minimum support price (MSP)[13] has not benefited the majority of the small and marginal farmers. For example, only 5–8 percent of the semi-marginal and marginal farmers in West Bengal benefit through the MSP policy from the sale of paddy, 15–29 percent from the sale of wheat, and 9–14 percent from the sale of mustard (NSSO 2016a). This implies that the policy does not have a significant impact on the earnings of West Bengal farmers.

Generally, the average size of landholdings needs to increase to remove the preponderance of the semi-marginal and marginal operational landholdings. Accordingly, this will require reverse tenancy and/or cooperative farming along with gainful employment opportunities in the rural sector. The latter will help farm-dependent households to shift naturally to nonfarm activities. Policy and decision makers also need to encourage food processing industries and to facilitate the establishment of farmer–producer linkage through contract farming. This would also require institutional mechanisms and government support such that farmers will not be exploited by capitalist producers during market shocks. Likewise, monetary and nonmonetary government incentives should be established to spread rural small-scale industries and to immediately improve infrastructures that cater to both farm and nonfarm rural sectors.

ACKNOWLEDGMENT

We thank the University Grants Commission, India, for its financial support for the major research project (No. F.5-419 / 2012[HRP]) conducted at the Department of Economics and Politics, Visva-Bharati. We also thank Dr. Amit

13 MSP for major agricultural products is an important policy instrument of the government of India, which guarantees the farmers a minimum price for their produce and thus protects them from market volatility. It is also the price at which government buys surplus coming in the market and helps create a buffer stock.

Mandal, project fellow, for helping the authors in collecting primary data for the research project, of which this paper was one of the outcomes.

The authors also gratefully acknowledge the suggestions of the anonymous referees in finalizing this paper.

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