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Challenges, Options and Strategies for Doubling Farmers' Income in West Bengal – Reflections from Coastal Region

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Abstract

Despite leading in production of many important agricultural commodities, the income of agriculture-dependent households remained one of the lowest (₹ 3980/ month per households) in West Bengal and far below the national average (₹ 6426/month/household). The paper has analysed the past performance of agriculture sector in the state's economy from the available secondary data and also has looked into effectiveness of the existing price policy. Besides, technology options, agricultural market scenario/linkage have been analysed through primary information from the most vulnerable group of farmers in the coastal region to understand how far doubling of income was achievable. However, the micro-level households' data analysis has indicated ample opportunities to increase farmers' income through enhancing cropping system intensification. Technology options are also available for increasing cropping intensities. The agriculture sector needs policy thrust like attracting private investment, value addition to agricultural commodities and marketing innovations. The paper has concluded that doubling of farmers' income in West Bengal is a challenging tasks, particularly due to low agricultural growth (< 2%), lack of market innovations and private investment, but is achievable. The real concern for the farmers in the state was not only to achieve higher (double) income for farmers but also to sustain the enhanced farmers' income which is inclusive across the farmers' groups.

Key words: Doubling farmers' income, coastal agriculture, West Bengal

JEL Classification: Q18, Q12

Introduction

The agriculture sector received an unprecedented 84 per cent hike in budget allocation (₹ 47,912 crores) during the financial year 2016-17 and the goal was to look beyond food security to doubling farmers' income by 2022. First time '*Krishi Kalyan Cess*' @ 0.5 per cent on all taxable services has been proposed in the budget (GoI, 2016). The farm sector deserved the allocation towards achieving 'income security' of the millions of smallholder farmers in the country. The economy of West Bengal largely depends on the agricultural output as nearly half (44%) of the active workforce thrives on agriculture being either primarily cultivators or agricultural labourers[1] (NSSO, 2014). Over the years

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[1] Cultivators were defined as an agricultural household for this survey was defined as a household receiving some value of produce more than Rs.3000/- from agricultural activities (e.g., cultivation of field crops, horticultural crops, fodder crops, plantation, animal husbandry, poultry, fishery, piggery, bee-keeping, vermiculture, sericulture etc.) and having at least one member self-employed in agriculture either in the principal status or in subsidiary status during last 365 days. Agricultural labourers were defined as a person is considered to be engaged as agricultural labour, if he/ she follows one or more of the following agricultural occupations in the capacity of a wage paid manual labour, whether paid in cash or kind or both: (i) farming (ii) dairy farming (iii) production

the dependency on the agriculture sector has not changed significantly. More and more cultivators are leaving farming, but remain dependent on agriculture as agricultural labourers in the absence of alternative gainful employment opportunities. Simultaneously, the contribution of agriculture sector to the state's Net State Domestic Product (NSDP) has decelerated sharply (from 25% to 16% during 2004-05 to 2014-15), indicating low productivity of the agricultural workforce.

West Bengal was one of the leading states in India in terms of agricultural area and production of many major crops like paddy, potato, jute, fish, fruits and vegetables. Despite leading in production of these commodities, the income of agriculture-dependent households is one of the lowest in the country. In fact, agricultural households' income level in the state is ranked 27th among all states (only above Bihar) and they earn less than one-fourth of the income that farmers in Punjab (₹ 18059/households) (NSSO, 2016).

One of the key impediments to increase the farmers' income in the state is attributed to small (14%) and marginal (82%) landholdings and farmers operate less than a hectare of land (0.77 ha) (*Agricultural Statistics at a Glance*, 2016). With these marginal landholdings, farmers produce low volume of marketable surplus, hence receive low return from their farming business. Therefore, they are incapable to increase their investment in agriculture. The farmers operate under diverse socio-economic conditions that affect their decisions to adopt new technologies. The socio-economic factors like input prices, market environment, fragmented and small/marginal landholdings, availability of own or hired human labour, labour wage rates, financial and credit needs, availability and capacity to absorption of credit, risk preferences, etc. all affect the adoption behaviour towards new technologies. The resource-poor farmers are naturally risk averters and prefer a lower outcome which is relatively certain to the prospect of a higher return with which a greater degree of uncertainty is attached. In general, the farmers in the state are in distress due to their low income and there is a need of concerted efforts to enhance the farmers' income significantly.

Under the circumstances, the policy makers have given special thrust to double the farmers' income by 2022 (Chand, 2017). However, the concept of doubling farmers' income has been criticised by some economists saying it as an unrealistic and impossible task (Gulati and Saini, 2016) as this would need to grow the agriculture sector by 14.86 per cent annually. This paper examined the issue doubling farmers' income in the state of West Bengal. It has looked into the past performance of the agriculture sector in the state in terms of trend in Net State Domestic Product (NSDP), area, production, yield of major cash crops and value of output from agriculture; workforce/rural households dependence on agriculture; change in cropping pattern, cropping intensities and irrigation, to find out the possible sources of growth. The effectiveness of price policies to ensure farmers' income has been studied through comparative analysis of minimum support prices (MSP), farm harvest prices (FHP) and cost of production (COP) of major cash crops grown in the state. Besides, it has looked into the conditions of farmers in the coastal region of the state, which is one of the most vulnerable and risk-prone region in terms of agricultural production. The effectiveness of technology adoptions (like natural resource management through land shaping techniques and crop diversifications through multiple cropping), and agricultural market scenario/linkage with the farmers has been analysed by collecting primary information from the farmers in the coastal region. The change in occupational pattern, income sources and different options (like cropping system intensification) has been looked into to suggest the suitable strategies for increasing farmers' income in the state. The paper is likely to be helpful for the policy makers to make informed decisions on formulating strategies for enhancing farmers' income in the state.

Data and Methodology

The paper is based on data collected from both secondary and primary sources. The secondary information was collected from various government published sources like *Agricultural Statistics at Glance* (2004-2016); *National Accounts Statistics* of database

of any horticultural commodity (iv) raising of livestock, bees or poultry (v) any practice performed on a farm as incidental to or in conjunction with farm operations (including forestry and timbering) and the preparation for market and delivery to storage or to market or to carriage for transportation to market of farm produce. Further, 'carriage for transportation' refers only to the first stage of the transport from farm to the first place of disposal.

from Central Statistical Organisaton (CSO) on state-wise and item-wise Value of Output from Agriculture and Allied Sectors, Govt. of India (CSO, 2004 - 2016); farm harvest prices (FHP) of Principal Crops in India, Directorate of Economics & Statistics, (Govt. of India, 2004 - 2016); minimum support price (MSP) and cost of production (COP) data from Commission for Agricultural Costs and Prices (CACP), Govt. of India, (CACP, 2004 - 2016); Agricultural Census 2000-01 and 2010-11; Income from Situation Assessment Survey of Agricultural Households (Jan-Dec 2013), National Sample Survey Office (NSSO) Report No. 498(59/33/1) (NSSO, 2016); and Situation Assessment Survey of Farmers: Indebtedness of Farmer Households, National Sample Survey (NSS) 59th Round (January-December 2003) (NSSO, 2005). The primary data were collected by households' survey during 2015-16 and 2016-17 under different research projects, (1) *Assessment and coping strategies of agricultural risk under coastal region of West Bengal and Odisha– A Socio-economic analysis (120 farm households) and (2) Impact assessment of land modification technologies under waterlogged sodic soils (80 farm households)*, carried out at ICAR-Central Soil Salinity Research Institute (CSSRI), Regional Research Station (RRS), Canning Town.

The trend analysis of various parameters like State Gross Domestic Product, contribution of agriculture to State Gross Domestic Product, per capita income, gross cropped area (GCA), net cropped area (NCA), gross irrigated area (GIA), cropping intensities (CI), value of output from agriculture, minimum support price, farm harvest price and cost of production has been computed through growth analysis (LOGEST by using MS Excel[2]). Farm budgeting techniques have been used for computing total cost, total return and net return by using input-output data involved in the farming business. The cost of cultivation (Cost C1) has been estimated following cost concept adopted by Directorate of Economics and Statistics, Govt. of India (Anonymous, 2017).

[2] The Excel Logest Function calculates the exponential curve that best fits a supplied set of y- and x- values. For a single range of x-values, the calculated exponential curve satisfies the Equation, y = b * m^x. where, x is the independent variable, y is the dependent variable, m is a constant base for the x value, and b is a constant which is the value of y when x = 0.

Results and Discussions

Performance and Contribution of Agriculture to State Economy

During 2004-05 to 2014-15, the Net State Domestic Product (NSDP) and per capita NSDP of the state grew at 6.34 per cent and 5.32 per cent, respectively, whereas contribution of agriculture decelerated sharply from 25 to 16 per cent with slow growth of agricultural & allied sector (1.71 %) (Table 1). Within the sector, growth rate of both agriculture (1.50 %) and fisheries (1.74 %) was low. West Bengal makes a large contribution to national agricultural production in several commodities like paddy (1st), jute (1st), vegetables (1st), potato (2nd), fish (2nd with 1st rank in inland fish production) and eggs (5th), besides producing many other commodities like pulses and fruits (Table 2). The state is highly suitable for growing many of the high-value crops (fruits, flowers and vegetables) and has a good natural resource base to enhance the existing productivity level through technology adoption and higher input-use efficiencies. Despite high volume of production, the average monthly income of agricultural households has been one of the lowest (₹ 3980 per month) and far below the national average (₹ 6426 per month) (Table 3). In fact, the income level of agricultural households is ranked 27th among all states (only above Bihar) (NSSO, 2016). This probably indicated the need of increasing value addition to the agricultural output in the state. Low agricultural income per household might be in the presence of a huge disguised unemployment situation in the state due to the absence of alternative gainful employment opportunities. This issue has also been examined through change in workers classification in the following section.

Agricultural Workers and Households Dependency on Agriculture

During 2003-04 to 2013-14, the number of agricultural households in West Bengal reduced from 69.23 lakh to 63.62 lakh (5.60%), whereas the percentage of agricultural workers in total workforce declined by 12 per cent from 57 per cent to 45 per cent but they remained dependent on agriculture as agricultural labourers (Table 3). The extent of reduction of agricultural households was in contrast to the national scenario where the number of agricultural

Table 1. Trend in contribution of agriculture to economy of West Bengal: 2004-05 to 2014-15

(NSDP at 2004-05 prices)

Year	Agriculture (in ₹ crore)	Fishing (in ₹ crore)	Ag & Allied (in ₹ crore)	State domestic product (in ₹ crore)	State per capita income (₹)	Population (crore No.)	% Share		
							Agric-ulture	Fishing	Ag & allied sector
2004-05	38530	6605	47480	190029	22649	8.39	20.28	3.48	24.99
2005-06	39189	6925	48495	201994	23808	8.48	19.40	3.43	24.01
2006-07	39503	7363	49333	217849	25400	8.58	18.13	3.38	22.65
2007-08	41883	7783	52260	234798	27094	8.67	17.84	3.31	22.26
2008-09	40202	7871	50678	244262	27914	8.75	16.46	3.22	20.75
2009-10	43549	7798	53991	263230	29799	8.83	16.54	2.96	20.51
2010-11	42288	7600	52458	279191	31314	8.92	15.15	2.72	18.79
2011-12	42330	7647	52637	289432	32164	9.00	14.63	2.64	18.19
2012-13	43688	7731	54188	310338	34177	9.08	14.08	2.49	17.46
2013-14	44314	8104	55820	332425	36293	9.16	13.33	2.44	16.79
2014-15	44978	8381	57705	356845	38624	9.24	12.60	2.35	16.17
ACGR (%)	1.50	1.74	1.71	6.34	5.32	0.96	-4.55	-4.32	-4.35

Note: ACGR stands for Annual Compound Growth Rate in percentage.
Source: Net State Domestic Product at Factor Cost by Industry of Origin at Constant Prices for West Bengal from 2004-05 to 2014-15 (as on 31.07.2015), https://data.gov.in/node/525481/download.

Table 2. Performance and contribution of major agricultural commodities grown in West Bengal

Crops/commodities	Area (million ha)	Production (million tonnes)	Yield (kg/ha)	All India rank (AIR)			Value (2013-14)	
				Area	Production	Yield	₹ million	AIR
Foodgrains	6.13 (4.93)	16.53 (6.56)	2698	8th	4th	5th		
Rice	5.38 (12.19)	14.68 (13.91)	2730	2nd	1st	7th	342869 (15.57)	1st
Jute	0.58 (71.11)	14.68 (75.95)	2642	1st	1st	2nd	41611 (83.23)	1st
Fruits (area in '000 ha and production in '000 tonnes)	228.25 (3.74)	3313.70 (3.83)	14518	11th	9th	-	554165 (14.53)	1st
Vegetables (area in '000 ha and production in '000 tonnes)	1387.2 (14.53)	26354.61 (15.55)	18998	1st	1st	-		
Potato ('000 ha, '000 tonnes)	412.20 (19.86)	12027 (25.05)	29178	2nd	2nd	2nd		
Fish (million tonnes)		1.68			2nd		284178 (24.74)	1st
Milk ('000 tonnes)		4961 (3.39)			11th		361819 (5.63)	7th
Eggs (lakh No.)		48316 (6.16)			5th			

Notes: 1. Fish production including marine fisheries, 2. Figures within the parentheses are percentage share to national total
Source: 1. Area, production and yield of crops/commodities are taken from *Agricultural Statistics at a Glance* 2016, Govt. of India, 2. Value of output from agriculture was taken from NSSO Database on State-wise and item-wise Value of Output from Agriculture and Allied Sectors, Govt. of India 2013 and 2016 (CSO, 2004-2016).

Table 3. Operational holdings, agriculture dependency and income from agriculture in West Bengal and India

Particulars	West Bengal			India		
	2003-04	2013-14	Change (%)	2003-04	2013-14	Change (%)
Estimated No. of rural households (lakh No.)	121.67	141.36	+19.69	1478.99	1561.44	+82.45
Estimated No. of agricultural households (lakh No.)	69.23	63.62	-5.60	893.50	902.01	+8.50
Percentage of agricultural households	57.00	45.00	-12.00	60.40	57.80	-2.60
Average monthly income from agricultural households (₹/month)		3980 (27^{th})			6426	
Average operational holding size (ha)	0.79	0.77	-0.02	1.41	1.15	-0.26
Cultivators (lakh No.)	56.13 (43.3)	51.17 (33.43)	-4.96 (9.87)	1276 (54.5)	1188 (45.1)	-88.00 (9.40)
Agricultural labourers (lakh No.)	73.51 (56.7)	101.89 (66.6)	28.38 (9.90)	1074 (45.9)	1443 (54.9)	369 (9.00)
Total agricultural workers (lakh No.)	129.64 (43.9)	153.06 (44.0)	23.42 (0.10)	2341 (58.2)	2631 (54.6)	290 (-3.6)
Total workers (lakh No.)	295.03	347.56	52.53	4025	4819	793

Notes: 1. Figures in parentheses with respect to cultivators and agricultural labourers indicate percentage to total agricultural workers. 2. Figures in parentheses with respect to total agricultural workers indicate percentage to total workers.
Sources: 1. Cultivators and agricultural labourers (Agricultural Census 2000-01 & 2010-11, Agricultural Statistics at a Glance (2007& 2016), 2. Income from Situation Assessment Survey of Agricultural Households (Jan-Dec 2013), National Sample Survey Office (NSSO) and 3. Situation Assessment Survey of Farmers: Indebtedness of Farmer Households, National Sample Survey 59th Round (January-December 2003), Report No. 498(59/33/1)

households has increased by 8.5 per cent, but the percentage of agricultural households to total households has decreased by 2.60 per cent. The average operational holdings size in West Bengal decreased marginally from 0.79 ha to 0.77 ha, whereas during the same time, the size of national average holdings fell sharply from 1.41 ha to 1.15 ha. The total agricultural workers (cultivators plus agricultural labourers) have increased marginally (0.10 %) in contrast to the country's trend (-3.6 %). In West Bengal, 9.87 per cent of cultivators have shifted from agriculture but became agricultural labourers, as is evident from a similar increase (9.90 %) in agricultural labourers during the same period (2004-05 to 2014-15). So, the workforce dependent on agriculture remained the same over the period through cultivators becoming the agricultural labourers. On one hand, the agriculture's contribution to state's economy was reducing, but the workforce dependent on agriculture remained almost same, therefore resulted into lowering the income per agricultural households. The agricultural technologies dissemination strategies are primarily focussed on cultivators (not agricultural labourers), though agricultural labourers benefit indirectly through adoption of these technologies. Therefore, strategies for enhancing farmers' income should have emphasis on non-farm and off-farm activities also to engage the agricultural labourers gainfully. Under this scenario, perhaps the technological interventions like diversification of crops and cropping system intensifications could be the possible sources of growth to enhance the agricultural income in the state.

Change in Cropping Intensities and Cropping Pattern

The possibility of enhancing cropping intensity through cropping pattern change in the state was analysed through its past performance and options. The trend in gross cropped area (GCA), net cropped area (NCA) and cropping intensity (CI) has been analysed for the period 2004-05 to 2014-15 (Table 4). The results indicated that the NCA and GCA decelerated by 0.29 per cent and 0.11 per cent, respectively, whereas cropping intensity increased marginally (0.19 %) due to difference in deceleration rate between GCA and

Table 4. Trend in gross cropped area, net cropped area, cropping intensities, irrigation and value of output from agriculture in West Bengal: 2004-05 to 2014-15

Year	Net cropped area (lakh ha)	Gross cropped area (lakh ha)	Cropping intensities (%)	% gross irrigated area to gross cropped area	Total value of agril output (₹ lakh) (2004-05 prices)	Value of agril. output ₹/ha of GCA (2004-05 prices)	Value of Agril. output ₹/ ha/ month of GCA (2004-05 prices)
2004-05	53.74	95.23	177	56.1	6218226	117436	9786
2005-06	52.95	95.33	180	57.7	6278991	118561	9880
2006-07	52.96	96.35	182	57.9	6463816	122051	10171
2007-08	52.96	97.52	184	58.1	6901645	130367	10864
2008-09	52.94	98.02	185	57.7	6692546	127332	10611
2009-10	52.56	95.30	181	58.0	7221510	144981	12082
2010-11	49.81	88.32	177	59.7	7136873	137300	11442
2011-12	51.98	93.53	180	58.8	7611049	146226	12185
2012-13	52.05	94.59	182	58.9	7409606	141567	11797
2013-14	52.34	96.18	184	58.9	7949912	151774	12648
2014-15	52.38	96.90	185	59.1	8162960	156196	13016
ACGR (%)	-0.29	-0.11	0.19	0.45	2.68	2.91	2.91

Notes: After 2011-12, the Gross Value of output from agriculture was deflated with CPIAL (2004-05 = 100) and 2014-15 has been projected as per growth during 2004-05 to 2013-14.
Sources: 1. Net cropped area, gross cropped area, cropping intensity and gross irrigated area were taken from Land Use Statistics at a Glance (2004-05 to 2013-14 & 2014-15), Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Govt. of India (20016 & 2017). 2. Total Value of Agricultural Output during 2004-05 to 2013-14 from State-wise estimates of value of output from agriculture and allied activities with new base year 2004-2005 (2004-05 to 2010-11), CSO (2004-2016).

NCA. The per cent gross irrigated area (GIA) to GCA was hovering around 58 per cent and had increased marginally (0.45 %). Therefore, the trend analysis of GCA, NCA, CI and GI revealed that the past performance was almost static and there were not many opportunities to enhance farmers' income through increasing these parameters (NCA or GCA). As a result, the total value of agricultural output growth was low (2.68 %) and per ha of agricultural output growth was also low (2.91 %). Thus, state level data analysis indicated that the possibility of doubling of farmers' income by 2022 through increasing cropping intensity was difficult, considering the past performance.

We have also examined the change in cropping pattern towards high-value crops (cereals to non-cereals crops like fruits, vegetables, flowers) during the previous decades in the state. West Bengal has nearly 96 lakh ha of gross cropped area which has remained almost static during 2006-07 to 2014-15 (Table 5). The decadal change in cropping pattern indicated that there was a shift from area under food-grains (70.4 % to 66 % during 1998-99 to 2006-07) towards high-value fruits & vegetable crops (from 12 to 16 %). This shift was attributed to the state's high focus on crop diversification towards high-value crops. However, the magnitude of change slowed down during 2006-07 to 2014-15, primarily due to the need of ensuring food security in the state. Therefore, change in cropping towards high-value non-food crops could be one of the possible strategies to enhance farmers' income, but there should be balanced strategies, not to compromise on food security of the population.

Effectiveness of Minimum Support Price Policy in West Bengal

We also examined the effectiveness of price policies, such as minimum support price (MSP) towards enhancing farmers' income. For this we

Table 5. Decadal change in cropping pattern in West Bengal: 1998-99 to 2014-15

Crop types	Share to total (%)		
	1998-99	2006-07	2014-15
Foodgrains	70.4	66.0	64.8
Fruits & vegetables	12.0	15.7	16.7
Non-food	14.5	16.7	16.9
Others	3.1	1.6	1.6
Total (Lakh ha)	100 (92.90)	100 (96.35)	100 (96.90)

Source: Authors' calculations from net cropped area, gross cropped area, cropping intensity and gross irrigated area from Land Use Statistics at a Glance 1998-99 to 2007-08, 2004-05 to 2013-14 & 2014-15, Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Govt. of India and Agricultural Statistics at a Glance (2004-2016).

analysed the relationship among minimum support price (MSP in ₹/q), farm harvest price (FHP in ₹/q) and cost of production (COP in ₹/q) for the period 2004-05 to 2014-15 for three major crops of the state, paddy, jute and potato (Table 6). Crop-wise and state-wise FHP (₹/q) represented the actual price received by the farmers and this must be more than the COP (₹/q) to ensure farmers' profitability. The MSP should be above the COP to avoid farmers' distress. In the case of paddy the FHP[3] has remained lower than the COP during all these years (2004-05 to 2014-15). Also, the MSPs in different years were less than the COP for the state of West Bengal. The possible reason might be that MSP is recommended by the Commission for Agricultural Cost and Prices (CACP) and declared by the Central Govt. and is uniform for all the states, although the COP of paddy was different across the states. So, MSP was less likely to ensure the remunerative price for paddy in the state. Despite lower FHP as compared to COP for paddy in the state, it (paddy) has remained the major crop over the period of time. Because paddy has a larger value for the farmers more than merely earning profit, like its contribution to household level food security, adaptability to different stressed conditions and low-risk as compared to other crops.

In the case of jute, the FHPs were above the COPs in different years and also the MSP was partially effective to ensure the remunerative price. No MSP was declared for potato but almost all the years the FHPs have remained above COP, indicating potato to be a highly remunerative crop in the state. Analysis of FHP, COP and MSP has indicated that MSP may not ensure a remunerative price of crops to the farmers. Rather, potato, for which no MSP was declared, was the most remunerative crop in the state. However, MSP was the most powerful price policy in India and cropping pattern could be altered through this policy along with effective implementation by the respective state government (as agriculture is a state subject), the farmers' income could be ensured and enhanced significantly.

The analysis of state-level secondary information indicated that the performance of agriculture in West Bengal was almost static over the years and there was a need to increase the agricultural growth by many times to achieve the target of doubling farmers' income. The state was in need of policy support to promote private investment in agriculture, particularly on technology dissemination, enhancing value addition and remunerative prices to the commodities. Having analysed the performance of agriculture in the state, we examined the reflections from the grassroots of West Bengal agriculture. Based on the household level primary data drawn from the coastal region of West Bengal, it was attempted to understand the impact of technology dissemination on farmers' income, farmers' behaviour towards technology adoption and understanding how far the proposition of doubling farmers' income was feasible to achieve.

Occupation Pattern and Households Level Farmers' Income

Primary survey was conducted to understand the baseline income and occupation pattern of farm households in the coastal areas of West Bengal through different ongoing and completed socio-economic research projects carried out through ICAR-CSSRI, RRS Canning Town. The occupational pattern indicated that agriculture was the dominant occupation (43 %), followed by migration of labourers (32 %) and agricultural labourers (7 %) (Table 7). In the coastal areas of West Bengal, a large number of agricultural labourers migrate (seasonally) to nearby cities or at distance places for alternative livelihoods. The migrants

[3] FHP of paddy was the average of three seasons (*kharif, autumn and rabi*) of paddy

Table 6. Trend in minimum support price, farm harvest price and cost of production for major cash crops grown in West Bengal: 2004-05 to 2014-15

Year	Paddy				Jute				Potato		
	FHP (₹/q)	MSP (₹/q)	COP (₹/q)	FHP-COP	FHP (₹/q)	MSP (₹/q)	COP (₹/q)	FHP-COP	FHP (₹/q)	COP (₹/q)	FHP-COP
2004-05	534	560	641	-107	870	890	1050	-180	300	266	34
2005-06	549	570	639	-90	1208	910	1168	40	452	382	70
2006-07	608	580	689	-81	1321	1000	1283	38	456	518	-62
2007-08	695	645	737	-42	1110	1250	1212	-102	459	391	68
2008-09	731	850	804	-73	1377	1375	1357	20	593	518	75
2009-10	882	1000	952	-70	2005	1575	1589	416	426	351	75
2010-11	1047	1000	1125	-78	2828	1675	2089	739	480	408	72
2011-12	990	1080	1194	-204	2307	2200	1459	848	519	466	53
2012-13	1164	1250	1360	-196	2362	2300	2299	63	643	520	123
2013-14	1500	1310	1503	-3	2617	2400	2542	75	1121	821	300
2014-15	902	1360	1552	-650	2928	2700	2921	7	902	623	279
ACGR (%)	9.18	10.78	10.71	-	12.63	12.81	10.29	-	9.72	7.01	-

Note: 1. FHP, MSP and COP stands for Farm Harvest Price, Minimum Support Price and Cost of Production,
2. FHP of paddy was the average of three seasons *(kharif*, autumn and *rabi*) of paddy.
Sources: 1. FHP was taken from Farm Harvest Prices of Principal Crops in India for various years (2004 to 2016), Directorate of Economics & Statistics, Ministry of Agriculture and Farmers Welfare, Govt. of India (2004 to 2016).
2. MSP and COP data were taken from various reports of Commission for Agricultural Costs and Prices/CACP, Ministry of Agriculture & Farmers Welfare, Govt. of India 2017, downloaded from http://cacp.dacnet.nic.in/ViewContents.aspx?Input=1&PageId=36&KeyId=0 for 2007-08 to 2014-15 and https://data.gov.in/node/89009/download for 2004-05 to 2006-07.

Table 7. Occupation and income pattern of sample households in coastal region of West Bengal

Particulars	% households primarily dependent	Average income (₹/year)	Average income (₹/month)
Agriculture	43	18683	1557
Business	6	47660	3972
Service	4	112000	9333
Fisheries	1	12877	1073
Migration (seasonal)	32	46768	3897
Agricultural labourers	7	14250	1188
Daily labourers (non-agri)	4	14235	1186
Others (incl. handicrafts)	3	14536	1211
Overall	100	45278	3773

Source: Authors' calculation from households' level primary survey during 2015-16 and 2016-17

are actually the agricultural labourers and they migrate, particularly during non-*kharif* season, due to lack of daily wage jobs in farming operations. Overall, the households' level income was estimated to be ₹ 45278 per year or ₹ 3773/ month from all sources. The income from agriculture was quite low (₹ 1557 per month per households) and was much lower than the income of migrant labourers (₹ 3897 per month), indicating the reasons behind the large scale seasonal migration from this region.

Intensification of Cropping System for Higher Income

In the coastal region of West Bengal, the cropping system is dominated by mono-cropping *kharif* rice. The cropping intensity was low (114 %) and more than 80 per cent of the farm lands remained fallow during the *rabi* season. However, despite having many constraints, farming in the coastal region has a good potential to enhance farmers' income through scientific intervention of soil and water resources. For example, implementation of land-shaping models (modification of land suitable for on-farm water harvesting) like farm pond, paddy-cum-fish and deep-furrow-and-high-ridge system along with scientific management of soil, water and nutrients could increase the cropping intensities significantly (from 114 % to 186 %) (Mandal *et al*., 2015).

The increased cropping intensities have resulted into higher cropping system intensification and have finally helped in enhancing farmers' income significantly. Such intervention (land shaping) created the opportunities of higher cropping system intensification from existing mono-cropping. Various options were rice-rice, rice-fish (paddy-cum-fish), rice-vegetables and rice-fish-vegetable cropping system (Table 8). All these cropping systems have been demonstrated at a large number of farmers field in the coastal areas and were found quite successful in terms of increasing farmers' income substantially and sustainably. The results from demonstrations indicated that farmers' income (net income) could be increased from merely ₹ 470 per month (*kharif* rice) to as high as ₹ 11999 per month (rice-fish-vegetable cropping system). Besides, growing betel vine (perennial crop) was also a good option to realise higher farmers' income (₹ 5667 per month).

The farmers in the coastal region operate on the average holdings of 0.60 ha, and therefore the return calculation was also shown on average land holdings. It indicated that the net return (income) per month on average holdings could increase from ₹ 282 per month (*kharif* rice) to ₹ 7199 per month (rice-fish-vegetables) and ₹ 3400 per month for betel vine cultivation. The cropping system intensification in the coastal region indicated feasible options to increase the farmers' income significantly and in fact, much higher than the baseline income at the regional level (₹ 3773 per month) or state level (₹ 3980 per month). However, long-term sustainability of the land shaping models was affected by many factors, which were evident from the post-project impact study (CSSRI, 2017).

The impact study on land shaping techniques/ models was carried out at different villages in *Sundarbans* area during 2015-16 for those interventions made around four years ago (2012) and all the support (input or financial) from the implementing agencies (ICAR-CSSRI or RAKVK, Nimpith) were withdrawn. Therefore, during post-project period, complete management of the land shaping technique was done by the farmers themselves. Although the land shaping techniques could be successfully managed by the farmers at different locations, however harnessing the extent of benefit out of the technologies varied. The differential benefits accrual depended on the farmers' own capacity (e.g., financial to manage the system) and remoteness of the area. Therefore, achieving the target of doubling farmers' income was feasible but the challenge is to make the benefits inclusive for all farmers.

Agricultural Marketing Scenario and Strategies

The agricultural marketing efficiency in terms of producer's share in consumer rupee was estimated to be 44 per cent for brinjal, 37 per cent for bhindi, 26 per cent for tomato, 45 per cent for guava and 60 per cent for marigold cultivation (Mandal *et al*., 2011). Marketing efficiency of these crops was also estimated by following Acharya's modified method (Acharya and Agrwal, 2011). The net price received by the farmers was calculated by deducting transportation cost plus value of loss incurred by the farmers (while transportation of commodities to the market) from the absolute price received by the farmers. The marketing efficiencies were estimated to be 0.79, 0.58, 0.36, 0.82 and 1.51 for brinjal, bhindi, tomato, guava and marigold, respectively, and the average area under production of these crops was 0.10 ha, 0.08 ha, 0.12 ha, 0.38 ha and 0.10 ha, respectively. This indicated that although farmers received reasonable share in consumers' price, it was the small scale of production that lowered the profitability in cultivation of these crops. The high cost of production (due to escalation of input cost) was the most important constraint faced by the farmers to enhance their production and in turn, the marketable surplus of the produce. The poor

Table 8. Cropping system intensification towards higher income in coastal region of West Bengal

Particulars	Cost/Return					Cropping system intensification options			
	Kharif-rice	*Rabi*-rice	Vegetables	Fisheries	Betelvine	*Kharif*-rice-*rabi* rice	*kharif* rice-fish	*kharif* rice-vegetables	*kharif* rice-fish-vegetables
Total cost (₹/ha)	32419	56325	39130	66632	98663	88744	99051	71549	138181
Gross return (₹/ha)	38063	82725	98500	145600	166668	120788	183663	136563	282163
Net return (₹/ha)	5644	26400	59370	78968	68005	32044	84612	65014	143982
Yield (t/ha) (No. in lakh for betel leaves)	3.83	5.4	9.88	1.95	2.91	9.23	5.78	13.71	15.66
Output-input ratio	1.17	1.47	2.52	2.19	1.69	1.36	1.85	1.91	2.04
Net return per month (₹/ha)	470	2200	4948	6581	5667	2670	7051	5418	11999
Net return per average size of holdings (0.60 ha)	3386	15840	35622	47381	40803	19226	50767	39008	86389
Net return per month (₹ per average holding of 0.60 ha)	282	1320	2969	3948	3400	1602	4231	3251	7199
Gross return per average size of holdings (0.60 ha)	22838	49635	59100	87360	100001	72473	110198	81938	169298
Gross return per month (₹ per average holding of 0.60 ha)	1903	4136	4925	7280	8333	6039	9183	6828	14108
No. of observations	85	35	48	32	80	22	28	44	25

Note: 1. Baseline income estimated as ₹ 3773/- per month for farmers in coastal areas (*Source:* Authors' calculation from primary survey), 2. Farmer's income at State level estimated to be ₹ 3980/- (*Source:* Situation Assessment Survey of Agricultural Households (Jan-Dec 2013), National Sample Survey Office (NSSO), Govt. of India. 3. Cost-return of betelvine cultivation has been taken from Mandal and Mandal (2016).

transportation facilities, occasional market glut situation during peak season, lack of remunerative price (very often) and intra-day price variation (price uncertainty) were the other important constraints faced by the farmers in marketing of their produce and hence instability in returns.

Constraints, Challenges and Strategies for Doubling Farmers' Income

The real concern for the farmers in the coastal region as well as in state was achieving a higher (say double) farmers' income and to sustain the enhanced income across the groups. The farmers operate under different socio-economic conditions, the technologies could be replicated but 'social cloning' was not possible. Therefore, enhancing income for all the farmers across the state would be a challenging task. Income of a segment of the farming community, like potato farmers, jute farmers, vegetable farmers, flowers farmers, fish farmers, integrated farming system practitioners etc could be enhanced within a short period of time, but enhancing income for all farmers including agricultural labourers needed more comprehensive strategies like increasing production through technology dissemination, enabling market environment for ensuring remunerative price, supply-chain management for both input delivery and output disposal and risk mitigation under unforeseen happenings. Some of the challenges that need to be addressed are discussed in the following section.

Adoption of Technologies

The research experiments at farmers' field often indicated encouraging results towards higher cropping system intensification and profitability. However, availability of good quality and quantity of irrigation water and accessibility will determine the extent of adoption of such cropping systems. The evolved

options might be technologically sound and profitable in terms of output-input ratios. But due to limited water availability farmers might compel to grow multiple crops in small plots (fragmented land) that have primary objectives of meeting household's level food security with less commercial/business motives. For achieving and continuing with higher cropping system intensification from the existing cropping system, farmers need continuous support like, more capital investment, additional knowledge on crop management and assurance of remunerative price.

Transforming Agriculture to Agribusiness through Sustainable Value Chain

There is a need to transform the smallholder farming operation to self-reliant framing business through promotion and development of sustainable value chain for agricultural commodities. At the grassroots level many success stories emerged during implementation of livelihoods improvement project. Out of these around one-fifth of the farmers continued even after the project was completed (CSSRI, 2017). The income of these farmers was more, actually more than double, but real challenge remained with the rest of the farmers who couldn't continue without the support. The agricultural production has to be demand-driven; i.e., to produce what the consumers want through development of sustainable value chain system. There is a need to transform agriculture into sustainable agribusiness and agriculture needed to be handled by the professionals.

Risk and Uncertainties

The operational area of farms in West Bengal was dominated by marginal farmers with average farm size of 0.77 ha. Further, the size of operational holdings was gradually declining over the period and lands were becoming fragmented to different plots/parcel. Small and marginal holdings and that too fragmented to several plots reduced the risk bearing abilities of the farmers and in turn capacity to withstand risk and uncertainties situation. Various risks such as water stress, salinity, presence of acid sulfate soils, damage caused by pest and diseases, prolonged waterlogged situation, flash rain, long dry spell, market price uncertainty and government policies affects the farm-level decisions and profitability. All these risks affect the crop cultivation; limit crop choice, reduce yields and have significant impact on farmers' income. Although crop insurance scheme was available but the percolation of such schemes to the beneficiaries has been quite low.

Conclusions

Doubling farmers' income by 2022 is a much needed policy thrust to keep the farming business profitable. The study of past performance of agriculture in West Bengal has revealed that doubling of farmers' income is a challenging task, particularly due to low agricultural growth (< 2 %) and lack of market innovations and private investment. However, the micro-level households' data analysis has indicated that there were ample opportunities to increase farmers' income through enhancing cropping system intensification. The technological options are available for increasing cropping intensities and the state agriculture needs policy thrust like attracting private investment, value addition and marketing innovations like sustainable food value chain.

The farmers need timely supply of quality seed and other inputs (irrigation, fertiliser, pesticides, etc.) particularly before two cropping seasons and remunerative prices for their produce. Support is needed of professionals, who could act as key service providers to supply inputs and facilitate availing credits, buying insurance products and selling of produce through single-window system. Such professionals have to act as the facilitators between farmers and government agencies. The paper has suggested that doubling of farmers' income of West Bengal is challenging but is achievable. However, the real concern for the farmers in the state is to achieve higher income and to sustain the enhanced income while making it inclusive across farmers' groups.

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