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SUBJECT IV
ROLE OF AGRI-BUSINESS ENTREPRENEURSHIP, INNOVATION AND VALUE CHAINS/NETWORKS IN FARMER INCOME IMPROVEMENT: MODELS, POLICIES AND CHALLENGES

Agribusiness Opportunities of Organic Agriculture in West Bengal – An Empirical Analysis

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ABSTRACT

Increased evidences on harmful effect of excessive use of chemicals and fertilisers in farming, environmental degradation and rising demand from health-conscious consumers, farmers are now gradually shifting to organic farming across globe, including India. During last five years, the area under certified organic agriculture in West Bengal has increased by 18 per cent despite facing several challenges while practicing organic farming. Objectives of the study were to analyse the current status and economics of organic cultivation; production and marketing constraints of organic produce; factors affecting adoption of organic agriculture; and consumer behaviour towards organic commodities. Result indicated that average organic farming experience of the farmers in the study area was six years. Cost of cultivation of organic paddy and vegetables were lowered by ₹4280 per ha and ₹11910 per ha, respectively, but per unit of production of organic crops were also less by 1.37 t per ha and 3.12 t per ha for paddy and vegetables, respectively, as compared to inorganic practices. Net return was positive for both paddy and vegetable grown organically. However, farmers producing organic vegetable were not gaining profit as comparable to inorganic farming, mainly due to absence of specialise market/linkages for organic produce which led to lack of premium price for the organic commodities. Only 2 per cent of organic farmers had the marketing linkage with the specialised organic market and rest (98 per cent) had to depend on the open market only. On other hand, consumer survey indicated there was a good agribusiness potential for a range of organic commodities including cereals, fruits, vegetables, spices and pulses. Towards harnessing the potential of agribusiness opportunities of organic farming in the state, there is a need of creation of value chain connecting farmers to the final consumer with the help of institutional linkages. Promotion of high value paddy such as aromatic and scented rice variety was effective and increased the interest of farmers in organic farming and the price premium was also available for such quality rice produced by the farmers. Besides, educating farmers about the consumer preference of the specific organic commodities, accordingly production of those specific commodities and positioning of product to the '*niche*' market through creation of separate value chains is essential.

Keywords: Organic farming; Agribusiness; Economics; Consumer demand; Organic market

JEL: Q02, Q13, Q15,

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I

INTRODUCTION

The organic agriculture is defined as "a production system that sustains the health of soils, ecosystems, and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and good quality of life for all involved" (FAO, 1999). Approximately 187 countries across the world have been practising organic farming till the end of 2019. As per the latest FiBL survey in 2020 there are 72.3 million hectares of organic farm land which is 1.5 per cent of the global agricultural land. Rising demand for organic products has created domestic and international agribusiness opportunities in food market (over 106 billion euros in 2019), which has influenced many farmers to shift to organic farming across countries (Willer *et al*., 2021). Green revolution made India food self-sufficient and fulfilled the goal of achieving national food security, however, indiscriminate use of chemical fertilisers and pesticides caused severe land and environmental degradation. The cultivated land began to lose its fertility over time due to farmer's excessive dependency on chemical fertilisers resulting in declining total factor productivity. Gradually farmers and consumers started realising the harmful effects of chemical farming to environment and also in human body. There is now increasing level of awareness about the health benefits of chemical free produce, so the consumers are also willing to pay premium price for the organic commodities. India is home to 30 per cent of the total organic producers in the world (3.10 million), but accounts for just 2.59 per cent (1.5 million hectares out of 57.8 million ha) of the total organic cultivation area in the world (Willer *et al*., 2021). Indian government has laid emphasis on promotion of organic agriculture (Ramesh, *et al*., 2005; Ramesh *et al*, 2010) and recently launched the National Programme for Organic Production (NPOP) for the certification process; maintain the standard of organic production, promotion of organic farming and recently allocated ₹ 500 crores funds for organic farming under the flagship programme *Parampragat Krishi Vikash Yojona* (Government of India, 2020; Kumar, 2020). India exported around 8.9 lakh tonnes (t) certified organic products to different countries and earned 1041 million USD during the year 2020-21 (APEDA, 2021). Oilseeds, sugarcane, cereals and millets, cotton, pulses, medicinal plants, tea, fruits, spices, dry fruits, vegetables, coffee, organic cotton fibre, functional food products etc. are cultivated organically in various parts of the country. In 2020-21, the area under organic cultivation (certified organic plus in-conversion) in India was 4.34 million ha (2.66 million ha under cultivation and 1.68 million ha under wild harvest) and produced 3.50 million t of organic commodities.

In 2020-21, West Bengal cultivated 21003 ha (0.48 per cent) out of 43.40 lakh ha of area in India under organic cultivation and produced 17437 tonnes of organic commodities (0.53 per cent of India) (APEDA, 2021). West Bengal contributed to

cereals, millets and plantations crops to the export of organic products from India and the state has potential to contribute in many other high value crops also including vegetables. Around 37 per cent of organic production from West Bengal is exported to different countries through APEDA and the rest (63 per cent) is being consumed at domestic markets. At the national level 28 per cent is exported to other countries and 72 per cent is consumed in the domestic market. This clearly indicates good demand for organic produce not only in the export market but the demand is also increasing in the domestic market. West Bengal has good potential to increase the organic production particularly pulses, non-basmati aromatic rice, spices and vegetables. As the market for organic produce at the global level is increasing rapidly, more area can be promoted under such production system in the state and also the state has suitable climate and natural resources to expand area under organic agriculture (Ganguly, 2009). Many traditional scented and aromatic varieties of rice like *Radhatilak, Dudheswar, Kalabhat, Kalomumiya, Gobindobhog* etc. are produced under organic farming in some parts of the state. Apart from this tea, flowers, fruits are also produced organically. Increasing demand for organically produced vegetables, rice, processed product in urban areas of West Bengal has created a new market for organic products. The farmers in West Bengal are also gradually realising the detrimental effect of chemical farming to soil health and over-exploitation of ecosystem. As a result, recently the usage of chemical fertiliser showed a declining trend (187 kg per hectare from 190 kg per hectare) in 2016-17 and use of organic manures increased (from 1.5 tonne per hectare to 1.88 tonne per hectare) (Ghosal, 2018). Many of the consumers are now concerned about their health and due to increased level of awareness through news/media; they are now demanding chemical free foods more. Therefore they are willing to pay premium price for organic products. Increasing demand for organic products has encouraged the farmers to shift to organic farming practices. This demand also led the government to take certain policies about promotion of organic farming in the state and decided to add over 10,000 hectares of additional land into existing organic land. The agriculture department of West Bengal identified 32 villages in North and South 24 Parganas, Howrah and Hooghly to convert the land into fully organic villages (Ghosal, 2017). Also, realising the need of creating sustainable supply chain for this high value produces the state government planned an organic supermarket in West Bengal exclusively for organic producers. Building a super market infrastructure under the *Rashtriya Krishi Vikash Yojona* has been planned, exclusively as an organic hub in state capital to facilitate easy interaction between sellers and consumers. However, currently many of the farmers have reported that they were not receiving desirable price premium to grow crops organically (Pandey and Sengupta, 2018; Biswas *et al*., 2011). Input availability and delivery system are also not adequate to grow organic crops as per the choice of farmers. Therefore, it becomes imperative to understand the current situation of organic growers in the state with particular focus on economics of crops, input-output delivery systems and agribusiness potential of organic produce that are grown in the state. The information would likely to help the

planners to take informed decision making towards promotion and creation of better agribusiness ecosystem for organic commodities in the state.

II

METHODOLOGY

Sources of Data

The study is based on primary data collected from the farmers practicing organic agriculture in selected areas of the state. The data for the study was collected through discussion with the government officials who are engaged in the promotion of organic agriculture, academicians, researchers, resources persons, traders and news articles, in the *Baruipur, Patharpratima* and *Kakdwip* blocks in South 24 Pargana district in West Bengal. Hence, the district was selected purposively for the research study on organic farming in the state. Few institutions such as *Ramakrishna Mission, Sundarini* and *Badaban Farmers Producer Company Ltd.* were working in these blocks to popularise organic farming, and the farmers of these blocks have started organic farming under their supervision. Three (3) Gram Panchyats (GP), *Belegachhia, Digambarpur* and *Rishi Bankim Chandra* were selected from the blocks of Baruipur, Patharpratima and Kakdwip, respectively. These GPs were selected purposively because people under these GPs were mainly dependent on agriculture for their livelihood throughout the year and adequate number of farmers practicing organic agriculture was available. After selection of the GPs, three (3) villages, *Jaler Hat, Ramnagar Abad* and *Gobindarampur* were selected from three different GPs, again purposively to obtain the desirable sample farmers required for the study. Finally, 80 farm households were selected purposively for collecting the data from the selected villages, 32 from *Jaler Hat*, 24 from *Ramnagar Abad* and 24 from *Gobindapur* villages, subject to availability of farmers. Most of the farmers (90 per cent) were following both organic and inorganic cultivation practices by allocating varying amount of land under organic or inorganic practices. Farmers in the study area were cultivating mainly paddy and vegetables, therefore the study focussed on these crops only. The primary data was collected during January-June 2020 from the farmers practicing both types , organic as well as inorganic farming. Primary data was collected by using pre-tested survey schedule through personal interview and also through telephonic interview in few cases (due to movement restrictions owing to COVID-19 pandemic situation) pertaining to farm size, educational status, occupation, cropping systems and pattern, income sources, costs and returns of crops grown, production and marketable surplus of crops, market access, selling of crops and constraints in organic farming. Consumer survey was conducted with 92 respondents through using online survey to analyse the consumers' behaviour towards purchase of organic commodities and also the premium price they were willing to pay. A semi-structured interview schedule was prepared by using Google-form, was circulated mainly through e-mail and WhatsApp. Besides, some secondary data was also consulted from various published sources such as District

Statistical Hand Book (2014), South 24 Parganas (Government of West Bengal, 2020) and published research articles. Secondary data was consulted from various published resources such as books, online portals, newspapers, journals and Govt. reports.

Analytical Framework

Descriptive statistics like mean/average, standard deviation, per cent analysis was employed for analysing the socio-economic data. Farm budgeting technique was used for analysing the economics of crops following CACP cost of cultivation norms (Government of India, 2008; Charyulu and Biswas, 2010). The factors affecting adoption of organic agriculture are analysed by using multiple regression model (Mohanty *et al*., 2015; Konar and Laha, 2021; Bhattacharya *et al*., 2021). The decision to practice organic agriculture might be affected by various socio-economic factors of the individual farmer. Variables such as age of the respondents, experience in farming in years, educational status, number of adult family members (farming was heavily dependent on family labour), operational holding size, distance from nearest market, availability of dung (from cattle) from own sources, were included in the regression model. Per cent area allocated under organic agriculture for individual farmers was considered as the dependent variable. Step-wise regression was carried out to identify the most important factors determining the adoption of organic agriculture by the farmers. The final multiple regression model was specified as below-

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7) + e_i$$
$$\text{Or } Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_{6+} b_7X_{7+} e_i$$

Y = Per cent area allocated by a household under organic agriculture (per cent)
X_1 = Operational holdings (ha) of individual farmers
X_2 = Age of farmers (years)
X_3 = Number of adult members in the family (No.)
X_4 = Availability of dung at households from own sources (t/ha)
X_5 = Presence of institutional buyer, dummy variable, 1 if available, 0 otherwise
X_6 = Educational level of the farmer (no. of years in school)
X_7 = Distance of nearest market (km)
e_i = denotes error term

The regression co-efficient (b_i) were estimated through ordinary least square method.

III

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Farmers

Out of the total sample farmers (80 farmers), the male and female respondents were 60 per cent and 40 per cent, respectively, indicating the high rate of female farmers'

participation in agriculture in the study villages (Table 1). Possible reason might be the engagement of male members in the family mostly in non-agricultural activities (often migrated to other places) in search of better earnings. The average age of male and female respondents was 48 and 38 years, respectively, indicating that the middle-aged people were mainly engaged in farming practices. Average family size was 5.5, comprising number of male and female members of the family (above 18 years) as 2.54 and 1.3, respectively. Agriculture was the primary occupation of all the respondents (100 per cent) and more than 50 per cent of their time was spent in farming activities. Most of the sample cultivators (90 per cent) were mainly producing paddy and vegetable in both organic and inorganic methods in different parts of their land. Growing rice in both *kharif* and *rabi* (*boro)* seasons was the most common practice followed by the farmers. Besides paddy, the cultivators produced a number of

TABLE 1. SOCIO-ECONOMIC PROFILE OF THE FARMERS IN STUDY AREA

Sl. No. (1)	Particulars (2)	Values (3)
1)	Household pattern	
	Male respondent (No.)	48
	Average age of the male respondents (years)	48.25
	Female respondent (No.)	32
	Average age of the female respondents (years)	38.04
2)	Family Particulars	
	Average family Size (No.)	5.5
	Average male members (No.)	2.54
	Average female members (No.)	1.64
	Average no of children (No.)	1.3
3)	Primary occupation as agriculture (per cent)	100
4)	Educational status of the respondents	
	Primary level (up to class IV) (per cent)	8.00
	Secondary education (up to class X) (per cent)	36.00
	Higher secondary level (up to class XII) (per cent)	34.00
	Beyond graduation level (per cent)	22.00
	Literacy rate (per cent)	100
5)	Household income	
	Income from agriculture (₹/year/hh)	137180
	Income from non-agriculture (₹/year/hh)	36000
	Average households' income (₹/year/hh)	173180
6)	Operational holdings	
	Average operational holding (ha)	0.58
	Average area under inorganic cultivation (ha)	0.31
	Average area under organic cultivation (ha)	0.27
7)	Cultivation practices type	
	Average area under inorganic paddy (ha)	0.29
	Average area under organic paddy (ha)	0.23
	Average area under inorganic vegetables (ha)	0.26
	Average area under organic vegetables (ha)	0.17
8)	Farming experience (years)	28.36
	Farming experience in organic agriculture (years)	5.82
9)	Livestock rearing	
	Share of farmers own cow (per cent)	100
	Share of farmers own goat (per cent)	22
	Share of farmers own poultry (per cent)	66

Note: hh indicated households.

vegetables such as tomato, cucumber, brinjal, okra, chilli, pumpkin, bitter gourd, sponge gourd, snake gourd etc. Nearly 100 per cent of the respondents were literate, out of which 8 per cent of the respondents had educational level up to primary level, 36 per cent had completed their secondary education, 34 per cent had passed higher secondary and 22 per cent of respondents had education level to graduation or beyond. Average annual households' income was estimated as ₹173180 per family, of which the contribution of income from agriculture was 79 per cent and the remaining (21 per cent) income came from non-agriculture sector (mainly as wage labourers).

Average operational holding of the farm households was 0.58 ha with average of 0.31 ha and 0.27 ha under the inorganic and organic cultivation, respectively. Rice-Rice and Rice-vegetables were the most common cropping pattern practiced by the farmers. Average area under paddy cultivation was 0.29 ha and 0.23 ha in inorganic and organic farming, respectively. In case of vegetable cultivation, the average area under inorganic cultivation was 0.26 ha and 0.17 ha under the organic cultivation. Average farming experience of respondents in inorganic farming and organic farming were 28.36 and 5.82 years, respectively, indicating organic cultivation in the study area was followed by the farmers since few years only. Almost all farmers owned a cow in their house and the average number of cow owned was 2 per family. From these cows, on average 14990 kg dung was available in a year, which was main ingredient to produce organic fertiliser like *Sasya Gobbo, Pancha Gobbo, Liquied Mannure, Vermicompost etc.* The urine of cow was also used in these types of fertiliser and in some kind of pesticides like *Bromhastro, Jibamrito, Nimastro, Ghonamrita etc.* Only 22 per cent of farmers had goat and 66 per cent had poultry in their house. But majority of farmers did not use poultry litter as organic fertiliser. The average number of goat and poultry birds was 1 and 3 numbers, respectively per farmer.

Production, Consumption and Marketable Surplus of Paddy and Vegetables

The average production of paddy was 24.33 quintal (organic and inorganic together) in a year per family/household, of which home consumption requirement was 9.69 quintal and rest were marketable surplus (14.64 quintal) sold to either in local or in wholesale market (Table 2). The average production of inorganic paddy was 15.29 quintal, 33 per cent of which was consumed at home and rest (67 per cent) was sold in the market. In case of organic paddy cultivation, the average production was 9.04 quintal, out of which 52 per cent was consumed at home and rest (48 per cent) was sold at market. Production of paddy under organic farming was less than the inorganic farming primarily due to lower area allocated under the organic cultivation as compared to inorganic cultivation. Many of the farmers in the study area were in the conversion period and their area allocation and production were increasing over the years. From the consumption status, it was seen that the farmers themselves preferred to consume organic rice than the inorganic rice.

TABLE 2. PRODUCTION, CONSUMPTION AND MARKETABLE SURPLUS OF PADDY AND VEGETABLES

		Paddy			Vegetables		
Sl. no.	Particulars	Inorganic	Organic	Total	Inorganic	Organic	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1)	Average area (ha)	0.29	0.23	0.52	0.26	0.17	0.43
2)	Total production (q)	15.29	9.04	24.33	39.23	20.00	59.23
3)	Home consumption (q)	5.00	4.69	9.69	2.35	1.66	4.01
4)	Quantity sold (q)	10.29	4.35	14.64	36.88	18.34	55.22
5)	Marketable surplus (per cent)	67.30	48.12	60.17	94.00	91.70	93.29

Average area under vegetable cultivation was 0.43 ha and the average production was 59.23 quintal in a year per farmer. Among the total production, family consumed 4.01 quintal (7 per cent) and rest (55.22 q or 93 per cent) were sold to the market. Average inorganic vegetables production was 39.23 quintal, out of which 6 per cent was consumed at home and rest (94 per cent) was sold in the market. In case of organic vegetable cultivation, the average production was 20 quintal and family consumed 8 per cent of the production and rest (92 per cent) quantity was sold to market. Similar to paddy, the production of vegetable under organic farming was less than the inorganic farming, primarily due to lower area allocation under organic vegetable cultivation by the farmers. Many farmers were in the conversion period and they were in the process of increasing area under organic vegetables cultivation in the study area. Like paddy consumption the farmers themselves preferred to consume organic vegetable than the inorganic vegetables. The share (per cent) of marketable surplus was higher in case of vegetables as compared to paddy irrespective of organic or inorganic practices they followed.

Economics of Paddy Cultivation under Organic and Inorganic Practices

Under inorganic farming, total cost of cultivation of paddy was ₹ 43570 per ha, whereas the total cost of cultivation of organic paddy was lower at ₹ 39290 per ha (Table 3). Cost of preparatory tillage was the same for both organic and inorganic farming practices (₹ 6400 per ha) which included cost of hiring power tiller and labour. Inorganic farming required 10 labourers per ha of land preparation and costs was ₹ 3000; whereas one hectare of land preparation required 8 labourers in case of organic farming and the cost was ₹ 2400 per ha. The cost of transplanting of paddy seedlings (₹ 6600 per ha) and cost of irrigation (₹ 7200 per ha) was similar in both organic and inorganic practices. But in fertiliser application there was a huge difference between organic and inorganic practices. In inorganic farming, 120 kg of chemical fertiliser (NPK and others) was used in a hectare of land and with the average cost of chemical fertiliser of ₹ 25 per kg. The farmers mainly used urea, single super phosphate (SSP), muriate of potash (MOP) and total fertiliser cost was ₹ 3000 per ha. But under the organic farming, farmers mainly used homemade low-cost fertilisers like *Sasya Gobbo, Pancha Gobbo, Liquied Mannure, Vermicompost etc.* and it was made with cow dung, cow urine, straw, parts of banana plants, water hyacinth, earthworms, milk, ghee, bran,

TABLE 3. ECONOMICS OF PADDY CULTIVATION UNDER ORGANIC AND INORGANIC PRACTICES

Sl. No.	Particulars	Inorganic			Organic		
		Unit applied	Cost/unit (₹)	Value (₹/ha)	Unit applied	Cost/unit (₹.)	Value (₹/ha)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1)	Cost of preparatory tillage						
	Machine labour (power tiller used in times)	4	1200	4800	4	1200	4800
	Human labourer (man-days)	8	200	1600	8	200	1600
2)	Land preparation (man-days)	10	300	3000	8	300	2400
3)	Transplanting cost (man-days)	22	300	6600	22	300	6600
4)	Irrigation cost (hour)	30	200	6000	30	200	6000
	Irrigation application (man-days)	6	200	1200	6	200	1200
5)	Fertiliser/manure cost (kg)	120	25	3000	80	10	800
	Fertiliser application (man-days)	15	170	2550	8	170	1360
6)	Pesticide used (ml)	400	2000/L	800	800	0	0
	Pesticide application (man-days)	6	170	1020	4	170	680
7)	Weeding cost (man-days)	25	170	4250	30	170	5100
8)	Harvesting cost (man-days)	20	250	5000	20	250	5000
9)	Threshing cost (man-days)	15	250	3750	15	250	3750
10)	Total cost (₹/ha)			43570			39290
11)	Yield (Kg/ha)			5284			3919
12)	Farm-gate price (₹/ha)			22			30
13)	Gross return (₹/ha)			116248			117570
14)	Net Return (₹/ha)			72678			78280
15)	Output-input ratio			2.66			2.99

Note: Average area under inorganic and organic paddy cultivation was 0.29 ha and 0.23 ha, respectively. *All ingredients for organic pesticides are locally available and there is no cost to make organic of pesticides.

flour etc. They used mustard peel (oil cake), sunflower peel, cow dung during land preparation. All these ingredients were low-cost as compared to chemical fertilisers and locally available. The cost such organic inputs were estimated to be ₹ 10 per kg. Around 80 kg of organic fertiliser was used per hectare for paddy cultivation and total cost of such fertiliser was ₹ 800 only. Fertiliser application cost under inorganic farming was ₹ 2550 per ha and for organic farming, the same was ₹ 1360 per ha. The price of chemical pesticides was ₹ 2000 per litre and 400 ml of chemical pesticides was used in a hectare of paddy field incurring ₹ 800 per ha. Organic pesticides like *Bromhastro, Jibamrito, Nimastro, Neem oil etc. was* prepared by using the urine of cow *(Gochona),* neem leaf, neem seed, casurina leaf, tobacco leaf. All these ingredients were locally available and very low cost (labour and inputs) was required for making these types of pesticides. But the quantity of pesticides in organic farming was much higher (bulky) than the quantity of pesticides used in inorganic farming (800 ml). The pesticide application cost in inorganic farming was higher (₹ 1020 per ha) as compared to organic farming (₹ 680 per ha) due to higher frequency of application. However, the weeding cost was substantially higher under organic farming (₹ 5100 per ha) than the inorganic farming (₹ 4250 per ha) because in organic farming fields, there was no use

of herbicides and weeds were cleaned manually. Cost of harvesting (₹ 5000 per ha) and threshing (₹ 3750 per ha) was similar in organic and inorganic farming practices.

Paddy yield was 5284 kg per ha under inorganic practices which was higher than the yield under organic practices (3919 kg per ha). One of the main reasons of these, farmers was in the conversion period and the full production potential was yet to be realised under the organic farming practices, as the experts said. The inorganic paddy was sold in the local, wholesale market and also from their doorstep at an average price of ₹ 22 per kg and the organic paddy was sold in the similar markets but realised a higher average price of ₹ 30 per kg. The organic paddy fetched higher price than the inorganic paddy because most of the farmers produced premium aromatic rice and few institutional buyers like *Sundarini, Badabon Farmers Producers Company Ltd.* promoting organic agriculture in the study area) were available in the study area. Few traders also procured the organic rice at higher price directly from the farmers. So, despite the lower yield, the gross and net return, output-input ratio of organic paddy was higher than inorganic paddy. Gross return of organic paddy was marginally higher (₹ 116248 per ha) as compared to inorganic paddy (₹ 116248 per ha). Similarly, the net return of organic paddy was realised higher for organic paddy (₹ 78280 per ha) as compared to inorganic paddy (₹ 72678 per ha) with higher output-input ratio of 2.99 and 2.66 under organic and inorganic paddy, respectively. Organic farmers received moderate premium price (₹ 30 per kg for organic as compared to ₹ 22 per kg for inorganic paddy or 36 per cent) for their production and as a result the realised output-input ration was higher in the study area; however, the price premium should be more as the retail price of the organic paddy sold in the city market (Kolkata) was much higher than inorganic paddy. So, the cost of organic paddy cultivation was less than the inorganic paddy cultivation and if the farmers get the premium price, then it will be further profitable which is desirable in terms of environmental (ecosystem services) sustainability and physical well-being of the consumers.

Economics of Vegetables Cultivation Under Organic Vs. Inorganic Practices

Total cost of cultivation of vegetables under inorganic farming was ₹ 91500 per ha which was higher than cost under organic practices, ₹ 79590 per ha (Table 4). Cost of preparatory tillage was the same in both organic and inorganic ways of farming practices (₹ 9600 per ha) including machine labour (use of power tiller) as well as human labourers. In vegetable cultivation, there were some additional material cost such as wicker, rope, net, bamboo, steel/iron wire for tying and staking of plants. The cost of purchase of these additional materials was calculated as ₹ 6000 per ha under both inorganic and organic farming practices. Inorganic farming of vegetables engaged 30 labourers per ha for 2 times of land with a cost of ₹ 9000. Transplanting cost of vegetables under both organic and inorganic farming system was accounted to be ₹ 9000 per ha. Irrigation cost was also similar for both types of farming practices (₹ 9600 per ha). But in case fertiliser application, there was a huge difference between the two cultivation methods. Fertiliser cost under inorganic farming was ₹ 15000 per ha for

TABLE 4. ECONOMICS OF VEGETABLES CULTIVATION UNDER ORGANIC VS. INORGANIC PRACTICES

		Inorganic			Organic		
Sl. No.	Particulars	Unit applied	Cost/unit (₹)	Value (₹/ha)	Unit applied	Cost/unit (₹)	Value (₹/ha)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1)	Cost of preparatory tillage						
	Machine labour (power tiller used in times)	6	1200	7200	6	1200	7200
	Human labour (man-days)	12	200	2400	12	200	2400
2)	Wicker, rope, net, bamboo, steel wire etc.			6000			6000
3)	Land Preparation (man-days)	30	300	9000	30	300	9000
4)	Transplanting cost (man-days)	30	300	9000	30	300	9000
5)	Irrigation Cost (hours)	40	200/hr	8000	40	200/hr	8000
	Irrigation application (man-days)	8	200	1600	8	200	1600
6)	Fertiliser/manure Cost (Kg)	600	25	15000	705	10	7050
	Fertiliser application cost (man-days)	30	170	6800	20	170	3400
7)	Pesticide Cost (ml.)	450	2000/L	900	850	-	-
	Pesticide application (man-days)	20	170	3400	12	170	2040
8)	Weeding cost (man-days)	60	170	10200	70	170	11900
9)	Harvesting cost (man-days)	48	250	12000	48	250	12000
10)	Total cost (₹./ha)			91500			79590
11)	Yield (Kg/ha)			14935			11811
12)	Farm-gate price (₹/ha)			18.28			18.58
13)	Gross return (₹/ha)			273012			219448
14)	Net Return (₹/ha)			181512			139858
15)	Output-input ratio			2.98			2.75

Note: Average area under vegetables under inorganic and organic cultivation was 0.26 ha and 0.17 ha, respectively. *The all ingredients are locally available and there is no cost to make organic of pesticides.

600 kg of chemical fertiliser, which was almost double the cost of fertiliser applied under organic farming (₹ 7050 per ha). Average cost of chemical fertiliser (average of NPK) was ₹ 25 per kg, much higher than organic fertiliser (₹ 10/kg). Farmers mainly used urea, single super phosphate and muriate of potash (MOP) as inorganic fertiliser. In case of organic farming farmers used homemade low-cost fertilisers like *Sasya Gobbo, Pancha Gobbo, Liquied Mannure (cow urine based), Vermicompost etc.* and these were made mainly using cow dung, cow urine, straw, parts of banana plants, water hyacinth, earthworms, milk, ghee, bran, flour, vegetable peels etc. They used mustard peel, sunflower peel and cow dung during land preparation (114 kg/ha). All these ingredients were low cost and locally available. So, the cost of preparation of these fertilisers was very low (mainly labourer and plants/animal waste), estimated to be ₹ 10 per kg. Around 705 kg of these organic inputs was used for cultivation of a hectare of land under vegetables. The total cost of these fertiliser was ₹ 7050 per ha. Fertiliser application cost for a hectare of land under inorganic farming was ₹ 6800 per ha, much higher as compared to cost incurred under organic farming practices (₹ 3400 per ha). The price of chemical pesticides was ₹ 2000 per litre and around 450 ml. of pesticides was used with a cost of ₹ 900 per ha. But the organic pesticides such as *Bromhastro, Jibamrito, Nimastro, Neem oil* and the cow urine *(Gochona),* neem leaf,

neem seed, casuarina leaf, tobacco leaf were used in preparation of organic pesticides. All of these ingredients were locally available without depending on external sources and there was very negligible cost to prepare these types of pesticides. Application cost of pesticides was ₹ 3400 under inorganic cultivation, much higher than the cost incurred for application of organic pesticides, ₹ 2040 per ha. However, the weeding cost was higher in organic farming (₹11900 per ha) as compared to inorganic vegetables cultivation (₹ 10200 per ha). Manual weeding was mainly followed under organic cultivation and no herbicides were used. Harvesting cost was similar (₹ 12000 per ha) for both organic and inorganic way of cultivation.

Average yield of vegetables under inorganic cultivation (14935 kg per ha) was much higher than the yield of organic vegetables cultivation (11811 kg per ha). It was clearly seen that total production of vegetable cultivation under organic farming was less than the inorganic farming. The inorganic vegetables were sold at ₹ 18.28 per kg and the organic vegetables were also sold almost at similar price (₹ 18.58 per kg), indicating no significant price premium was realised by growing the organic vegetables by the farmers. Gross return under inorganic cultivation was ₹ 273012 per ha, higher than gross return under organic vegetables cultivation, ₹ 219448 per ha. Similarly, net return was lower (₹ 139858 per ha) for organic vegetables as compared to inorganic vegetables (₹ 181512 per ha). Also the realised output-input ration was lower in case of organic vegetables (2.75) as compared to inorganic vegetables cultivation (2.98). Since organic farmers were forced to sell their vegetables at inorganic vegetable price rate, the output input ratio of organic vegetable cultivation was less than inorganic vegetable cultivation. The cost of organic vegetable cultivation was less than the inorganic vegetable cultivation, as soon as the farmers would get the premium price like paddy, then growing organic vegetables might be more profitable. However, in the present scenario, farmers were not receiving the premium price for organic vegetables, as a result, farmers were losing interest in the cultivation of organic vegetable despite knowing the benefits of organic farming. In terms of environmental and physical well-being, organic farming method is healthier and more sustainable than inorganic farming, provides better ecosystem services and therefore deserve better price or incentives for growing organic vegetables.

Market Access for Selling Organic Paddy and Vegetables

Paddy cultivators used different selling points to sell the organic and inorganic paddy. Majority of both inorganic (95 per cent) and organic (69 per cent) paddy cultivators sold their marketable surplus into local market. There was no separate marketing channel (value chain) for selling organic paddy; therefore, the organic growers were dependent on the same marketing channel like inorganic paddy selling. Some farmers (35 per cent) went to the wholesale market for better price, irrespective of types of paddy (organic or inorganic). Few traders were also active and came to farmers' doorstep to buy paddy from them directly, particularly for aromatic organic

paddy. Organic farmers mainly produced the traditional varieties of aromatic rice, which often received relatively higher price when sold directly to the buyers. Around 58 per cent of organic farmers could sell their produce at farm gate and the same was only 30 per cent under inorganic paddy selling. Besides, organisations like *Sundarini*, *Badabon Farmers Producers Company Ltd.* etc. worked as a marketing linkage between the consumers and the organic paddy cultivators. However, only few farmers (2 per cent) could access such marketing channel in the study area. They directly procured organic paddy from the farmers, and after processing and packaging, they sold to their stores in urban areas like Kolkata and also through online platform. After procuring it, they sent the payment directly to the farmers' bank account. Such model of intuitional linkages for marketing of organic produce was desirable to make the organic cultivation successful in the state. Majority of both inorganic (78 per cent) and organic (89 per cent) vegetables cultivators sold their produce in local market. In absence of separate organic marketing channel for selling of organic vegetables they did not get any price premium for the organic vegetables. Some inorganic (44 per cent) and organic (42 per cent) growers having better transportation facilities sold their produce in nearby wholesale market. Few local traders were also available who procure the vegetables at farm gate (13 per cent and 17 per cent for organic and inorganic vegetable, respectively). However, there was no exclusive marketing linkage between organic vegetable growers and consumers like paddy, supported by institutional buyers (*Sundarini* and *Badabon Farmers Producer Company Ltd.)*. Despite the demand in urban areas, farmers were forced to sell organic vegetables in the inorganic vegetable market, as there was no separate selling option for the organic vegetables.

TABLE 5. MARKET ACCESS FOR SELLING ORGANIC PADDY AND VEGETABLES

		Paddy		Vegetables	
Sl. No.	Particulars	Inorganic	Organic	Inorganic	Organic
(1)	(2)	(3)	(4)	(5)	(6)
1)	Share of farmers sold at local market (per cent)	95.34	69.23	77.77	89.47
2)	Share of farmers sold at other/wholesale market (per cent)	34.88	34.61	44.44	42.10
3)	Share of farmers sold at farm gate (per cent)	30.23	57.69	16.88	13.15

Constraints of Farmers in Practicing Organic Agriculture

Farmers highlighted ten different constraints in large scale adoption of organic farming in the study area. Lack of separate organic market/linkages was reported by all farmers (100 per cent) as the most severe problem. According to them separate organic marketing channel was very much needed to sustain the organic farming. After that 96 per cent respondent marked the lack of premium price available was a disincentive for practicing organic agriculture. Farmers were forced to sell their organic products at the price range similar to inorganic products. If the farmers failed to receive adequate price (minimum procurement price) for organic produce, then they may not

be interested in continuing organic farming. Lack of support through government schemes, marketing linkages and subsidy (for certification) from government was another constraint reported by around 94 per cent of framers. Active government support dedicated for promotion of organic agriculture in the state. Lack of information about the market trend, price and product-positioning were major constraints reported by 82 per cent of respondents. Due to the lack of access to proper information, often intermediaries actually shared the profit in greater extent depriving the producers. Many farmers did not have the proper knowledge (76 per cent) about the organic farming process which was a constraint for practicing organic farming. Certification was an important integral component of organic farming and without certification a farmer cannot expect to realise the premium price for his organic product. Only 4 per cent of the farmers could complete the certification process, 38 per cent farmers were undergoing in the process of certification and rest (58 per cent) farmers had no certification details. The certification process was too lengthy and costly, particularly for the small-holder farmers. Most farmers did not have the proper knowledge about the certification process and the cost of the certification was very high (₹ 12000 per year), often unaffordable by many small farmers (APEDA, 2020). So, this was one of the important constraints identified by 74 per cent of the farmers. Farmers (70 per cent) did not have the proper training on making of bio-fertilisers, bio-pesticides and organic farming techniques. Inadequate availability of farm input (although locally available but required in bulk quantity), difficulties in control of pest and disease only with bio-pesticides or bio-control methods were also other important constraints for adoption of organic farming in the study area. Finally, high labour requirement and cost of labourers were reported as a major constraint (40 per cent) by the farmers.

TABLE 6. CONSTRAINTS OF FARMERS IN PRACTICING ORGANIC AGRICULTURE

Sl. No.	Constraints	Per cent respondents	Rank
(1)	(2)	(3)	(4)
1)	Lack of separate organic market/linkages	100	1
2)	Can't get proper price for organic product (price premium)	96	2
3)	Lack of government support (subsidy, market linkages etc.)	94	3
4)	Lack of information about the market trend, price and product positioning	82	4
5)	Lack of awareness among farmers about organic farming method	76	5
6)	Certification process is complicated and costly	74	6
7)	Lack of proper training in organic farming practice	70	7
8)	Inadequate availability of farm input	67	8
9)	Control of pest and disease is difficult	54	9
10)	High labour requirement and cost	40	10

Determinants of Adoption of Organic Farming in West Bengal

To identify the various determinants of adoption of organic agriculture, multiple regression analysis was performed taking into different factors. Initially, a large number of socio-economic variables were considered and step-wise regression was

applied to identify the most important factor. The percentage of area allocated under the organic farming by individual farmers was considered as the dependent variable in the analysis. Operational holdings, number of adult members in the family and nearest market distance did not appear to be the significant factors to determine how much area a farmer would allocate in organic farming. Possible reason might be, it was the linkages with institutional support from NGOs or government schemes influencing the organic farming but non-availability of price premium for organic produce were affecting the allocation of area under organic farming. Obviously, the access to organic market supply chain was more crucial for practicing organic agriculture than availability of any market near to their farm. Therefore, availability of institutional buyers was a significant factor in allocation of area under organic farming. It was noted that organic agriculture was more preferred by the younger farmers and level of education a positive factor significantly influencing the adoption of organic farming. Availability of cow dung from farmers' own sources was the most important and significant factor to determine the allocation of area under organic farming (Mandal *et al*., 2006). Overall, the factors included in the regression model could explain 77 per cent of the variation in the dependent variable and the model was a good fit.

TABLE 7. FACTORS AFFECTING ADOPTION OF ORGANIC CULTIVATION PRACTICES

Sl. No. (1)	Factors (2)	Co-efficient (3)	Standard Error (4)
1)	Constant	4.03758**	1.9083
2)	Operational area in ha (X_1)	-1.0371	5.2222
3)	Age of the farmers in years(X_2)	-0.8349***	0.193
4)	No. of adult members in family (X_3)	0.0962	1.0472
5)	Dung availability at household in t/year (X_4)	1.5076***	0.29136
6)	Presence of institutional buyer as dummy (X_5)	2.4189***	1.0325
7)	Education level in no. of years in school (X_6)	1.7042***	0.6934
8)	Nearest market distance in km (X_7)	-0.7154	1.0288
9)	F-value	27.3044***	
10)	Adjusted R-square	0.7667	
11)	No of observations (N)	80	

Note: ***, ** and * indicates level of significance at 1,5, and 10 per cent, respectively.

Agribusiness Opportunities for Organic Produce and Consumer Demand

Organised retailers such as Spencer, Reliance Fresh, Big Basket, Daily Bazar, Amazon were selected for collection of the price information on organic produce. These were the major retailer selling organic produce in the market through their stores or online platform. Along with these retailers there were many small traders available in the city who were selling organic commodities directly to the farmers through their own stores or online. However, detailed and adequate information was not available with respect to those sellers, and therefore was not included in the analysis. Paddy, vegetables, fruits, spices, pulses were the major commodities sold by these retailers. Price information was collected on different varieties of paddy such as Basmati, Sona masuri and Brown Rice. The average price of basmati rice was ₹ 180 per kg and the

average price for Sona masuri and brown rice was ₹ 100 and ₹ 93 per kg, respectively. Potato, brinjal, tomato and onion were selected under vegetable category as these were the commodities also produced by the farmers in the study area. The average price of organic potato was ₹ 78 per kg, ₹ 48 per kg for brinjal, ₹ 75 for tomato and ₹ 30 per kg for onion. Organic turmeric powder was sold in open market at ₹ 408 per kg and chilli powder was sold at ₹ 509 per kg. In the fruits section papaya and watermelon were sold at ₹ 49 per piece and ₹ 46 per piece, respectively. Average price of banana was ₹ 25 per kg and cucumber were sold at ₹ 50 per kg. Pulses such as moong, chana (gram), green moong (whole), and red masoor (lentil) dal were selected among organic pulses which have good potential to be grown organically by the farmers in the state. The average price for moong, green moong dal, chana dal and red masoor dal were ₹ 193 per kg, ₹182 per kg, ₹145 per kg and ₹ 144 per kg, respectively. Different retailers were selling the same items at different prices and there were huge difference between those prices even within the same day. It reflected the consumer demand about the preference of organic commodities in the retail market and there were good opportunities of receiving higher price for selling organic produce by the farmers. However, the farmers can take advantage of growing such organic commodities those have higher consumer demand as evident from the trend in the online selling and there is a need to establish market linkages with the organised retailers or creating separate value chain for marketing the organic produce. Farmers need to be educated about the consumer preference of the specific organic commodities and accordingly promotions were to be made. Production catering to the market demand and not looking for the market after the production should be the strategies for promotion of organic commodities in the state.

Besides, a consumer survey with 92 respondents was conducted to understand the frequency and types of commodities purchased by them. Frequency of purchasing of organic food indicated that the demand of organic foods in the market was increasing rapidly, particularly through organised retailers. Over 20 per cent of the consumers bought organic product ‘at least once’, 52 per cent of total consumers bought organic food ‘often’ and 28 per cent of consumers bought organic product ‘very often’. It indicated that people were very much aware about the organic products and they also had the purchasing capacity to buy organic food. Consumers’ preference analysis indicated that 33 per cent of total respondents preferred to buy organic vegetables, followed by fruits (28 per cent), cereals (24 per cent), spices and other commodities (15 per cent). Therefore, it indicated that there was a good demand for fresh organic vegetables, fruits, cereals and spices in the market.

IV

CONCLUSION

Realising the harmful effects of excessive use of chemicals and fertilisers, rising consumers demand for healthy food and government promotion for sustainable

TABLE 8. OPEN MARKET PRICES OF SELECTED ORGANIC COMMODITIES SOLD BY ORGANISED RETAILERS IN KOLKATA

Sl. No (1)	Commodities (2)	Spencer (₹/kg) (3)	Reliance fresh (₹/kg) (4)	Big basket (₹/kg) (5)	Daily bazaar (₹/kg) (6)	Amazon (₹/kg) (7)	Average (₹/kg) (8)
1)	Paddy						
	Basmati	212.50	160	159	200	167	179.7
	Sona masuri	110	85	110	100	95	100
	Brown rice	93.50	98	97	90	86	92.9
2)	Vegetables						
	Potato	120	50	50	70	99	77.8
	Brinjal	59	40	36	60	46	48.2
	Tomato	120	90	54	50	60	74.8
	Onion	-	35	25	30	-	30
3)	Spices						
	Turmeric (Powder)	580	-	270	380	400	407.5
	Chilli (Powder)	650	-	335	550	500	508.75
4)	Fruits						
	Cucumber	99	40	24	35	50	49.6
	Banana	20	25	-	30	-	25
	Papaya (per piece)	59	35	22	-	80	49
	Watermelon (per piece)	-	40	39	-	60	46.33
5)	Pulses						
	Moong dal	220	200	165	160	220	193
	Chana dal	160	125	115	155	170	145
	Green Moong dal	180	200	159	170	200	181.8
	Red Masoor dal	146	150	122	130	170	143.6

Source: Online sources of Spencers, Big basket and Amazon and website of Jio mart (Reliance Fresh) and Daily Bazar, accessed during 12-13 July 2020.

agriculture farmers were gradually shifting to organic farming. The farmers in West Bengal also started practising organic agriculture through the support of different grassroots level organisations, but on a low scale. Farmers were growing organic paddy (aromatic but non-basmati category) and vegetables in some parts of their land. Despite lower yield, the economics of organic paddy was positive but the farmers deserved more profit in view of the prevailing high retail market price and consumer demand. In case of organic vegetables, the profitability was less than inorganic vegetables primarily due to loss of yield and lack of price premium. But the organic vegetables has high demand in the organised retail and in export market, therefore, establishing linkages with such institutional buyers would increase the profitability of the farmers. Based on the study, the following specific suggestions are made to harness the agribusiness opportunities of the organic agriculture in the state, (1) promotion of aromatic and scented rice varieties along with branding and packaging would be profitable and effective way to increase the interest of farmers in organic farming; (2) ensuring price premium to the quality rice produced by the farmers and establishing market linkages with the help of non-governmental organisations or service providers are essential for promotion of organic cultivation. Government may promote such more

institutions/agencies for the expansion of organic farming in West Bengal; (3) Government might create system to incentivise (e.g., minimum procurement price) the organic vegetables production, viewing the quality assurance of the commodities; (4) Farmers needed to be educated about the consumer preference (what consumers want) of the specific organic commodities and accordingly promotions are to be made; and (5) provide training on making of bio-fertilisers, bio-pesticides and farming techniques, pest management with the locally available resources. There are huge agribusiness opportunities for a whole range of agricultural commodities covering cereals, fruits, vegetables, pulses and spices, for which exclusive value chain needs to be created and organic commodities must be sold in separate marketing channels than selling the inorganic produce.

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