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## Extent of Adoption of Sustainable Agricultural Practices by Farmers in Uttar Dinajpur District, West Bengal

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DOI : <https://doi.org/10.5281/zenodo.19365994>

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### ARTICLE DETAILS

**Research Paper**

**Accepted:** 15-03-2026

**Published:** 10-04-2026

### Keywords:

*Agriculture, Sustainable  
Agriculture Practices,  
Mean Awareness Index,  
Adoption Quotient Index,  
Problem Confrontation  
Index, Uttar Dinajpur  
District, West Bengal.*

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### ABSTRACT

The paper presents an overview of awareness and adoption level of Sustainable Agriculture Practices (SAPs) and the problems faced to adopt SAPs in Uttar Dinajpur district. A multi-stage random sampling method was used to collect primary data from 135 farmers. Mean Awareness Index and Adoption Quotient Index is used to find out the awareness level and adoption level respectively of selected eight SAPs, and Problem Confrontation Index (PCI) is used to identify the problems of farmers to adopting SAPs. In this district, awareness score is 42.45, adoption score is 22.04 and problem confrontation score is 54.68. Farmers are more awarded about climate-based improved seeds, crop rotation, and the use of animal manure or organic fertilizers and in terms of adoption scores- climate-based improved seeds, animal manure or organic fertilizers, and crop rotation emerge as the most commonly adopted SAPs compared to other SAPs. Higher input cost, lack of farm trials and demonstration and lack of technical information & knowledge are the primary challenges farmers faced when attempting to adopt SAPs in this area and the overall problem confrontation rate is high (3986), and the severity rate exceeds 50 percent, posing a barrier to the adoption of

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- **Introduction**

Agriculture is the foundation of India's economy, playing a crucial role in ensuring food security, generating employment, and supporting overall economic growth. The Indian agriculture provides a livelihood for about 42.3 percent of the population and contributes 18.2 percent to the country's GDP at current prices (Economic survey, 2023-2024). Hunger and food insecurity remain major development priorities, exacerbated by climate change, price volatility in globalized food markets, and overconsumption in rich countries. Existing agriculture and food systems are central to the livelihoods of poor people and are technically capable of producing enough food for all (Adolph & Grieg-Gran, 2013). For this reason, agriculture has experienced significant transformations since World War II. Advancements in technology, mechanization, greater reliance on chemicals, specialization, and policies aimed at lowering food prices have all contributed to higher productivity in food and fiber (DeLonge 2016; Envirothon 2019). So, for decades, agriculture has had a significant negative impact on the environment. More land, fertilizers, and pesticides are being used to increase production to meet the demands of a growing population. The consequences of this include deforestation and soil degradation, loss of biodiversity, irrigation problems, and pollution, among other problems (Coulibaly et al., 2021). This has given rise to a new form of farming known as sustainable agriculture to address the issue (Pineiro et al., 2020). So, the sustainable agricultural practices (SAPs) are agricultural practices or approaches to management that fulfil present food and fiber demands without damaging the environment, exhausting natural resources, or limiting the capacity of future generations to produce food (Velten et al., 2015). Since the release of the Brundtland Report in 1987, the idea of sustainable agriculture has become increasingly important, alongside the wider concept of sustainable development (Tait & Morris, 2000). The objective of SAPs is to maximize agricultural production or output without harming the environment, public health, community or animal welfare and to minimize the addition of external inputs to maintain agricultural resources, achieving socio-economic, environmental and economic well-being, including quality of life, environmental and livelihoods (Kornegay et al. 2010). But several factors combine to prevent farmers from prioritizing long-term sustainability goals, including limited resources, agricultural policies that increase short-term productivity while relying on environmentally harmful inputs, and the adoption of interventions that ignore household diversity (Adolph, 2020). Adopting these sustainable practices typically requires strong incentives, significant efforts from farmers, and support from governments and public-private partnerships at national and local levels (Pineiro, 2020). If there is



mutual causality between local partnerships, there is a potential for positive feedback between program participation and practice adoption that will lead to a consistent acceleration of innovation, cultural change, and collaboration (Shaw et al., 2011).

- **Review of Literature**

In 1987, the United Nations' Brundtland Commission defined sustainability as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs,' a principle that also underpins the concept of sustainable agriculture adopts productive, competitive and efficient practices, while protecting and improving the environment and the global ecosystem, as well as the socio-economic conditions of local communities in line with human dignity (Pinter et al., 2007). Sustainable agriculture indicators are measurable indicators that help determine whether agriculture is environmentally sound, economically sustainable, and socially responsible in the long term (Dumanski et al., 1998) and deciding to what extent or to what extent pre-conceived notions of sustainable agriculture should be adopted requires decisions that require careful, participatory consideration of a country's underlying social, economic, and cultural conditions (Gatzweiler et al., 2001). Environmental indicators such as soil erosion rates, soil fertility and nutrient balance, water conservation management, water use efficiency, groundwater table stability, crop and livestock diversity, natural habitat conservation, greenhouse gas emissions, renewable versus fossil-based energy use measure how agriculture impacts natural resources and ecosystems (Kulshreshtha 2014; Walker 2002). Return on investment, liquidity, productivity, stability of production over time, efficiency of labour productivity, and profitability as input-output are primary indicators of economic stability (Bathaei & Streimikiene, 2023). social aspects such as fair wages, safe working environments, food security for farmers, quality of life, human rights, social impact of farming and participation in local decision-making are focus on human well-being and social resilience (Jancker & Mann, 2020). On the other hand, institutional and policy indicators are measurable as sustainable agriculture. Institutions and policies shape the patterns of human behaviour. They constrain human behaviour and thereby compel people to engage in SAPs. Some of these are the existence of supportive policies and incentives, security of land tenure, access to agricultural extension services, and adoption of innovation and best practices (Gatzweiler, 2001).

A cultivator may adopt sustainable agriculture for three reasons: first, consumer demand for chemical-free or organic products and the potential for increased cultivators' revenue, second, potential cost savings for cultivators, and third, the farmer's personal beliefs. Cost savings may be associated with reduced use of chemicals, fertilizers, and other inputs, or with producers' ability to more effectively



address environmentally related regulations (D Souza et al., 1993). Rainfall, insect and disease shocks, government effectiveness in providing extension services, plot ownership status, social capital, plot location and size, and household wealth, all influence farmers' investment in SAPs (Kassie et al., 2012). Farmers' adoption and intensity of use of various SAPs depends significantly on factors such as the age of the household head, gender, education, household size, access to extension services, and household wealth status (Usman et al., 2021). In contrast, lack of adequate knowledge about sustainable agriculture and unfamiliarity with technology were significantly and negatively associated with a lower tendency to adopt SAPs (Mishra et al., 2018). A typical farming household has to make rational choices among multiple SAPs in different cropping systems because they have different combinations of risks and preferences. Therefore, the adoption of a particular SAP may be dependent on the use of another (Adebayo et al., 2018).

Farmers play a central role in ensuring sustainable agricultural systems based on their knowledge and expectations (Rehman et al., 2021). Therefore, raising awareness is crucial to influence policy making for the adoption of SAPs (Gebaska et al., 2020). Lack of awareness and reliance on fellow farmers as a source of information leads to the cessation of the use of important sustainable practices such as alley crops, use of green manure, crop rotation and minimum tillage systems (Ashrit & Thakur, 2022; Edeoghon, 2008). But it can be assumed that a correct understanding of the phenomenon increases awareness of the relationship between actions and their consequences, which seems to be necessary for farming according to the rules of sustainable agriculture. Although being aware of the issue does not necessarily mean that farmers will adhere to environmental standards, such awareness does contribute to shaping their behaviour (Okumah, 2018).

Numerous studies on the adoption of SAPs have highlighted various obstacles that limit their broader implementation. Several challenges also deter participation in natural resource management programs. These challenges can be categorized into four main areas: the viewpoints of individual landowners, the nature of the management practices being promoted, the socio-economic makeup of the adopter's community, and the broader institutional context (Cary et al., 2001). Like as, there are several key obstacles to adopting SAPs, including high input expenses, limited access to information and expertise, resistance to change, and unsuitable government policies (Kheiri, 2015). And also, inadequate knowledge, burdens related to materials and processes, financial difficulties, cost-benefit considerations, limitations in capacity and market access, and insufficient skills—these six factors serve as barriers to the adoption of SAPs (Akenroye et al., 2022). But, where receiving agricultural training, being close to cities, owning larger farms, and off-farm income encourage farmers to adopt SAPs (Msemu et al., 2018).



According to the 2011 census, Uttar Dinajpur district has a total population of 30,07,134 (Muslims 49.92%, Hindus 49.31%, Scheduled Castes and Tribes 26.87% and 5.41% respectively), of whom 88% live in rural areas and the literacy rate is 60.13 percent, which is lower than the national average. The district has an average population density of 960 persons per square kilometre and a sex ratio of 936 (Census, 2011). It is one of the least developed districts of India, along with West Bengal, with high illiteracy rates, lack of healthcare and livelihood opportunities, and widespread rural poverty. Although it is a predominantly agricultural district, rapid population growth limits the attraction of new rural workers to agricultural employment, while the low level of urbanization hampers the development of the non-agricultural sector (Roy, 2011). According to the National Agricultural Research Report 2015-16, Uttar Dinajpur is the second poorest district in West Bengal (42.84%) after Purulia (49.69%). Since it is an agro-centric district, poverty reduction is possible only through agricultural development based on SAP adoption. At present, farmers are using non-agricultural organic waste, animal manure and crop rotation which are signs of introduction of organic farming in the district and diversification is being done in most of the blocks of central and eastern part. (Siddiqui & Afzal, 2018). But it is not enough to understand the sustainability of agriculture and also the author did not explain the awareness rate and adoption rate of SAPs in this area. So, this study is very important to understand what is the awareness rate, what is the adoption rate of SAPs and What problems they face to adopting SAPs in this district.

- **Objectives**

This study was conducted with the following objectives:

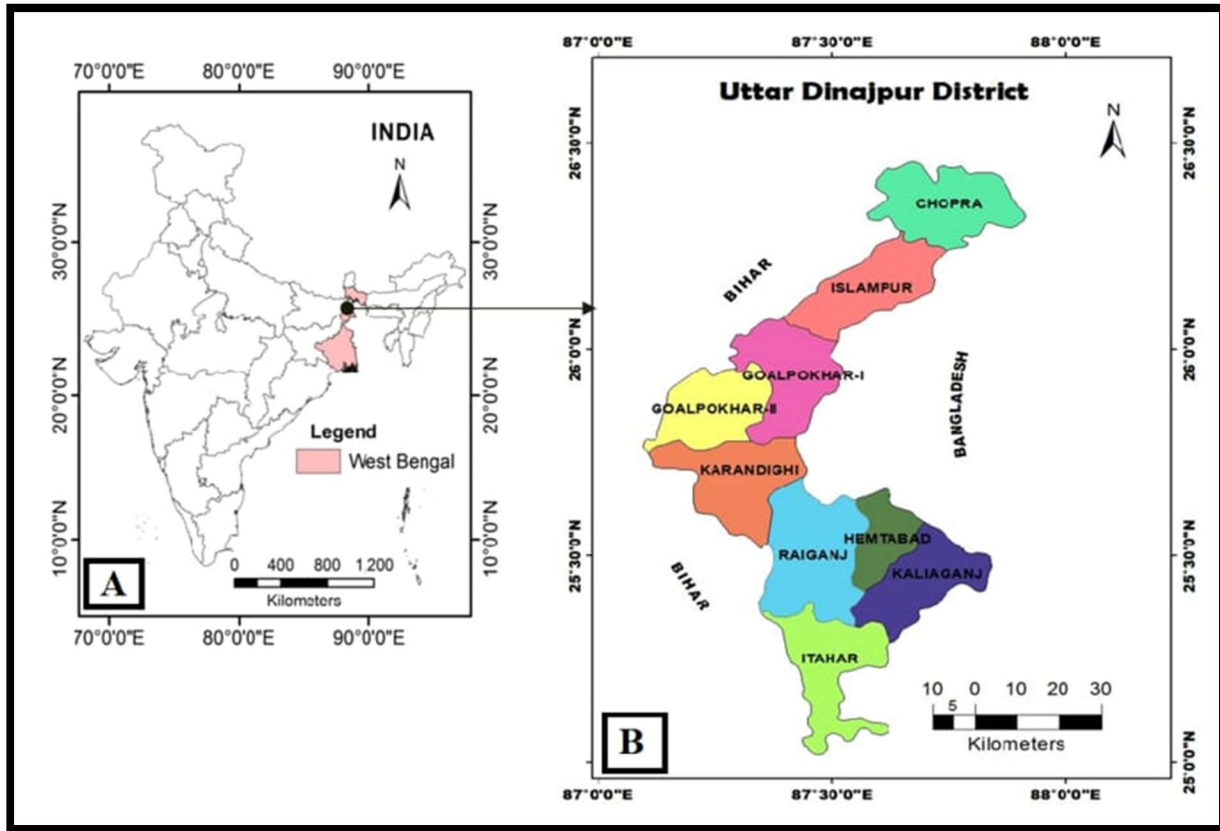
1. To assess the awareness of farmers about SAPs in Uttar Dinajpur district.
2. To examine the status of selected personal and socio-economic characteristics of farmers in Uttar Dinajpur district.
3. To find out the rate of adoption of SAPs by farmers in Uttar Dinajpur district.
4. To understand the barriers of farmers to adopting SAPs in Uttar Dinajpur district.

- **Methodology**

### **Study Area**

The study area Uttar Dinajpur district is one of the districts of West Bengal, India. It is located between 25<sup>0</sup>11' north latitude and 26<sup>0</sup>49' north latitude and 87<sup>0</sup>49' east longitude and 90<sup>0</sup>00' east longitude. The area of the district is 3,140 square kilometres. It is bordered by Bangladesh to the east, Bihar state to the west, Darjeeling district and Jalpaiguri district to the north, and Malda district and Dakshin Dinajpur

district to the south. Uttar Dinajpur has 2 municipalities, 9 CD Blocks with 98 Gram Panchayats covering 1,494 villages during 2011 Census. Here, Summer is from mid-March to May, the rainy season enters the district in early June and lasts until September, and winter is observed from mid-November to



February. The maximum temperature is  $41^{\circ}\text{C}$  and the minimum temperature is  $5^{\circ}\text{C}$  and the district has recorded an average annual rainfall of 1,645 mm. Total cropped area is 5,71,238 hectares and it is one of the agriculturally oriented districts in West Bengal and the major crops include rice, oilseeds (mustard), wheat, jute, maize, potatoes, mangoes, bananas, pineapples, litchis, papayas, guavas, brinjals, chillies, cabbage, cauliflower, tomatoes, turmeric, ginger and bay leaves. Irrigation sources are government canals, high-capacity deep tubewells, medium-capacity deep tubewells, low-capacity deep tubewells, shallow tubewells, river lift irrigation, and open dug tubewells (Census of India, 2011). More than 97 percent of the area of the district is irrigated mainly by tube wells and tanks. Therefore, tube wells are the main source of irrigation in the district (Siddiqui et al., 2017).

For the study, A multi-stage random sampling method was used to collect primary data and an ex-post facto research design was employed to investigate farmers' awareness of, adoption of and problems of SAPs of farmers in this area. The authors selected all 9 CD Blocks and 2 most agricultural villages from



every selected CD Block. 15 farmers are selected randomly from every CD block and data were collected from total 135 farmers by the face-to face interviews to the farmers with the help of questionnaire. The MAPs were created by QGIS software and data were calculated by MS Excel software.

## Empirical framework of the study

### Awareness Score Estimation

A schedule was developed to assess farmers' awareness about SAPs. For this purpose, a schedule consisted of 8 items with multiple options, such as "fully aware," "partially aware," and "not aware." Two scores were assigned if the farmer was fully aware of a topic, 1 score if the farmer was partially aware, and 0 score if the farmer was not aware. Accordingly, a total score was calculated for each respondent based on their Mean Awareness Index (MAI) method (Mallappa & Pathak 2023, Ghirvu 2013). The formula of Mean Awareness Index can be written as

$$MAI = \frac{(0 \times NA) + (1 \times PA) + (2 \times FA)}{N} \times 100$$

Where, NA is-Not Aware, PA is-Partially Aware and FA is-Fully Aware, N is the maximum number of awareness score.

### Adoption Quotient Index.

Adoption quotient for an individual farmer was computed from the adoption scores gained by the farmer for the adoption a practice. It is lies between 0 to 100, 0 mean no adoption and 100 means highest level adoption. According to Pareek & Chattopadhyay (1966), the formula of Adoption Quotient Index can be written as.

$$AQI = \frac{\sum_{j=1}^N \left( \frac{E_j}{P_j} \times \frac{(T_p - T_2 - G)}{T_p - T_1} \right) \times W_j}{\sum_{j=1}^N W_j} \times 100$$

Where,  $E_j$  = Actual area (Bigha) of adoption.

$P_j$  = Potential or Possible area (Bigha) of adoption.

$T_p$  = Time of investigation.

$T_1$  = Time (year) of introduction of the practice in the community.

$T_2$  = Time (year) of the farmer started using the practice.



G = Gap or Break (in year) in using the practice.

$W_j$  = Weight of difficulty of adopting the  $j^{\text{th}}$  practice (Easy=1, Moderate=3 and High=5 that's mean 1 to 5 rating scale).

N = Number of SA practices considered.

According to Singhal & Vatta (2017), Overall adoption level in the area was also worked out by calculating the arithmetic mean of the adoption quotient of all the respondents as bellow...

$$\text{Overall adoption Level} = \frac{\sum \text{AQI}}{N} \quad , \quad N = \text{Total Number of respondents.}$$

### Problem Confrontation Index (PCI).

The Problem Confrontation Index (PCI) is used to identify the problems for bay leaf cultivator to producing bay leaf. Problem confrontation with each constraint was assessed using a 4-point rating scale such as high, moderate, low and not at all and the weights for these responses were assigned as 3, 2, 1 and 0 respectively (Hoque and Usami, 2008). The problem confrontation score was obtained by adding the weights of the problem responses and it is range between 0 to 405, where 0 indicates no problem and 405 indicates highest problem. The mean value of the problems was calculated and a rank order of the problems was prepared based on the individual mean values (Mithun et al., 2018).

The Problem Confrontation Index (PCI) was calculated to generate the rank order (Rahman and Rahman, 2014). PCI was calculated using the following formula:

$$\text{PCI} = (N \times 0) + (L \times 1) + (M \times 2) + (H \times 3)$$

Where, N for Not at all, L for Low, M for Moderate and H for High respectively.

After getting the value of PCI, the severity of the problem was calculated by following formula:

$$\text{Severity of the Problem} = \frac{\text{Observation Score of PCI}}{\text{Possible Score of PCI}} \times 100$$

The independents variable, age of a respondent is measured in actual years, education in years of schooling, annual income in based on their total income in a year, family size is total number of family members, farm size is based on their total firm land (Bigha), farming experience based on the respondent's period of time engaged in agriculture. These are explained by Mean and Standard Deviation.



- **Results and Discussion**

The main characteristics of the farmers participating in the study are presented in Table 1. A total of 135 farmers from 9 community development blocks of Uttar Dinajpur district were included in this study.

**Table 1:** Socio-economic characteristics of the farmers (N=135).

SL No.	Variables	Category	F	%	Mean	SD	Min..	Max..
1.	Age.	Less than 40 years	23	17.04	50.44	11.21	29	73
		40 years to 55 years	54	40.00				
		Greater than 55 years	58	42.96				
2.	Education.	Less than 8	82	60.74	5.33	5.54	0	17
		8 to 12	39	28.89				
		Greater than 12	14	10.37				
3.	Family Size.	Less than 5	40	29.63	5.95	2.37	2	13
		5 to 7	70	51.85				
		Greater than 7	25	18.52				
4.	Household Income.	Less than 1 Lakh	34	25.19	169244.4	110140.7	72000	96000
		1 Lakh to 2 Lakhs	72	53.33				
		Greater than 2 Lakhs	29	21.48				
5.	Farm Size.	Less than 3 Bigha	48	35.56	4.07	2.76	0.5	12
		3 Bigha to 5 Bigha	57	42.22				
		Greater than 5 Bigha	30	22.22				
6.	Farming Experience.	Less than 15 Years	16	11.85	26.04	9.80	8	50
		15 years to 30 years	83	61.48				
		Greater than 30 years	36	26.67				

\*\*Source: Field Survey 2025 and authors calculation.

In this area where most of the farmers are over 55 years old (42.96%) and the mean value and SD of farmer's are 50.44 and 11.21 respectively. Here education level of farmers is too low. Significant

differences were observed in the educational status of farmers across districts. About 60% of farmers are educated up to 8th standard, about 28% are educated from 8th to 12th standard, and about 10% are educated above 12th standard. Mean value and SD of the education levels are 5.33 and 2.37 respectively. About 70% of farmer’s family size is 5 to 7 (51.85%) and above (18.52%). Mean and SD of family size of the farmers are 5.95 and 2.37 respectively. The majority (53.33%) of the farmers family income lies between 1 Lakh to 2 Lakhs. According to authors visit, most of this income comes from non-agricultural work such as migrant works, non-agricultural labours and small business. Mean and SD of household incomes are 169244.4 and 110140.7 respectively. The majority (42.22%) of the farmers have 3 to 5 bigha land following to less than 3 bigha (35.56%) and about 70% of farmers are small farmers. Mean and SD of farm size are 4.07 and 2.76 respectively. Most of the farmers have between 15 and 30 years of farming experience (61.48%). Mean and SD of farming experience of the farmers are 26.04 and 9.80 respectively.

The authors selected 8 SAPs of farmers such as soil fertility check, crop rotation, climate based improved seeds, legume intercropping system, animal manure or organic fertilizers, water conservation management system, agricultural waste management system, and drop tolerant crop. According to Table-2, the majority of the farmers are fully aware about climate based improved seeds (61.48%) and crop rotation (57.78%) and according to them, it is easy (48.89% and 42.96% respectively) to adopt. Most of the farmers were fully aware (37.88%) about animal manure or organic fertilizers and it was moderate (48.15%) difficulty to adopt.

**Table 2:** The categories of Awareness and Adoption of SAPs of farmers.

SL No.	SAPs	Awareness Categories	F	%	Adoption Categories	F	%
1.	Soil Fertility Check	Not Aware	82	60.74	Easy	4	2.96
		Partially Aware	42	31.11	Moderate	34	25.19
		Fully Aware	11	8.15	High	97	71.85
2.	Crop Rotation	Not Aware	29	21.48	Easy	58	42.96
		Partially Aware	28	20.74	Moderate	45	33.33
		Fully Aware	78	57.78	High	32	23.70
3.	Climate based Improved Seeds	Not Aware	6	4.44	Easy	66	48.89
		Partially Aware	46	34.07	Moderate	61	45.19
		Fully Aware	83	61.48	High	8	5.93
		Not Aware	85	62.96	Easy	6	4.44



4.	Legume Intercropping System.	Partially Aware	34	25.19	Moderate	36	26.67
		Fully Aware	16	11.85	High	93	68.89
5.	Animal Manure or Organic Fertilizers.	Not Aware	40	29.63	Easy	38	28.15
		Partially Aware	44	32.59	Moderate	65	48.15
		Fully Aware	51	37.88	High	32	23.70
6.	Water Conservation Management System	Not Aware	101	74.81	Easy	19	14.07
		Partially Aware	13	9.63	Moderate	15	11.11
		Fully Aware	21	15.56	High	101	74.81
7.	Agricultural Waste Management system	Not Aware	69	51.11	Easy	18	13.33
		Partially Aware	33	24.44	Moderate	45	33.33
		Fully Aware	33	24.44	High	72	53.33
8.	Drop-tolerant Crop	Not Aware	76	56.30	Easy	24	17.78
		Partially Aware	16	11.85	Moderate	35	25.93
		Fully Aware	43	31.85	High	76	56.30

\*\*Source: Field Survey 2025 and authors calculation.

But, above half of the farmers were not aware about other SAPs such as, water conservation management system (74.81%), legume intercropping system (62.96%), soil fertility check (60.74%), drop tolerant crop (56.30%), and agricultural waste management system (51.11%) and its were high (74.81%, 68.89%, 71.85%, 56.30% and 53.33% respectively) difficult to adopt such practices.

**Table 3:** The farmers awareness score and adoption score of SAPs by MAI and AQI respectively in Uttar Dinajpur district (N=135).

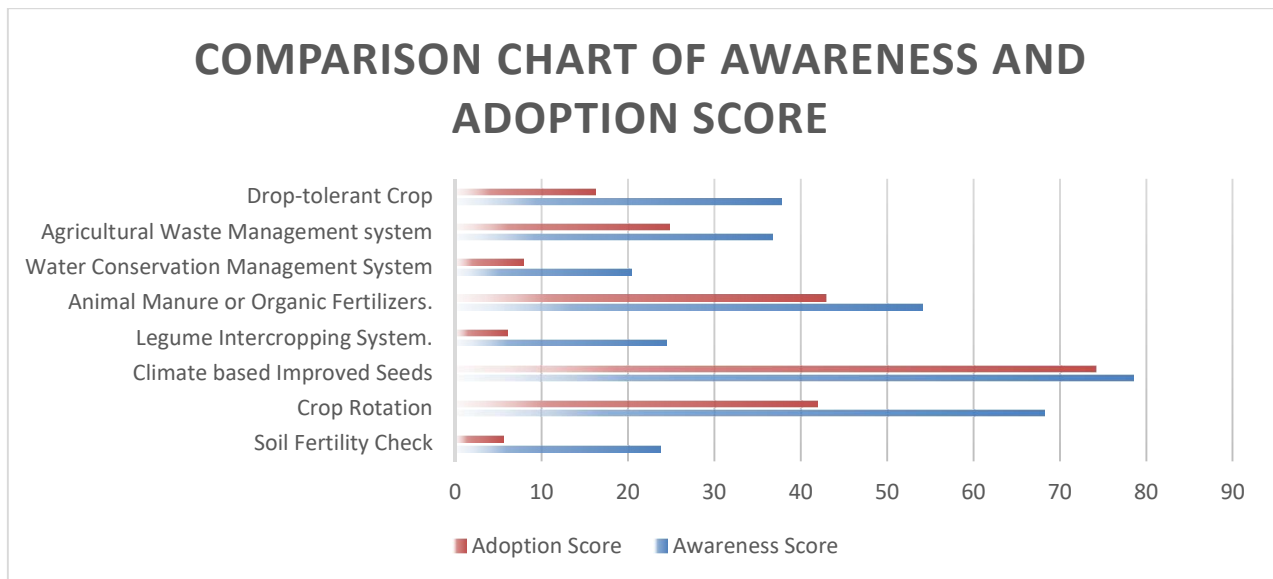
SL No.	SAPs of the Farmers	Awareness Score	Rank	Adoption Score	Rank
1.	Soil Fertility Check	23.70	7 <sup>th</sup>	5.56	8 <sup>th</sup>
2.	Crop Rotation	68.15	2 <sup>nd</sup>	41.86	3 <sup>rd</sup>
3.	Climate based Improved Seeds	78.52	1 <sup>st</sup>	74.13	1 <sup>st</sup>
4.	Legume Intercropping System.	24.44	6 <sup>th</sup>	6.00	7 <sup>th</sup>
5.	Animal Manure or Organic Fertilizers.	54.07	3 <sup>rd</sup>	42.86	2 <sup>nd</sup>
6.	Water Conservation Management System	20.37	8 <sup>th</sup>	7.90	6 <sup>th</sup>
7.	Agricultural Waste Management system	36.67	5 <sup>th</sup>	24.73	4 <sup>th</sup>



8.	Drop-tolerant Crop	37.78	4 <sup>th</sup>	16.13	5 <sup>th</sup>
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\*\*Source: Field Survey 2025 and authors calculation.

According to Table-3, as on awareness score, climate based improved seeds (78.52) is ranked 1<sup>st</sup>, crop rotation (68.15) is ranked 2<sup>nd</sup>, and animal manure or organic fertilizers (54.07) is ranked 3<sup>rd</sup> and as on adoption score, climate based improved seeds (74.13) is ranked 1<sup>st</sup>, animal manure or organic fertilizers (42.86) is ranked 2<sup>nd</sup> and crop rotation (41.86) is ranked 3<sup>rd</sup>. Here, as awareness has increased, the adoption level has also increased. This means that as awareness increases about SAPs among farmers, the level of adoption will also increase.



On the other hand, water conservation management system (20.37) is the least ranked, soil fertility check (23.70) is 2<sup>nd</sup> least ranked, and legume intercropping system (24.44) is 3<sup>rd</sup> least ranked as on awareness score and soil fertility check (5.56) is the least ranked, legume intercropping system (6.00) is 2<sup>nd</sup> least ranked, and water conservation management system (7.90) is 3<sup>rd</sup> least ranked as on adoption score. Here, as awareness has decreased, the adoption level has also decreased compared to others. This means that if the farmers have less awareness about SAPs, then there is less adoption of SAPs. These are described by the chart above.

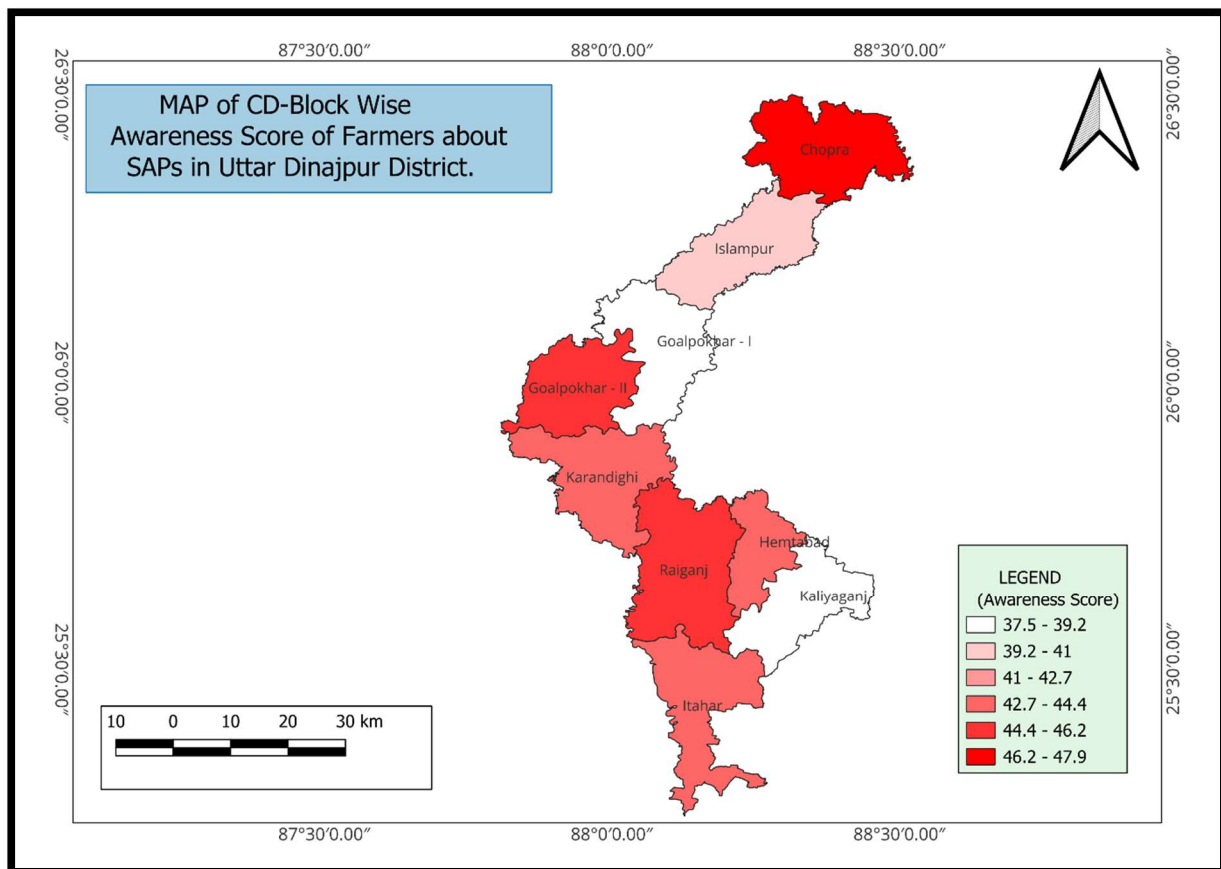
**Table 4:** Block wise overall awareness score and adoption score of SAPs of the farmers in Uttar Dinajpur district (N=120).

SL No.	CD-Blocks of Uttar Dinajpur	Awareness Score	Rank	Adoption Score	Rank
1.	Chopra	47.92	1 <sup>st</sup>	26.03	1 <sup>st</sup>

2.	Islampur	39.58	7 <sup>th</sup>	20.59	8 <sup>th</sup>
3.	Goalpokhar I	37.5	9 <sup>th</sup>	16.65	9 <sup>th</sup>
4.	Goalpokhar II	44.16	3 <sup>rd</sup>	22.05	5 <sup>th</sup>
5.	Karandighi	43.75	4 <sup>th</sup>	21.29	6 <sup>th</sup>
6.	Hemtabad	43.33	5 <sup>th</sup>	23.20	4 <sup>th</sup>
7.	Kaliaganj	38.33	8 <sup>th</sup>	22.66	3 <sup>rd</sup>
8.	Raiganj	44.58	2 <sup>nd</sup>	25.21	2 <sup>nd</sup>
9.	Itahar	42.92	6 <sup>th</sup>	20.72	7 <sup>th</sup>
***	Uttar Dinajpur	42.45	---	22.04	---

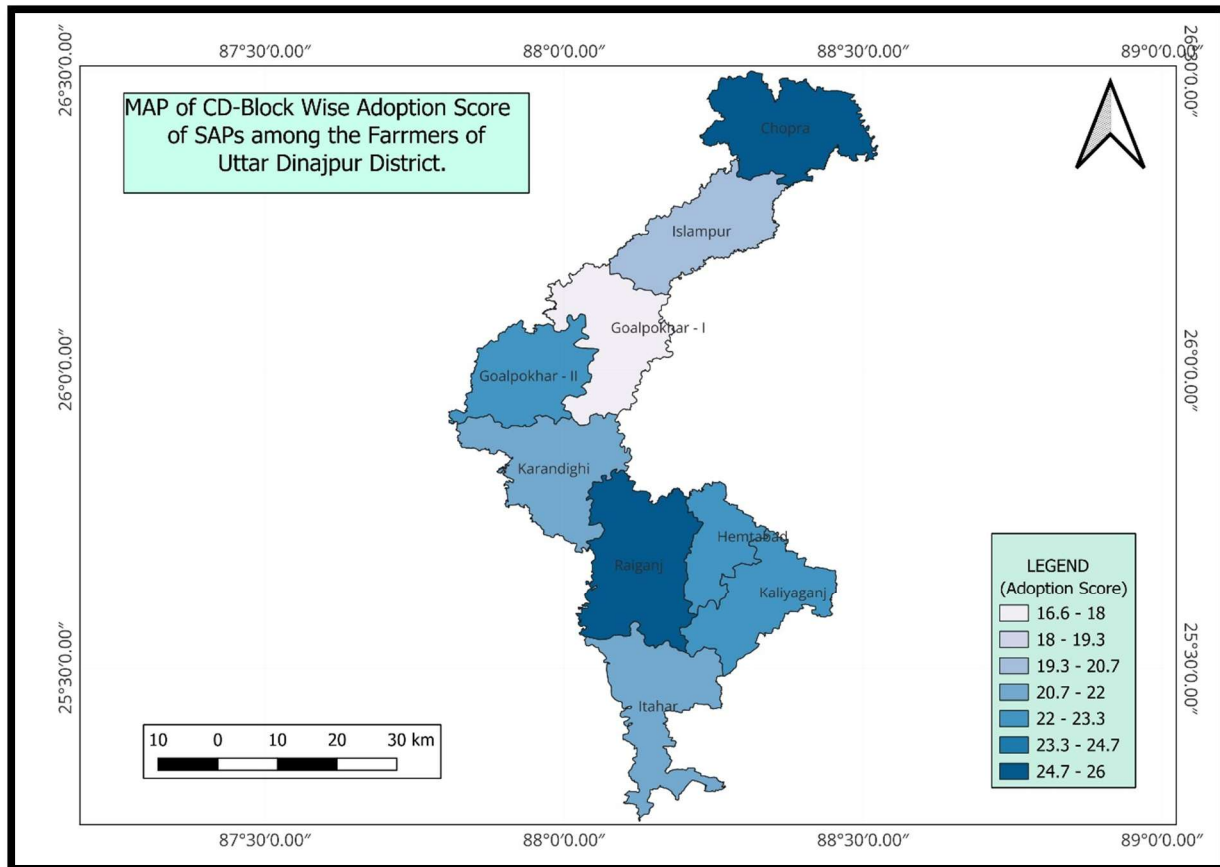
\*\*Source: Field Survey 2025 and authors calculation.

Table-4 shows that, according to farmer’s awareness score of SAPs, Chopra CD block is ranked 1<sup>st</sup> (47.92) and Raiganj CD block is ranked 2<sup>nd</sup> (44.58) among the nine CD block of Uttar Dinajpur district. Among these nine CD blocks of Uttar Dinajpur, the CD block with the lowest awareness score is Goalpokhar CD block which is ranked 9<sup>th</sup> (37.5) and Kaliyaganj CD block which is ranked 8<sup>th</sup> (38.33). These are illustrated by the map below.





From Table-4, according to farmer’s adoption score of SAPs, Chopra CD block is ranked 1<sup>st</sup> (26.03) and Raiganj CD block is ranked 2<sup>nd</sup> (25.21) among the nine CD block of Uttar Dinajpur district. Among these nine CD blocks of Uttar Dinajpur, the CD block with the lowest awareness score is Goalpokhar CD block which is ranked 9<sup>th</sup> (16.65) and Islampur CD block which is ranked 8<sup>th</sup> (20.59). These are illustrated by the map below.



But if we consider the entire Uttar Dinajpur district, it can be seen that its awareness score is 42.45 and adoption score is 22.04. Despite the growing interest in sustainable practices, this low adoption score highlights a significant disconnect between farmers' awareness and their actual practices.

In Table-5, among the selected eighteen categories of problems of the farmers, as on PCI score the problem Higher input cost (Seed, Labour, Organic Fertilizers, Pesticide) is ranked 1<sup>st</sup> (PCI=322, Severity=79.51) and the problems Lack of farm trials and demonstration on SAPs and Lack of technical information and knowledge on SAPs are ranked 2<sup>nd</sup> (PCI=312, Severity=77.04) and 3<sup>rd</sup> (PCI=311, Severity=76.79) respectively. Based on these results, it can be said that these three problems are the main problems that became the barriers of adoption of SAPs of the farmers in this area.

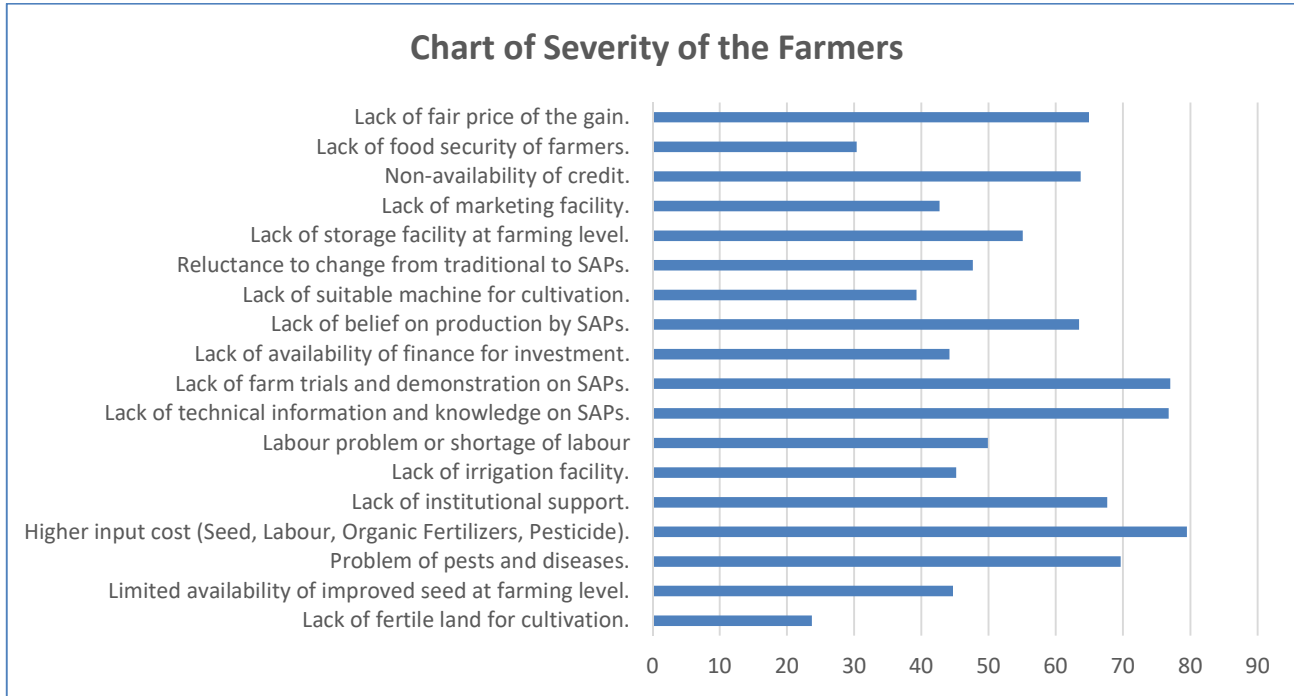
**Table 5:** Comparison among the 18 selected problems of the farmers for adopting SAPs in Uttar Dinajpur district with Problem Confrontation Index (PCI) and Rank Order.

SL No	Category of Problem	Extent of Problems				PCI Score	Seve- rity %	Ran k
		Not at all (0)	Low (1)	Mod e- rate (2)	High (3)			
1.	Lack of fertile land for cultivation.	56	60	18	00	96	23.70	18 <sup>th</sup>
2.	Limited availability of improved seed at farming level.	41	31	39	24	181	44.69	13 <sup>th</sup>
3.	Problem of pests and diseases.	05	32	44	54	282	69.63	4 <sup>th</sup>
4.	Higher input cost (Seed, Labour, Organic Fertilizers, Pesticide).	11	05	40	79	322	79.51	1 <sup>st</sup>
5.	Lack of institutional support.	05	41	34	55	274	67.65	5 <sup>th</sup>
6.	Lack of irrigation facility.	33	42	39	21	183	45.19	12 <sup>th</sup>
7.	Labour problem or shortage of labour	38	29	31	37	202	49.88	10 <sup>th</sup>
8.	Lack of technical information and knowledge on SAPs.	05	24	31	75	311	76.79	3 <sup>rd</sup>
9.	Lack of farm trials and demonstration on SAPs.	08	13	43	71	312	77.04	2 <sup>nd</sup>
10.	Lack of availability of finance for investment.	19	61	47	08	179	44.20	14 <sup>th</sup>
11.	Lack of belief on production by SAPs.	14	27	52	42	257	63.45	8 <sup>th</sup>
12.	Lack of suitable machine for cultivation.	42	47	26	20	159	39.26	16 <sup>th</sup>
13.	Reluctance to change from traditional to SAPs.	32	31	54	18	193	47.65	11 <sup>th</sup>
14.	Lack of storage facility at farming level.	32	30	26	47	223	55.06	9 <sup>th</sup>
15.	Lack of marketing facility.	21	60	49	05	173	42.72	15 <sup>th</sup>
16.	Non-availability of credit.	13	29	50	43	258	63.70	7 <sup>th</sup>
17.	Lack of food security of farmers.	33	86	11	05	123	30.37	17 <sup>th</sup>
18.	Lack of fair price of the gain.	10	25	62	38	263	64.94	6 <sup>th</sup>

\*\*Source: Field Survey 2025 and authors calculation.

\*\*Total number of extents of each problem are 135 and maximum possible score of PCI is 405.

On the other hand, among the selected eighteen categories of problems of the farmers, the last three ranked problems are Lack of fertile land for cultivation which is ranked 18<sup>th</sup> (PCI=96, Severity=23.70), Lack of food security of farmers which is ranked 17<sup>th</sup> (PCI=123, Severity=30.37) and Lack of suitable machine for cultivation which is ranked 16<sup>th</sup> (PCI=159, Severity=39.26). Looking of the results of these three problems, it can be said that these problems have little impact on adoption of SAPs of the farmers in this area.



CD block wise overall view of problems of farmers for adopting SAPs in Uttar Dinajpur district in table-6 showed that Goalpokhar-I CD block is ranked 1<sup>st</sup> (PCI=542, Severity=66.91) and Islampur CD block is ranked 2<sup>nd</sup> (PCI=528, Severity=65.19) in PCI and rank order. From this result, it can be said that in Goalpokhar-I CD block and Islampur CD block there is high problem for adopting SAPs of the farmers. The reason for this that awareness of SAPs among farmers is low and many of the lands here are low-lying and waterlogged most of the year, making crop rotation impossible. Despite the existence of canals for water, they do not hold water and remain fallow.

**Table 6:** Block wise problems of the farmers for adopting SAPs in Uttar Dinajpur district with Problem Confrontation Index (PCI) and Rank Order.

SL No.	CD-Blocks of Uttar Dinajpur district	Extent of Problem	Frequency	PCI score	Severity (%)	Rank
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1.	Chopra	Not at all	68	384	47.41	9 <sup>th</sup>
		Low	83			
		Moderate	56			
		High	63			
2.	Raiganj	Not at all	74	400	49.38	8 <sup>th</sup>
		Low	70			
		Moderate	48			
		High	78			
3.	Goalpokhar I	Not at all	10	542	66.91	1 <sup>st</sup>
		Low	63			
		Moderate	112			
		High	85			
4.	Islampur	Not at all	16	528	65.19	2 <sup>nd</sup>
		Low	60			
		Moderate	114			
		High	80			
5.	Karandighi	Not at all	53	435	53.70	4 <sup>th</sup>
		Low	71			
		Moderate	74			
		High	72			
6.	Goalpokhar II	Not at all	57	421	51.98	6 <sup>th</sup>
		Low	79			
		Moderate	60			
		High	74			
7.	Kaliyaganj	Not at all	45	436	53.83	3 <sup>rd</sup>
		Low	85			
		Moderate	69			
		High	71			
8.	Hemtabad	Not at all	35	430	53.09	5 <sup>th</sup>
		Low	88			
		Moderate	99			

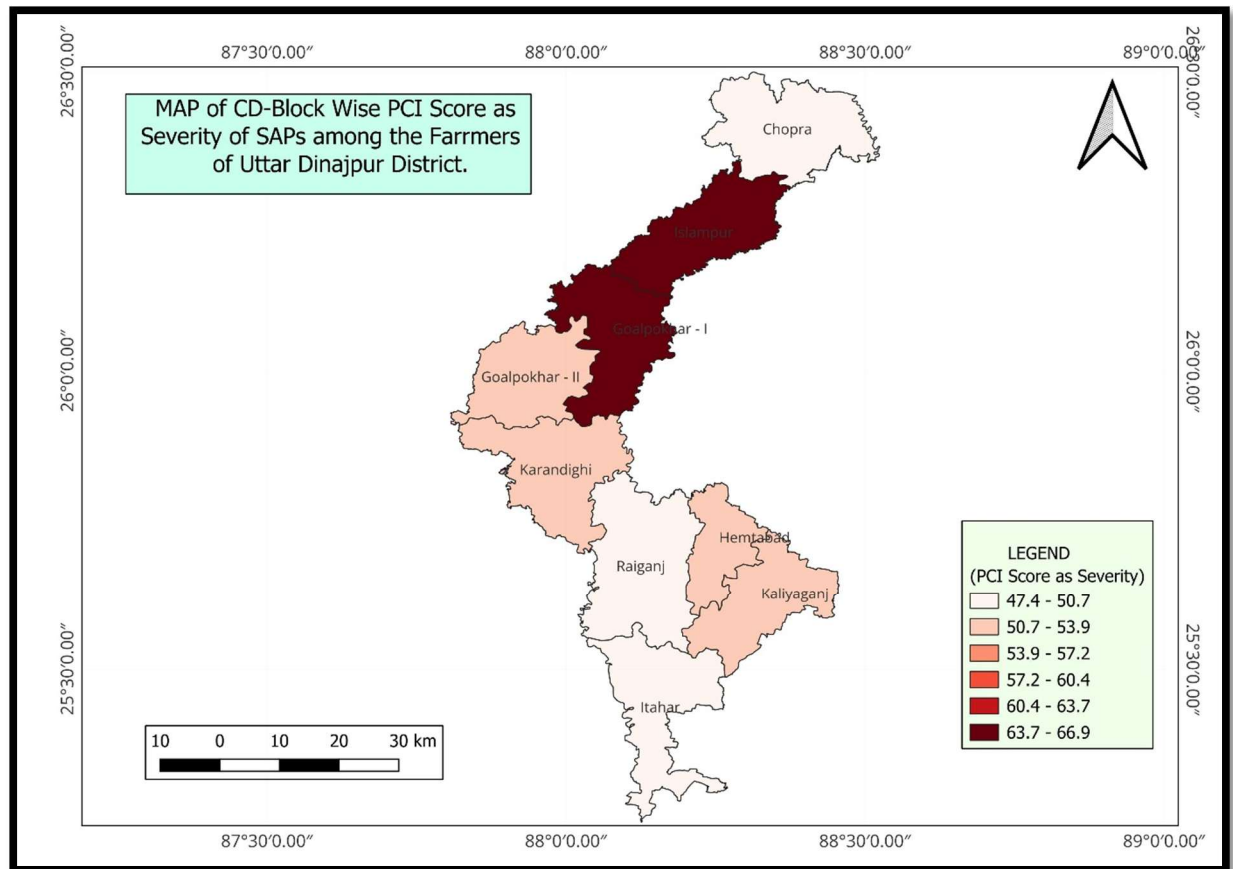


		High	48			
9.	Itahar	Not at all	62	410	50.20	7 <sup>th</sup>
		Low	75			
		Moderate	64			
		High	69			
***	Uttar Dinajpur	Not at all	420	3986	54.68	---
		Low	674			
		Moderate	696			
		High	640			

\*\*Source: Field Survey 2025 and authors calculation.

\*\*Total number of extents problem of each block are 270 and maximum possible score of PCI is 810.

But in Chopra CD block and Raiganj CD block where problems for adopting SAPs of farmers is low compared to others CD block. In PCI and rank order, these two CD blocks are ranked 9<sup>th</sup> (PCI=384, Severity=47.41) and 8<sup>th</sup> (PCI=400, Severity=49.38) respectively. The reason for this is that there is a high level of awareness among the farmers for adopting SAPs here. Also, Chopra CD Block has more upland than waterlogged land, making it possible to do crop rotation and also so many storages facility here. On the other hand, Raiganj CD block is close to the city, so it can be very convenient for selling crops. But if we consider the entire Uttar Dinajpur district, it can be seen that its severity rate is more than 50 percent, which is obstacle to the adoption of SAPs.



## • Conclusion

In this paper, a multi-stage random sampling method was used to collect primary data and an ex-post facto research design was employed to investigate farmers' awareness of, adoption of and problems of adopting SAPs of 135 farmers in Uttar Dinajpur district with a particular focus on the adoption of Soil fertility check, Crop rotation, Improved seeds, Legume intercropping system, Organic fertilizer using, Water conservation and management system, drought tolerate crop and Waste management system.

Most of the farmers in this area are above 55 years of age (42.96%) and most of the farmers have 15 to 30 years of experience in farming (61.48%) and about 60% of the farmers are educated up to class VIII. About 70% of the farmers have 5 to 7 members in their family and about 70% of the farmers are small farmers. The awareness score in Uttar Dinajpur district is 42.45, while the adoption score is 22.04. The result stated that in this district, farmers are more informed about climate-based improved seeds, crop rotation, and the use of animal manure or organic fertilizers (by ranking) compared to other practices. In terms of adoption scores, climate-based improved seeds, animal manure or organic fertilizers, and crop rotation (by ranking) emerge as the most commonly adopted sustainable agricultural practices (SAPs) compared to other SAPs. Although interest in sustainable practices is increasing, the low adoption score



reveals a notable gap between farmers' awareness and their implementation of these practices. However, Higher input cost (Seed, Labour, Organic Fertilizers, Pesticide), Lack of farm trials and demonstration on SAPs and Lack of technical information and knowledge on SAPs are the primary challenges farmers encounter when attempting to adopt sustainable agricultural practices in this area and it is evident that the overall problem confrontation rate is high (3986), and the severity rate exceeds 50 percent, posing a barrier to the adoption of SAPs. A comprehensive analysis of the various problems is essential for the government to take appropriate action. Judicious use of existing technology, natural and human resources, along with launching and implementing new projects and initiatives, will make it possible to bridge the long-standing gap between the goals and the available means. We believe that innovative solutions supported by advanced technology, robust research, efficient resource utilization, improved infrastructure and region-specific government initiatives will undoubtedly contribute to increasing the adoption rate of sustainable agricultural practices among farmers in Uttar Dinajpur district.

## References

- Adebayo, O., Bolarin, O., Oyewale, A., & Kehinde, O. (2018). Impact of irrigation technology use on crop yield, crop income and household food security in Nigeria: A treatment effect approach. <https://doi.org/10.3934/agrfood.2018.2.154>
- Adolph, B. (2020). Trade-offs in sustainable agricultural intensification: the farmers' perspective. *International Institute for Environment and Development*, Retrieved from <https://pubs.iied.org/pdfs/17743IIED.pdf>
- Adolph, B., & Grieg-Gran, M. (2013). *Agriculture and food systems for a sustainable future: an integrated approach*. International Institute for Environment and Development. <https://doi.org/10.61463/ijset.vol.12.issue5.268>
- Akenroye, T. O., Kumar, M., Dora, M., Ihua, U. B., Mtonga, V. J., & Aju, O. (2022). Evaluating the barriers to adopting sustainable agriculture practices in smallholder coffee farming: implications for global value chains. In *Africa and Sustainable Global Value Chains* (pp. 117-142). [https://doi.org/10.1007/978-3-030-78791-2\\_6](https://doi.org/10.1007/978-3-030-78791-2_6)
- Ashrit, R. R., & Thakur, M. K. (2021). Is awareness a defining factor in the adoption of sustainable agricultural practices? Evidence from small holder farmers in a southern state of India. *SN Social Sciences*, 1(8), 218. <https://doi.org/10.1007/s43545-021-00222-6>



- Bathaei, A., & Štreimikienė, D. (2023). A systematic review of agricultural sustainability indicators. *Agriculture*, 13(2), 241. <https://doi.org/10.3390/agriculture13020241>
- Cary, J., Webb, T., & Barr, N. (2001). The adoption of sustainable practices: Some new insights. *Land and Water report available on: www.lwa.gov.au/download/final\_reports/BRR19.pdf Accessed*, 12(12), 2005.
- Coulibaly, T. P., Du, J., & Diakité, D. (2021). Sustainable agricultural practices adoption. *Agriculture*, 67(4), 166-176. <https://doi.org/10.2478/agri-2021-0015>
- DeLonge, M. S., Miles, A., & Carlisle, L. (2016). Investing in the transition to sustainable agriculture. *Environmental Science & Policy*, 55, 266-273. <https://doi.org/10.1016/j.envsci.2015.09.013>
- D'souza, G., Cyphers, D., & Phipps, T. (1993). Factors affecting the adoption of sustainable agricultural practices. *Agricultural and resource economics review*, 22(2), 159-165. <https://doi.org/10.1017/s1068280500004743>
- Dumanski, J., Terry, E., Byerlee, D., & Pieri, C. (1998). Performance indicators for sustainable agriculture. *The World Bank, Washington*, 115-1124. Retrieved from- Final\_Report\_BRR19.pdf
- Edeghon, C. O., Ajayi, M. T., & Ugboya, T. O. (2008). Awareness and use of sustainable agricultural practices by arable crop farmers in Ikpoba Okha local government area of Edo State. *Journal of Sustainable Development in Agriculture & Environment*, 3(2), 55-63. Retrieved from- Microsoft Word - Document2
- Gatzweiler, F. W., Backman, S., Sipilainen, T., & Zellei, A. (2001). Analysing institutions, policies, & farming systems for sustainable agriculture in central and eastern European countries in transition. *Sustainable Agriculture in Central and Eastern European Countries (CEESA)*. Retrieved from- Gatzweiler, F. W., Backman, S., Sipilainen, T., &... - Google Scholar.
- Gebska, M., Grontkowska, A., Swiderek, W., & Golebiewska, B. (2020). Farmer awareness and implementation of sustainable agriculture practices in different types of farms in Poland. *Sustainability*, 12(19), 8022. <https://doi.org/10.3390/su12198022>
- Ghirvu, A. I. (2013). The AIDA model for advergaming. *The USV Annals of Economics and Public Administration*, 13(1 (17)), 90-98. Retrieved from- Microsoft Word - USVAEPA\_VOL.13,ISSUE\_1\_17\_,2013\_fulltext.doc.
- Ghosh, S. A Study of Crop Combination in Uttar Dinajpur District, West Bengal. *Geography In The 21st Century: Emerging Issues and The Way Forward*, 321. Retrieved from- GEOGRAPHY



IN THE 21ST CENTURY: EMERGING ISSUES AND THE WAY FORWARD - Dr. Ranjan Sarkar - Google Books.

- Hebsale Mallappa, V. K., & Pathak, T. B. (2023). Climate smart agriculture technologies adoption among small-scale farmers: a case study from Gujarat, India. *Frontiers in Sustainable Food Systems*, 7, 1202485. DOI 10.3389/fsufs.2023.1202485.
- Hoque, M. J., & Usami, K. (2008). Effects of training on skill development of agricultural extension workers in Bangladesh: a case study in four upazilas (sub-district) under Kishoreganj District. *Journal of Social Sciences*, 4(1), 21-28. Retrieved from- <https://repository.lib.tottori-u.ac.jp/records/6594>.
- Registrar General, I. (2011). Census of India 2011: provisional population totals-India data sheet. *Office of the Registrar General Census Commissioner, India. Indian Census Bureau*, 2.
- INDIA, F. Economic Survey (2023-2024): Retrieved from- doc2024722351601.pdf
- International Institute for Population Sciences (IIPS) & ICF. (2017). *National Family Health Survey (NFHS-4), 2015-16: India (Vol. 1)*. IIPS. <https://dhsprogram.com/pubs/pdf/FR339/FR339.pdf>
- Janker, J., & Mann, S. (2020). Understanding the social dimension of sustainability in agriculture: a critical review of sustainability assessment tools. *Environment, Development and Sustainability*, 22(3), 1671-1691. Retrieved from- [The-social-dimension-of-sustainability-in-agriculture-A-review-of-sustainability-assessment-tools.pdf](#)
- Kassie, M., Jaleta, M., Shiferaw, B., Mmbando, F., & Mekuria, M. (2013). Adoption of interrelated sustainable agricultural practices in smallholder systems: Evidence from rural Tanzania. *Technological forecasting and social change*, 80(3), 525-540. <https://doi.org/10.1016/j.techfore.2012.08.007>
- Kheiri, S. (2015). Identifying the barriers of sustainable agriculture adoption by wheat farmers in Takestan, Iran. *International Journal of Agricultural Management and Development*, 5(4), 159-168. DOI: 10.5455/ijamd.175275.
- Kornegay, J.L., Harwood, R.R., Batie, S.S., Bucks, D., Flora, C.B., Hanson, J., ... Willis, P. (2010). Towards sustainable agriculture system in the 21st century. National Research Council of The National Academics. Retrieved March 12, 2016, from <http://nap.edu/12832>.
- Kulshreshtha, S. N. (2009). Agricultural practices as barriers to sustainability. *Public Policy in Food and Agriculture*, 220-231. Retrieved from- [Agricultural Practices as Barriers to Sustainability](#).



- Mishra, B., Gyawali, B. R., Paudel, K. P., Poudyal, N. C., Simon, M. F., Dasgupta, S., & Antonious, G. (2018). Adoption of sustainable agriculture practices among farmers in Kentucky, USA. *Environmental management*, 62(6), 1060-1072. <https://doi.org/10.1007/s00267-018-1109-3>
- Mithun, M. N. A. S., Hoque, M. J., & Rahman, M. H. (2018). Problem Confrontation in Participating Professional Trainings by the Sub Assistant Agriculture Officers. *Bangladesh Journal of Extension Education* ISSN, 1011, 3916. Retrieved from- [Problem-Confrontation-in-Participating-Professional-Trainings-by-the-Sub-Assistant-Agriculture-Officers.pdf](#).
- Msemu, E., Sayi, S., & Kazuzuru, B. (2018). Barriers to adoption of sustainable agriculture practices among farmers in Tanzania, case study of Mbarali district. *World Wide Journal of Multidisciplinary Research and Development*. Retrieved from- [Barriers-to-Adoption-of-Sustainable-Agriculture-Practices-Among-Farmers-in-Tanzania-Case-Study-of-Mbarali-District.pdf](#)
- National Research Council, Division on Earth, Life Studies, & Committee on Twenty-First Century Systems Agriculture. (2010). *Toward sustainable agricultural systems in the 21st century*. National Academies Press.
- Ogunniyi, A., Omonona, B., Abioye, O., & Olagunju, K. (2018). Impact of irrigation technology use on crop yield, crop income and household food security in Nigeria: A treatment effect approach. <https://doi.org/10.3934/agrfood.2018.2.154>
- Okumah M., Martin-Ortega J., Novo P. (2018). Effects of awareness on farmers' compliance with diffuse pollution mitigation measures: A conditional process modeling. *Land Use Policy*, 76, 36–45. <https://doi.org/10.1016/j.landusepol.2018.04.051>
- Oyetunde-Usman, Z., Olagunju, K. O., & Ogunpaimo, O. R. (2021). Determinants of adoption of multiple sustainable agricultural practices among smallholder farmers in Nigeria. *International Soil and Water Conservation Research*, 9(2), 241-248. <https://doi.org/10.1016/j.iswcr.2020.10.007>
- Pareek, U., & Chattopadhyay, S. N. (1966). Adoption quotient: A measure of multipractice adoption behaviour. *The Journal of Applied Behavioral Science*, 2(1), 95-108. <https://doi.org/10.1177/002188636600200106>
- Piñeiro, V., Arias, J., Dürr, J., Elverdin, P., Ibáñez, A. M., Kinengyere, A., ... & Torero, M. (2020). A scoping review on incentives for adoption of sustainable agricultural practices and their outcomes. *Nature Sustainability*, 3(10), 809-820. <https://doi.org/10.1038/s41893-020-00617-y>



- Pintér, L., & Herren, H. R. (2007). From common principles to common practice. *International Forum on Assessing Sustainability in Agriculture (INFASA)*, Retrieved from- *Sustainable Agriculture: From Common Principles to Common Practice*
- Rahman, M. H., & Rahman, M. Z. (2014). Problems Faced by the Coastal People in Biodiversity Conservation and Management Activities in St. Martin's Island, Bangladesh. *Bangladesh Journal of Extension Education*, 26(1&2), 11-17. Retrieved from- Problems Faced by the Coastal People in Biodiversity Conservation and Management Activities in St. Martin's Island, Bangladesh | Dr. S. R. Lasker Library
- Rehman, A., Farooq, M., Lee, D. J., & Siddique, K. H. (2022). Sustainable agricultural practices for food security and ecosystem services. *Environmental Science and Pollution Research*, 29(56), 84076-84095. <https://doi.org/10.1007/s11356-022-23635-z>
- Roy, C. (2011). Economic backwardness of Uttar Dinajpur: a block level analysis. *MPRA*. Retrieved from- *MPRA\_paper\_40376.pdf*
- Shaw, L., Lubell, M., & Ohmart, C. (2011). The evolution of local partnerships for sustainable agriculture. *Society & Natural Resources*, 24(10), 1078-1095. <https://doi.org/10.1080/08941920.2010.550384>
- Siddiqui, Haque, S. (2017). Assessment of irrigation extension and development in Uttar Dinajpur District of West Bengal: A block level analysis. *Asian Profile*. Retrieved by- *Assessment-of-Irrigation-Extension-and-Development-in-Uttar-Dinajpur-District-of-West-Bengal-A-Block-Level-Analysis.pdf*.
- Siddiqui, S. H., & Afzal, M. F. (2018). Changing cropping pattern and sustainable agriculture: A spatio-temporal analysis of Uttar Dinajpur District, West Bengal. *the Geographer*, 65(2), 9-19. Retrieved from- *Changing-cropping-pattern-and-sustainable-agriculture-A-spatio-temporal-analysis-of-Uttar-Dinajpur-district-West-Bengal-The-Geographer-Vol-65-No-2-July-2018.pdf*
- Singhal, S., & Vatta, L. (2017). Impact of Krishi Vigyan Kendra on adoption of improved agricultural production practices. *International Journal of Science, Environment and Technology*, 6(2), 993-1000. Retrieved from- *1635-libre.pdf*
- Tait, J., & Morris, D. (2000). Sustainable development of agricultural systems: competing objectives and critical limits. *Futures*, 32(3-4), 247-260. [https://doi.org/10.1016/s0016-3287\(99\)00095-6](https://doi.org/10.1016/s0016-3287(99)00095-6)



- Union of Concerned Scientists – Counting On Agroecology: Why We Should Invest More in the Transition to Sustainable Agriculture, 2019. Retrieved from- <https://www.jstor.org/stable/resrep17292>.
- Velten, S., Leventon, J., Jager, N., & Newig, J. (2015). What is sustainable agriculture? A systematic review. *Sustainability*, 7(6), 7833-7865. <https://doi.org/10.3390/su7067833>
- Walker, J. (2002). Environmental indicators and sustainable agriculture. *ACIAR Monograph Series*, 84, 323-332. Retrieved from- [Environmental\\_Indicators\\_and\\_Sustainable20160627-30798-1v4ouoe-libre.pdf](#)