Abstract

Chapter I

Agriculture is the backbone of Indian economy as well as the largest sector of livelihood adjustment of the people which accounts for more or less 23 per cent of the national income. Indian agriculture is clearly divided into two eras. One is pre-green revolution (i.e., before 1960s) and another one is post-green revolution era (i.e., after 1980s). Agricultural transformation implies the fact of a positive linkage of agricultural sector along with the other sectors of economic activities. The prima facie evidence of agricultural transformation lies in the process of shift of individual farms of highly diversified and subsistence oriented towards the more specialized and commercialized form of economy. The district of Uttar Dinajpur is dominated by agriculture. The agrarian society of this district witnessed the multiple cropping patterns over the year. But over the last two decades the agricultural scenario of this district has dramatically changed. As a result of this tea, maize and potato cultivation in Uttar Dinajpur district has been encroaching the agricultural lands with unchecked multiplication of such small tea gardens and has significantly reduced the yield of crops such as paddy, jute, wheat, cereals, pulses etc. (The Statesman, dated 29th august, 2014).

Over the last two decades small paddy, wheat and jute fields of the district have continuously converted into small and small tea gardens and maize fields especially due to more economic benefit and shorter crop period compared to paddy and jute. The blocks of *Chopra, Islampur, Goalpokhar* and parts *of Karandighi* getting high of the scenario whereas *Raiganj*, *Itahar, Hemtabad, Kaliaganj and GoalpokharII* blocks are receiving less transformation scenario showing a high disparity situation. The chapter is receiving some specific Objectives to study the trend and pattern of agricultural transformation, finding the major causes of transformation of agriculture in the district and its impacts on socio-economic conditions of the farmers, changes of cropping pattern in relation to land use, problems of agricultural transformation. and finally finding out the necessary steps for the overall development in the agricultural sector. To confirm the objectives the selective Hypotheses are lesser cropping period has accelerated the adoption of agricultural transformation, Low recurrent investment in respect of traditional crops has also accelerated the adoption of agricultural transformation, economic benefit has led to agricultural transformation in Uttar Dinajpur district. So far Methodology is concerned to discuss the trend

and pattern of the production of tea, maize, potato, mustard etc. (transforming crops) along with other traditional or native crops (paddy, jute, pulses etc.) a number of graphical techniques were taken up. The secondary data has been collected from District Statistical Handbook, Uttar Dinajpur, Bureau of Applied Economics and Statistics and office of the Deputy Director of Agriculture (administration), Raiganj, Uttar Dinajpur. The physical set up of the study area was analyzed by using relief map, soli map, drainage map, climate map, irrigation map etc. based on Survey of India topographical maps (map no. 73N/1, 73N/4, 73N/12, and 73N/14), District Planning map series, National Bureau of Soil Survey and Land use planning map etc. After selecting the major crops, the relative percentage share of each major crop to gross cropped area has been calculated for the period of 1996-97 and 2016-17. Finally, a comparative analysis for each crop has been done thorough the choropleth maps. To show the changes of land use and land cover of the study area satellite imageries was used to identify the temporal changes in the study area. To show the changes of land use and land cover of the study area satellite imageries were used to identify the temporal changes in the study area. To find out the major impacts of agricultural transformation in the district primary data on socio-economic condition of the farmers have been gathered through observation and schedule/questionnaire method. A detailed cost-benefit analysis made possible knowing the important facts.

Chapter II

The chapter is involving the geographical character of the district. The District of Uttar Dinajpur, West Bengal was a part of undivided district namely West Dinajpur. On 1st April 1992 the West Dinajpur District separated from each other and formed two newly formed districts, one is Uttar Dinajpur and another is Dakshin Dinajpur. The District Headquarter is located at Karnojora, Raiganj. Uttar Dinajpur District includes 9 (nine) Development Blocks. The District of Uttar Dinajpur having an area of 3,142 sq.km which ranked 15th in terms of total geographical area in all over West Bengal. The regional topographical characteristics of this district is generally flat having gentle southerly slope with elongated shape. Due to its peculiar shape the district forms “chicken’s neck” along the Islampur corridor.

The topographic data reveals the fact that the maximum elevation of this district is 92 m which is found in the extreme northern part of the district i.e., in the piedmont zone and it becomes 27m in the mature floodplain which is situated at Itahar block. Almost four-fifths of this district is

dominated by the active floodplains characterized by great alteration of sediment deposits over a period of time. The proportion of highland at Chopra, Islampur, Goalpokhor-I, Goalpokhor-II and Karandighi block is 65.67%, 57.73%, 41.22%, 47.70% and 23.08% respectively. This highland of Islampur sub-division is locally named as "Dangis''. The main climatic features of this district are characterized by hot-humid summer having abundant rainfall and cold weather. Summer continues from the month of April to June. The average annual rainfall of the district is about 1950 mm which varies from one region to another. The maximum and minimum temperature of this district is 42ºC and 6ºC respectively. These major divisions further are divided into two agro-climatic sub-regions, i.e., the Terai-Tista floodplain and the Gangetic floodplain. The Uttar Dinajpur District is dominated by old alluvial soil deposits through the major rivers of this region/district like Kulik, Nagar, and Mahananda. The old alluvium soil of this district formed in Pleistocene age and is favourable for growing paddy, jute, wheat, sugarcane, vegetables etc. Mahananda, Nagar, Kulik, Tangan, Chhiramati, Sui, Gamari, Dauk are the noteworthy rivers. There are many tributaries and streams flowing in the district like Sudhani, Pitani, Lona, Bina, and Gandhar etc.The area in this district under forest is 1483.75 Acre. The forest type is mainly northern tropical having most mixed deciduous forest. The distribution of forests is very erratic and mostly spread over the small pockets. There are some pockets of natural forest of 282.11 Acre and comprises of pure assemblage of homogenous patterns. According to the 2011 census Uttar Dinajpur district has a population of 3,000,849 roughly equal to the nation of Albania. This gives it a ranking of 124th in India. The district has a population density of 956 inhabitants per square kilometers (2,480/ sq. mile).

Chapter III

The agricultural practice in an area is determined by a number of physical factors. To identify the major causes of agricultural transformation in Uttar Dinajpur district a questionnaire survey was carried out. After selection of the sample villages, Cochran's (1963) formula has been applied to determine the sample size as the population is large size to identify the major controlling factors. Two villages from each block were chosen through this method and total 18 (eighteen) villages were chosen in this purpose as already said. From the census data 2011 total number of cultivators was in each village were collected. Major causes of agricultural transformation in the study area have recorded as follows: Economic Benefit of transforming crops compared to the

traditional crops, ratio of periodic money back or regular cash flow is comparatively high in case of transforming crops, Higher production, Lesser cropping period in case of transforming crops, perishability or low price of pineapples, inspired by other successful farmers, lesser effort, low recurrent investment etc.

In case of Chopra block 36.84% of the respondents think that the economic factor or higher profitability is the main reason behind the agricultural transformation in this block. According to their view tea cultivation is more profitable compared to other traditional crops and this fact tends to lead the small farmers toward small tea plantation from traditional crops like Jute, Paddy, and Mesta etc. Higher production of transforming crops like tea, maize is one of the determining causes of agricultural transformation in Chopra block and 15.79% of the respondents in Chopra block think that the higher production rate of transforming crops accelerated the trend of agricultural transformation in this block.

Low recurrent investment in case of transforming crops (10.53%), lesser cropping period in case of transforming crops (10.53%), ratio of periodic money back or regular cash flow is considerably high in case of transforming crops (7.89%), lesser effort of transforming crops (7.89%), etc. are the causes that are promoting the fact.

To measure the level of economic benefit or profitability of various crops cost-benefit analysis was done. Cost and benefit of selected crops and their effect on the decision-making arena of the farmers than native crops are the important scenarios here. From the above-mentioned cost-benefit analysis an attempt has been made to show the 'Cost- benefit Ratio (B-C Ratio)' of major crops of the study area. In this regard the cost-benefit Ratio of selected crops calculated on the basis of the following formula.

Cost-benefit Ratio = Total Returns (in Rs.) / Total of cost C (in Rs.)

Total returns in terms of money expressed included the sum value of main agricultural product and by-product if any exists.

As far as the cost-benefit ratio of wheat is concerned the average cost-benefit ratio was 1:0.96 which indicated the less profitability nature of Wheat in the study area. The cost-benefit ratio of maize in the study area indicated that maize cultivation is more profitable compared to traditional crops like paddy, wheat, and jute etc. The average cost-benefit ratio of jute was 1:1.56 in the

district as a whole. The maximum cost-benefit ratio was 1:1.78 in Raiganj block and the minimum cost-benefit ratio was 1:1.28 in Chopra block. Potato is one of the most important commercial crops in this district of Uttar Dinajpur. The average cost-benefit ratio of potato in the district was 1:1.40.The cost-benefit ratio of maize and potato was comparatively high compared to the cost-benefit ratio of jute, paddy and wheat and due to economic reason or profitability of transforming crops compared to traditional crops of the farmers of Uttar Dinajpur district tending to lead towards the cultivation of commercial crops.

Chapter IV

Agricultural land use is one of the most dynamic concepts in agricultural geography. In this study the year of 1996-97 and 2016-17 has taken as base year and 20 years interval is taken into account to show the Spatio-temporal analysis of agricultural land use pattern. In this chapter the researcher has tried to analyze the spatio- temporal aspect of agricultural land use pattern. The researcher has divided this chapter into segments. Those are Block-wise comparative analysis of percentage share of each crop to gross cropped area for the year of 1996-97 and 2016-17, changes in cropping pattern of Uttar Dinajpur district are taking the crop groups as well as individual crop under consideration, growth and trend analysis of agricultural land use pattern in terms of areal coverage for major crops. For this purpose, the year of 1996-97 and 2016-17 has been taken into consideration as base year and 20 years interval has been considered to analyze the temporal variation in agricultural land use pattern. For example, in 2016-17 the total areal coverage of the district for *Aus* paddy drastically reduced and it becomes only 640 ha. In 1996-97 Islampur shared highest percentage of *Aman* cultivation which was 65.09 percent only. In 2016-17 the total area under *Aman* cultivation in Uttar Dinajpur district was 1, 99,725 hectare which was 35.71 percent out of the gross cropped area. To determine the changing cropping pattern in the study area two base years have been taken into consideration at an interval of two decades i.e. 1996-1997 and 2016-2017. The analysis has been done on the basis of crop group as well as individual crop wise. it is to be inferred that the area under cereals group has been increased in both the decadal term. This is due to the tremendous increase of maize cultivable area in the district though the area under various Paddy crops has been reduced significantly. From the year of 1996-1997 to 2006-2007 the share of growth was only 2.37% but from 2006-2007 to 2016-2017 it increased rapidly at 12.08%. Finally for the year of 1996-1997 to 2016-

2017 it has increased at 14.74% of rate. In case of Pulses there was also a negative growth rate in terms of area. From 1996-1997 to 2006-2007 there was 35.22% (-) decline in area and from the decade of 2006-2007 to 2016-2017 it was marginally increased (2.08%).There is a massive increment of area under mustard in all the blocks of the study area. The maximum increasing trend was found in Chopra block (1196.88%) followed by Islampur (208.64%), Kaliaganj (175.36%), Itahar (106.62%), Raiganj (47.33%), Hemtabad (31.60%), Karandighi (23.46%), and Goalpokhor-II (13.38%) and in Goalpokhor-I (2.04%) respectively. Actually, the shift of agricultural land use pattern from traditional towards commercial triggered the fact of agricultural transformation in this district.

Chapter V

In psychology, perception is a "more complex psychological behavior that relates to a particular frame of reference developed in our personal and social boundaries" (Quader et al., 2020).In this chapter an attempted has been made to analyze the opinion or perception of farmers of Uttar Dinajpur district. In this study area agricultural transformation has already been started since last 20-25 years back. In the northern part of this district small or tiny tea gardens have increasing at a greater pace. The highest number of agricultural transformations in Islampur, Raiganj and Chopra blocks were witnessed respectively and lowest was found in Kaliyaganj and Itahar blocks.

In Uttar Dinajpur district more than average number of people supported new agricultural system being the transforming practices. The majority of the district population works predominantly in agriculture and agricultural productivity plus development is usually required to produce transformational income growth and cash going in rural regions in order to encourage and support non-farm products and services-growth. In Uttar Dinajpur district 52.78 percent young people think that agricultural transformation has been a good one and one step improved for more productive crops with exceptional income hikes.

Large number of the farmers agreed with the fact that agricultural transformation process in the study area has taken its momentum. Most number of the respondents stated that they have adopted changing cropping pattern since last 8-10 years back. Almost the same percent of respondent said that they have transformed from traditional to transforming crop since, 15-20

years. A massive number of the respondent has agreed that agricultural transformation has increased their net income and they are quite satisfied though it interrupted the overall agricultural development in the study area.

Chapter VI

Agricultural system is greatly connected with structural transformations in various developed as well as developing countries. The trend and pattern of agricultural transformation in Uttar Dinajpur district took its momentum since the last two decades. To show the trend and pattern of agricultural transformation in the study area the author has collected secondary data of production of major crops during the period of 1996-1997 to 2016-2017. The production data of district as a whole along with the all nine blocks have been collected from District Statistical Handbook, Uttar Dinajpur, Bureau of Applied Economics and Statistics and from the Office of the Deputy Director of Agriculture (administration), Raiganj, Uttar Dinajpur. Most interestingly it was found that among the total rice production in the district the share of Aus is very negligible and it is continuously following a decreasing trend. Though there was a declining trend of area under aman cultivation and was found in the study area but in case of production there is noted marginal increase during the period of study. In the same way the Boro rice have a decreasing trend followed by the Aus. In case of Wheat the production was 65.0 thousand tons in 1997-1998 and the net production declines to 60.9 thousand tons in 1998-1999.But in 2015-2016 it increased to 112.3 thousand tones and in 2006-2007 it became 105.9 thousand tons respectively and showed increasing trend. The massive increase in the production of maize in Uttar Dinajpur district since last two decade has strongly supported the fact of agricultural transformation in the district. In 1997 to 2000-2001 it was only 0.1 thousand tones which is very negligible in regard to agricultural production in this district is concerned. In the year of 2015-2016 the total production of pulses in this district was 4.6 thousand tons and in 2016-2017 it was only 4.0 thousand tons. There was a positive compound growth of production in case of maize, mustard, potato and tea in the district of Uttar Dinajpur during the period of study being called as transforming crops over spatio-temporal perspectives. Resultantly food grains will be seriously in scarce in near future in the district and the reactions are already witnessed among the veteran farmers as found during the field visits.

Chapter VII

Agricultural transformation is a continuous process which is closely associated with structural changes in agricultural sector, profitability of the farmers, value added chain and socio-economic conditions of the farmers and finally with the environmental aspect of any region. The future trend of agricultural transformation in Uttar Dinajpur district has been analyzed on the basis of production as well as the total coverage area of major crops in the study area. To forecast the production and areal coverage of various major crops up to the year 2025 ARIMA model (George Box and Jenkins, 1970) has been used. This is the first step of ARIMA model analysis in which the best fitted model was identified regarding the forecasting of production of various major crops of Uttar Dinajpur district. In this regard first the assessment of data was done if the data is stationary or non-stationary by nature. The production data of all the major crops were non-stationary hence the data was transformed in'd' times to make the data stationary. Identification of ARIMA model involves to identify the orders of the following three major components namely *p, d, and q.* As the non-stationary data has been transformed into stationary in first order, so we can mention the *d*=1. After the identification the order of *d,* the value of *p* (AR) and *q* (MA) also have been identified on the basis of auto correlation functions (ACF) and partial auto correlation functions (PACF) using the correlogram and partial correlogram.

The selected model for aman (ARIMA 1, 1, 1) shows that there is a slight increase of production of aman paddy during the period of 2022-2025 was found. The forecast value of aman production becomes 587.86 thousand tons to 644.42 thousand tons during the period of 2022 and 2025.The selected model (ARIMA 0, 1, 0) for forecasting the future trend glimpses the fact that there is observed a sharp decline in terms of production of boro in the study area. In 1997 the total production of boro in Uttar Dinajpur district was 176.08 thousand tons and it declined to only 118.90 thousand tons in 2017.The production of boro declines to – 153.27 thousand tons in 2025.The best fitted model of ARIMA (1, 1, 2) shows that there is a massive increase of production of maize in Uttar Dinajpur district. In 1997 the total production of maize in the district was only 0.1 thousand tons and it increased sharply and became 328.4 thousand tons in 2018.The forecast value of maize production during the period of 2022-2025 rose from 535.31 thousand tons to 665.65 thousand tons. This fact reveals the fact of a massive increase of production of maize in the district of Uttar Dinajpur.

Chapter VIII

The major problems that exist in the pathway of agricultural transformation in this district manifold like Lack of Irrigation facility, Existence of Middleman, Excessive uses of fertilizer, Existence of Insects, Fluctuating rate of transforming crops, Problem regarding NOC and Credit card, Price hike of fertilizer and pesticides, Insufficient Training and demonstration facility, Poor marketing facilities, Problem regarding Geographical Land, Labour crisis in peak season, Leads to monoculture etc. These constraints create some interruption in the way of agricultural transformation. By taking suitable measures these problems can be overcome.

Chapter IX

The chapter deals with the suggestions and ideas through the comprehensive research and study to address the current issues and to start the right course of action for the future growth of Agricultural development. The government and Tea Board of India may think about extending the benefits of the scheme to all registered and unregistered small tea growers in the district of Uttar Dinajpur. Developing irrigation systems and promoting water collection methods for secure water supply may boost crop yield. If tea factory is made in cooperative system, the interests of small tea growers will be protected to a large extent. Small Tea Growers' Association may establish a collective storehouse for locally accessible raw leaves in order to offer them at a reasonable price to the Bought Leaf Factories. In order for the farmers to get the right price of raw leaf (the price determined by the Tea Board), proper coordination of the tea farmers with the Tea Board of India is needed and proper monitoring by the tea board is necessary, especially in the determination of the price of tea leaves. The Small Tea growers should focus more on enhancing the quality of green tea leaves through the use of better planting materials, standard green tea leaf plucking at appropriate times and regular intervals, adoption of a proper pruning cycle, use of timely and adequate doses of fertilizers. In order to increase the quality of tea leaves, emphasis should be placed on the application of organic fertilizers instead of chemical fertilizers and pesticides. Sufficient number of SHG (Self Help Group) can be formed with block wise small tea gardens which will try to solve various problems of small tea growers in the future. The quality of raw tea leaves may be preserved through the implementation of a local storage system. It is crucial to store tea correctly since poorly preserved tea may expire or become rotten/decompose much more quickly, or it may build up impurities that affect the

flavour and aroma of tea. Small tea producers have the ability to establish a cottage tea processing facility, as was the case in the Uttar Dinajpur district with a few particularly motivated cultivators. The list does not end here rather there are so many other problem related issues but these are the most leading.

Chapter X

This chapter is purely dealing with the conclusion and summary of the entire research work. Actually, the issue is in one hand giving negative impetus to the production of food crops especially paddy which may in turn create food crisis in the entire district. Most pragmatic impact will also fall on food processing small industries. On the other hand, consumption of maize is still not a common habit of food of the local inhabitants. Hence it will disrupt the social integrity of the district civilians. On the other hand, declining trend of jute production will lead to reduction of income opportunities especially marginal farmers. Business mindedness may even create the avenues to adopt more and more the transforming crops and in reality, economic disparities may occur in the district.

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