Chapter-I

Introduction

1.1 Prelude

Agriculture is the backbone of the Indian economy as well as the largest sector of livelihood adjustment of the people. More or less 23 percent of the national income is derived from the agricultural sector (Dandekar & Rath, 1971). In case of U.K, U.S.A, Canada and Australia agriculture contributes only 2, 3, 4and 5 percent of their national income respectively (Daramola et al., 2007). In addition, 58 percent of the working population is directly associated with agricultural activities (Ahmad et al., 2011). Besides these there are a number of crucial factors which are also greatly influenced by this "mother sector" of economy. Such as the national income, employment, manpower to industry, foreign exchange resources, capital formation, the purchasing power of people, socio-economic conditions of the farmers, inspiration to development of rural agricultural banks, rural periodic markets etc. (Jaffee, 1998). Most importantly there is an interrelationship and interdependency between agriculture and industry to some extent. In Indian context the agro-based industry has a vital role to create employment opportunities, poverty eradication and rural development.

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) (Nelson et al., 2019). The major features of pre-green revolutionary period were traditional agriculture i.e. lack of uses of fertilizers, pesticides, high yielding varieties, modern agricultural tools and techniques, and vast non-irrigated areas which led to self-insufficiency in terms of food grain production in India (Saha, 2013). On the other hand, 1960s and next decades, known as "first wave" of green revolution in India, dramatically increased food grain production, and the country started her journey on the pathway of self-sufficiency and food security (Bugow, 2021). This era witnessed radical changes in agricultural and allied sectors by massive and progressive uses of high yielding varieties, pesticides, fertilizers, credit system, irrigation facilities especially rapid increase in the number of tube well, new technology inputs etc.(Grover et al., 2017). This generated better momentum as far as the concern of food grain production in India. The 1980s, known as "second wave" of green revolution accelerated the pace of production not only in case of wheat but also includes paddy, maize, millets, and other cereals (Genetic Resources Action International, 2012).

This particular period witnessed the fact of crop diversification and agricultural transformation in India. In this particular decade Indian economy kept its first footstep from traditional agriculture towards agro based and allied sectors which tend to lead the acceleration of Indian economy.

Agricultural transformation can roughly be defined as processes by which individual farms shifts from highly diversified, subsistence-oriented production towards more specialized production oriented towards the market or other systems of exchange (e.g., long-term contracts) (Staatz, 1998).

Carswell (1997) argues that agricultural intensification is a strategy for achieving sustainable livelihood, comparing evidence from a number of areas that have undergone a process in particular, the introduction of green revolution methods. The Green Revolution was essentially a package of inputs (fertilizer, high yielding varieties etc.) that were designed to lead to agricultural intensification (Carswell, 1997).

Agricultural transformation implies a positive linkage of the 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 (Kurosaki, 2003). According to J.M. Staatz (1998) agricultural transformation is a necessary part of the process of structural transformation, in which an increasing proportion of economic output and employment are generated by sectors other than agriculture. As far as the structural transformation is concerned it is the process of binding together of three major components of economic activities i.e. agriculture, manufacturing, and service sector and the structural transformation is the triggering factor of agricultural transformation. Demographic variables have a critical effect on the structural transformation of an economy, particularly on reaching the turning point where the size of the agricultural labour force begins to decline (Bosch et al., 2012). The time requires to reach this point depends on the initial share of agriculture within the total labour force, the rate of growth of the total labour force and the rate of growth of non-farm employment. Countries with a large initial share of total labour force in agriculture and countries with high growth rates of total labour will make a long time to reach the turning point (CEA, 2005; Gabre-Madhin and Johnson, 1999). When agricultural transformation accelerates its pace, its contribution on GDP and employment declines in relative sense, but the agricultural sector continues its momentum in absolute terms. The dynamics of agricultural transformation ensures the food sufficiency and

food security, increases the income of rural households, alleviates rural poverty, and creates dynamism in rural market centers, increases employment opportunities especially in non-farm sector (Adesugba & Mavrotas, 2016). In the present scenario the agricultural transformation is the symbol of powerful engine of rural economic growth especially in case of developing countries.

The agrarian society of the district witnessed multiple cropping patterns over the years. But over the last two decades the agricultural scenario of this district has dramatically changed. As a result tea, maize and potato cultivation in Uttar Dinajpur district has been encroached the agricultural lands that have harvested traditional crops earlier. The unchecked multiplication of such small tea gardens and has significantly reduced the yield of crops such as paddy, jute, wheat, pulses and vegetables (The Statesman, dated 29thAugust, 2014).

But on the other hand, such agricultural transformation has rejuvenated the rural economy and generated better momentum to create rural employment which has directly uplifted the socio-economic conditions of the farmers in the district. There is doubt that such agricultural transformation is playing a dynamic role in every sphere of rural economy by increasing annual income of the farmers, creating progressive rural markets, using new technology inputs etc. The most vital part of such transformation is to create a positive linkage between farm and non-farm activities in rural economy. The present work is based on the detailed study of the agricultural transformation and its impact on socio-economic conditions of the farmers of Uttar Dinajpur district.

1.2 The study area

The district of Uttar Dinajpur came into existence through bifurcation of the erstwhile district of West Dinajpur, effective from 1st April 1992. The district of Uttar Dinajpur lies between 25^{o} 10′ to 26^{o}35′ North latitude and 87^{o}45′to 88^{o}35′ East longitude covering an area of 3,142 Sq. Km. Bangladesh bounds the district in the east, Bihar in the west, Darjeeling in the north and Malda in the south. The older alluvium is the prime matrix of country soil. Uttar Dinajpur is bestowed with a very fertile soil due to the alluvial deposition which helps to grow paddy, jute, mesta, sugarcane etc. The regional topography is generally flat with a gentle southerly slope towards which the main rivers flow like Kulik, Nagar, Mahananda, etc. The Uttar Dinajpur district is rather peculiar in shape.

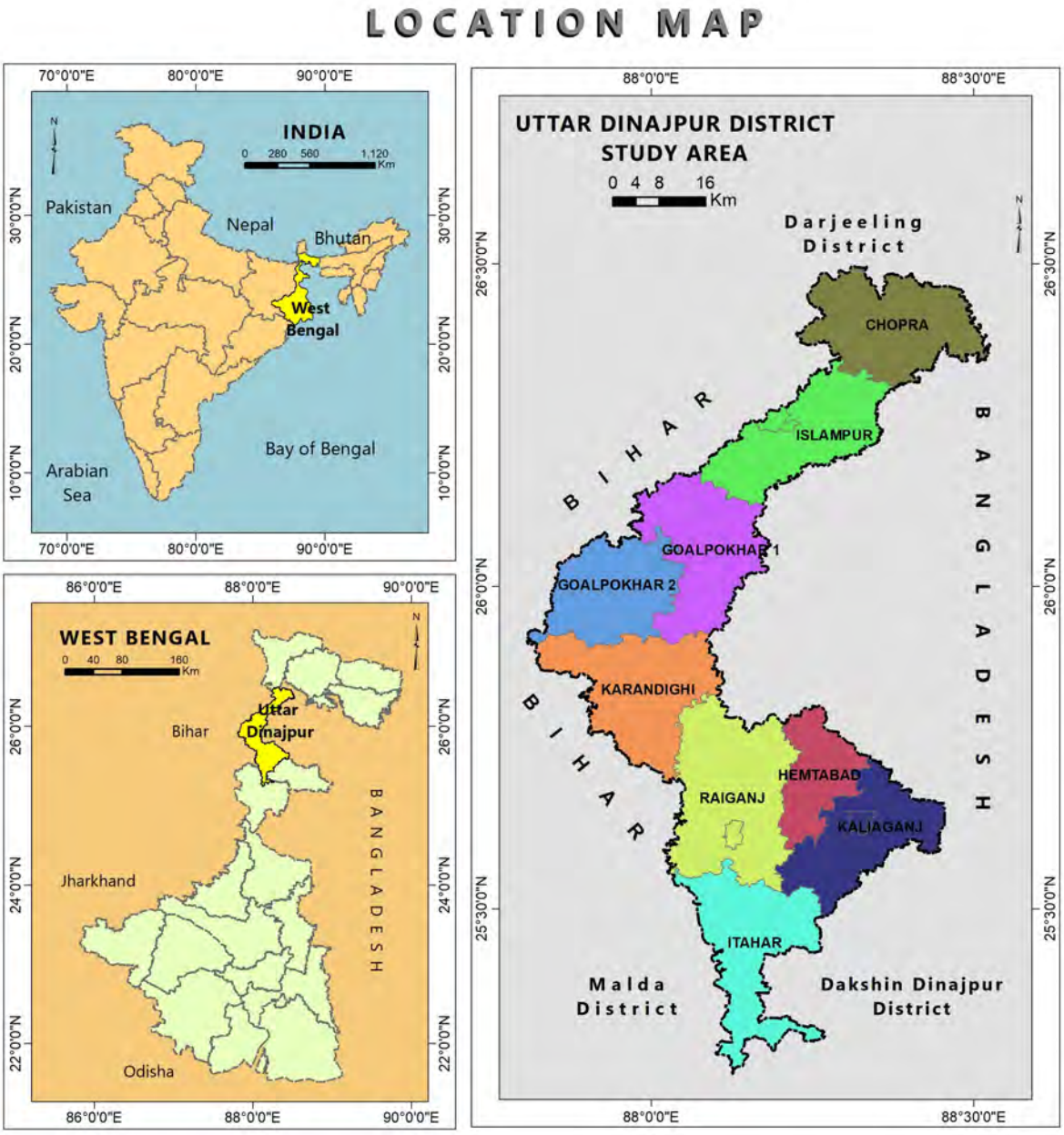

Figure 1.1 Location map of the study area

The general appearance of the district is between sixty to seventy miles long, but its width rarely exceeds ten miles at any point. This corridor is flat, sloping gently south ward. In the south and western part of the district the curious formation known as the 'Barind', geologically classed as old alluvium, makes its appearance. The characteristics of this undulating country interspersed with ravines. Mean maximum and mean minimum temperature ranges between 10°C to 12°C.The maximum rainfall experience in July (52mm) and August (36mm) and minimum in January (9 mm).

The district consists two subdivisions namely Raiganj and Islampur. It has 9 community development blocks, 4 municipalities, 9 police stations, 9 panchayat samitis, 98 gram panchayats and 1516 mouzas. As per 2011 census the total population of the district is 30, 00, 849 with a decadal growth of 22.90 percent over 2001 census. Of the total population the rural population is approximately 87.94percent. The SC and ST population of the district are 27.71percent and 5.11percent respectively. Uttar Dinajpur has a sex ratio of 936 females for every 1000 males. Average literacy rate of the district in 2011 is 60.13 percent compared to 47.89 percent of 2001 and female literacy rate is 53.15percent (Census, 2011).

1.3 Problem: Formulation of the thesis

Uttar Dinajpur is one of the most backward districts in West Bengal (District Agricultural Handbook, 2012), predominately agro based and agriculture is the main stay. Majority of the rural population is engage in agriculture and multiple cropping is followed. Over the last two decades the paddy, wheat and jute fields of the district have been continuously converting into small tea gardens and maize fields, especially due to more economic benefits compare to paddy and jute. This trend is affecting the self-sufficient food crop growing local population in the district. It has resulted inter-block disparity in output benefits. Though such agricultural transformation is able to uplift the socio-economic conditions of the people of the district but it may result regional disparity in the agricultural society. Karandighi (headquarter of Karandighi CD Block) situated along National Highway 31, where thousands of traders once gathered after the paddy harvesting season in winter to collect and transport rice, sees less business these days (The Statesman, dated 29thAugust, 2014). It used to be a famous hub of the famous *Tulia panji, bansful, Katki, maru, sampamashuri, elai and shova* varieties of rice that was transported to different parts of West Bengal. But nowadays the scenario is declining in trend. Actually, the growth of tea plantation and maize cultivation has directly hampered paddy production along with jute, pulses, wheat etc. in the district. A number of newer tea gardens have come into existence without securing trade license or NOC from the appropriate authority. If the trend of tea and maize cultivation remains unchecked or unabated, could spell doom for agriculture in the district of Uttar Dinajpur. Many problems regarding the agricultural transformation of the district have been realized so far, such as increasing cost of cultivation, fluctuating market price, diseases of crops, insufficient irrigation facilities, excessive and injudicious use of chemical fertilizers, intervention of middlemen, labour crisis etc.

1.4 Scope of the study

The backbone of the economy of the district is principally agricultural activities and agricultural transformation in the district is resulting of prolonged phases of soil exhaustion. As the agricultural transformation has already accelerated in the district, it has become essential to highlight the major causes, impacts, problems and potentialities regarding such transformation. The present work is an inclusion towards the different works done by government, non-government and private initiatives on agricultural transformation of Uttar Dinajpur District.

1.5 Objectives

1. To analyze the trend and pattern of agricultural transformation in Uttar Dinajpur district.
2. To identify the major causes behind the transformation of agriculture in the district.
3. To study the impact of agricultural transformation on socio-economic conditions of the farmers.
4. To analyze the temporal changes of cropping pattern in relation to land use.
5. To identify the major problems of agricultural transformation.
6. To suggest necessary steps for the overall development in the agricultural sector.

1.6 Hypothesis

Hypothesis developed for fulfillment of the above objectives is as follows -

1. Lesser cropping period has accelerated the adoption of agricultural transformation.
2. Low recurrent investment in respect of traditional crops has also accelerated the adoption of agricultural transformation.
3. Economic benefit has led to agricultural transformation in Uttar Dinajpur district.

1.7 Research methodology

For the purpose of fulfillment of the above mentioned objectives the following methodology has been taken into account.

1. To discuss the trend of the production of tea, maize, potato, mustard etc. (transforming crops) along with other traditional or native crops (paddy, jute, pulses etc.) simple linear regression have been done against each crop. The production data of each crop from 1996-1997 to 2016-2017 has plotted against each year. The main source of production data for individual crop is

various published and unpublished material. 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. Compound annual growth rate (Gupta, 2008) of production of individual crop under all nine blocks has been calculated to determine the trend of growth of each crop during the study period .The compound annual growth rate of production of each crop has been calculated on the basis of data from 1996-1997 and 2016-2017. Finally the calculated value of each crop under the blocks has been demonstrated through choropleth maps. In this way the inter-block variation of growth of production of each crop during the study period has been demonstrated.

2. For the purpose of spatio-temporal analysis of agricultural land use pattern of the study area a number of methodologies have been applied. To fulfill the objective the secondary sources of data were the District Statistical Handbook, Uttar Dinajpur, Bureau of Applied Economics and Statistics, Deputy Director of Agriculture (administration), Raiganj, Uttar Dinajpur and various other published and unpublished have been collected. The physical setup of the study area was analyzed by using relief map, soli map, drainage map, climate map etc. based on Survey of India topographical maps (map no78C/1, 78C/2, 78C/3, 78C/6, 78C/7, 78B/3, 78B/4,78B/7, 78B/8, 78B/11, 72O/13,72O/14 AND 72N/16.), District Planning Map Series, National Bureau of Soil Survey and Land use planning map etc. To analyze the spatio-temporal changes in the agricultural land use pattern of the study area there has been selected the major crops of the study area and the change detection has been made on the basis of the data of 1996-1997 and 2016-2017 respectively. The crop covered at least one percent of the gross cropped area has been considered as a major crop for the study.

   After selecting the major crops, the relative percentage share of each major crop to gross cropped area has been calculated for the period of 1996-1997 and 2016-2017. Finally a comparative analysis for each crop has been done through the choropleth maps.

   To show the changes in cropping pattern of the district crop group wise as well as individual crop wise analysis has been done for the period of 1996-1997, 2006-2007 and 2016-2017 respectively. The rates of shift from one crop to another the area of each crop and crop group in absolute term has been calculated.

The following formula has been applied to calculate the rate of change of area under each crop.

$$\frac{(present\ area\ coverage - past\ area\ coverage) * 100}{(past\ area\ coverage)}$$

The calculated value of each crop has been demonstrated through radar diagram to show the pattern of shift at district as well as block level. Beside these the compound annual growth rate (Gupta, 2008) of area under each crop has been calculated by using following formula.

D = ((B/A) ^ (1/C)-1)*100

Where, D= Compound annual growth rate

A= Component areal strength of initial year

B= Component areal strength of final year

C= No. of year

3. 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. Land use and land cover map was prepared on the basis of satellite imageries for two base years i.e. 1996 and 2016 in this regard.
4. To show the changes in productivity of major crops during the period of 1996-1997 and 2016-2017, Productivity Index (PI) of Enyedi (1964) has been applied.
5. To show the structural changes in agriculture spatio-temporal variability of land-holding size and number, advancement in farm mechanization, changing marketing system, pattern of irrigation and uses of pesticides have been analyzed through suitable cartographic techniques.
6. Field investigation and in-depth study of literature will be carried out to determine the major causative factors of agricultural transformation. Stratified random sampling has been chosen for data collection. Henry Garrett's ranking method was introduced to find out the most significant factor of agricultural transformation in the district. In this regard the farmers were asked to assign a particular rank against each factor and finally the outcome of those individual ranks was converted into Garrett value by using the following formula.

Percent position= 100(Rij-0.5)/Nj

Where, Rij = Rank given for the i^{th} variable by j^{th} respondents

Nj = Number of variables ranked by j^{th} respondents

7. To find out the major impact of agricultural transformation in the district primary data on socio-economic conditions of the farmers has been gathered through observation and schedule and has been tabulated thereof. In this regard a number of statements regarding the socio-economic condition of the farmers have been framed out and the perception of the farmers has been taken into account in this respect. To fulfill the particular objective, a five-point Likert scale has been used and the collected data has been analyzed through one way ANOVA.
8. Perception study regarding agricultural transformation has been conducted through schedule survey and the collected data has been analyzed by using suitable cartographic techniques.

7. Primary and secondary data has been collected to identify the major problems associated with agricultural transformation of the district. Lastly a set of corrective measures have been recommended to solve the problems and overall development of agriculture in the district.
8. The future trend of production of varies crops has been done using ARIMA model.

1.8 Sources of data

To fulfill the objectives, the database was an integration of both primary and secondary. The physical setup of the study area has been analyzed by using a relief map, drainage map, soil map, climate map etc. based on Survey of India topographical maps (map no.78C/1, 78C/2, 78C/3, 78C/6, 78C/7, 78B/3, 78B/4,78B/7, 78B/8, 78B/11, 72O/13,72O/14 AND 72N/16) at a scale of 1:50,000, District Planning Map Series, National Bureau of Soil Survey and Land Use Planning Maps, Central Ground Water Board Maps. The secondary data includes all the published and permissible Governmental records have been fetched. The office of the Deputy Director of Agriculture (administration), Raiganj, Uttar Dinajpur, Bureau of Applied Economics and Statistics, Uttar Dinajpur and Office of the District Land and Land Reforms, Uttar Dinajpur were the major sources of data regarding the area under various crops, production and productivity of principal crops of Uttar Dinajpur district at block level. In addition to these published reports and books such as Economic Reviews, Agricultural Census, Estimates of Area and Production Reports, Agricultural Bulletin like Annual plan published by Agriculture Dept., Uttar Dinajpur, Statistical Abstract, Govt. of West Bengal, District Census Hand Book, District Planning Map Series published by Survey of India have also been collected and used for obtaining relevant information time to time. Different satellite images have also been used in various aspects of the work.

The primary data has been collected through the selective survey using semi-structured schedule/questionnaire. Two villages from each block having agricultural transformation has been surveyed through this method. The schedule contains the following aspects like the major causes of agricultural transformation, major crops grown in the field, socio-economic impact of agricultural transformation, major problems associated with agricultural transformation etc. For perception study separate schedule/questionnaire has been formulated. A pilot survey during research work also helped to collect a realistic picture of the agricultural transformation in the district.

1.9 Review of literature

To complete the research in a systematic and scientific way review of past literature is an essential and integral part. The past studies not only reflect a glimpse of the present work but also direct the pathway of successful research work. As far as the 'Review of Literature' is concerned it provides a guideline regarding the fulfillment of a research work in a proper way. However, the literature review is directly or indirectly concerned with the objectives of the study. In this regard the present literature review connected to present research work has been explained objective wise.

To identify the major causes of agricultural transformation in Uttar Dinajpur district:

Uchema et al. (2013) analyzed the correlation between the new value and job creation in agricultural sector in Nigeria. In this paper they highlighted the fact that a huge unemployment of youth generation in Nigeria has insisted the country towards the agricultural transformation. The study is purely based on primary data collected through questionnaire and interview method among three hundred respondents. To show the relationship between the new values i.e., agricultural transformation and creating employment opportunities the authors applied Karl Pearson's Coefficient of Correlation (r) as a prime methodology. There derived a positive relation between the new value and job creation which leads to the poverty alleviation in Nigeria. This method may also be fruitful to show the agricultural transformation as one of the major causes of poverty alleviation in Uttar Dinajpur district.

Biswas, (2016) studied in detail the causes of agricultural transformation in the North Bengal, especially in Uttar Dinajpur and Jalpaiguri district. In this paper he clearly mentioned a number of causes behind the emergence of small tea gardens in the northern part of the Uttar Dinajpur district which was traditionally dominated by pineapple, wheat, jute, paddy etc. The author

outlines the major causes of agricultural transformation in the region such as the paucity of available market of pineapple, lack of processing unit, transportation problems, lack of cold storage, fluctuating rate of pineapples etc. , demonstrative effects of the big tea gardens in neighboring districts of Darjeeling and Jalpaiguri , comparatively high profitability along with a steady income in tea cultivation inspire the small and marginal farmers towards tea cultivation in Uttar Dinajpur district. This study is purely based on primary data using stratified random sampling and in my research work the same procedure of data collection.

Baruah, (2003) tried to identify the major causes of increase of small tea growers in Assam. According to Baruah there are a number of causes behind the rapid increase of small tea gardens in Assam. The most vital factor is economic benefit as far as the development of small tea gardens in Assam. Behind this the fanciness of tea plantation among the youth generation also tends to lead the growth of small tea plantation in Assam.

Mazumdar, (2008), explained the growth and development of small tea growers in North Bengal with special reference to Jalpaiguri and Uttar Dinajpur. According to his assessment the northern part of Uttar Dinajpur district especially in Chopra and Islampur block the pineapple cultivation is rapidly converting into small tea gardens. Due to lack of available marketing facility, porosity of pineapple, low price of pineapple etc. forced the farmers of pineapple and other traditional crops towards small tea plantation. Comparatively higher price of tea, locally available market and continuous cash flow inspired the farmers towards tea cultivation.

Baruah, (2007), analyzed the causes behind the shift of traditional crops towards plantation agriculture in North East India with special reference to Assam. In his view due to better economic benefit compare to other traditional crops, continuous cash flow, low recurring investment, higher demand etc. are the motivating factors behind the changing agricultural pattern in Assam.

Tea Board of India (2011) demonstrated the fact that in late sixties the Tarai region of Jalpaiguri, Darjeeling and Uttar Dinajpur district area partially covered by pineapple cultivation. In a very short period, pineapple cultivation took its momentum and became one of the most profitable crops in this region. But this trend was continued for fifteen to twenty years. In early nineties the pineapple field of this region rapidly converted into small tea gardens. Due to insufficient preserving facility, lack of marketing facility, low price of pineapples etc. are major

causes of agricultural transformation in this district. On the other hand, the economic benefit of tea also motivated the farmers of this region towards tea plantation.

According to the **Committee on Commodity problem (2012)**, in India a number of farmers shifted towards small tea plantation from paddy, Jute, pineapple and other native crops due to enjoy more economic benefit. But most of the small tea growers have not sufficient knowledge about the modern techniques associated with tea cultivation. So there is needed to enrich their knowledge of recent technology, uses of fertilizer, pesticides etc.

Hannan, (2013), discussed the various causes of growth of small tea gardens in Chopra block of Uttar Dinajpur district and its surroundings. He explained that a vast area of Chopra and Islampur block of Uttar Dinajpur district was previously under pineapple field. But with the passage of time, a vast area of pineapple field converted into small tea gardens. He underlined a number of factors of agricultural transformation in the district. Low price of pineapple, unavailable proper marketing facility, insufficient cold storage are the triggering factors of such transformation in this region. Beside this suitable climate, favorable soil etc. also is responsible for such transformation in this region.

Kaboshi, (2012) analyzed the major causes, implications and impacts of structural transformation in developed countries like U.S.A, U.K, Germany, Japan, and other developing countries. In this paper he tried to highlight the causes and impacts of structural transformation in the form of declining trend of agriculture and increasing trend of service sectors. As a result an unequal growth has been noted in socio-economic conditions of the farmers in the study area.

Joarder, (2018) tried to identify the major causes and impacts of agricultural transformation which have been taken place in the northern part of Bangladesh. This journal also presents the trend of agricultural transformation along with the major problems in the study area. The data source of this paper is mostly primary by nature. He has selected 27 mouzas covering the north-western Bangladesh and the primary data have been collected through focus group discussions (FGDs) among the farmers who are directly associated with the process of agricultural transformation. He has analyzed the collected primary data through various cartographic techniques. Semi-structured questionnaire was used to understand the impact of agricultural transformation on different farming groups. As my research work is very much similar to this

fact, the procedure of primary data collection along with the methodology has been very much convenient to my research work.

Jayne, (2018) in his thesis elaborates the concept of agricultural transformation from native crops to HVA (High value agricultural products) in sub-Saharan countries with special reference of Uganda. In this regard he explained the crop diversification as a symbolic fact of agricultural transformation. To measure the degree of crop diversification in Uganda he applied the Shannon Diversity Index, The triple-hurdle model (Burke et al., 2015), The Herfindahl – Hirschman index, Simpson index of Diversity etc.

To study the impacts of agricultural transformation on socio-economic conditions of the farmers:

Khan, and Patekar, (2015) assesses the role of agricultural transformation in poverty eradication and extending employment opportunities in rural India. He also emphasized that agriculture is the main stay of rural development and rural livelihood depends upon the agricultural development. Through a number of examples, the authors strongly established that the rural development can only be accelerated through the agricultural development and in this regard agricultural transformation has a great role to play.

Ladele et al., (2015), attempted to analyze in detail the positive relation between the agricultural extension and transformation agenda in Nigeria. They focused on the rejuvenating country's pride through a successful crop transformation which should create self-sufficiency on food crop production, generate employment opportunities and uplift the socio-economic status of the small and marginal farmers which represent almost 70 percent of the country's total population. They also suggest a set of recommendations regarding the successful transformation in agriculture. Multi stage sampling technique has been applied to collect the information through questionnaire. Finally, the collected data has been presented by using various statistical techniques i.e., frequency, percentage, mean, S.D, ranking etc. In the present work the following statistical techniques has been applied by the author to measure socio-economic condition and perception of farmers regarding agricultural transformation.

Obiura and Emodi (2013), discussed regarding the agricultural transformation agenda, which is about enhancing the capacity of agricultural commodities, values chain, leading to industrialization and employment creation, food security, infrastructural investments, private

sector leadership and accessible market information systems to the farmers. Recommendations have been made for a true and sustainable agricultural transformation in Nigeria.

Briones, and Felipe, (2013), focused about the employment share in agriculture and a shift from agricultural output from traditional to high value products in the developing countries of Asia. Though this is the era of industrialization but agriculture remains the largest employer in many large Asian countries like India, China etc. Many countries of Asia now are in a position of shift towards the next agricultural development.

Golan, and Kohli, (2013) assessed the performance of agricultural sector in Vietnam, Indonesia and the Philippines (VIP Countries) during the period of 1980 to 2011. They also made an attempt to analyze the future prospects and food security of these countries. The first part of the journal dealt with a macro economic analysis of future scenarios at global scale. The second part included analysis at the country level of future agricultural production. In the paper designed by **Shivay, and Kumar, (2007)** the scenario of agricultural transformation and resultant food habit change in many states of India have been presented accurately. Moreover, this paper illustrated that crop diversification is more pronounced around the urban centers and in the rain fed areas of India. Such diversification is influenced by rapid technological changes in agricultural and improved rural infrastructure. As a result the socio-economic conditions of Indian farmers are uplifting in a significant way.

Goutam & Bhardwaj, (2011) noted that better agricultural practices are needed to bring sustainability to Indian agriculture. Excessive use of chemical fertilizers and pesticides has long-lasting and deteriorating effects on soil health. On the other hand sustainable agriculture will create more rural employment. Switching over to new crops is more liable to the use of chemical fertilizer and pesticides compared to the traditional crops.

The paper framed by **Roy, (2009)** elaborated the rubber cultivation in Tripura and outlined the existing position, productivity, profitability, its prospects and pitfalls. Recently how rubber cultivation took a new look into economic development in the state has also been discussed vividly. Moreover, it has been analyzed in the paper how many of the investors are replacing the heritage cultivation impacting the crop diversity and marrying the prospect of rubber plantation to a greater extent as transforming crop.

Bomako, (2010) examined the implications of economic growth vis-à-vis reduction in poverty, analyzed the progress underway and diagnosed the critical elements of change in policy required to reach the objectives of agricultural scenario.

Malaque & Yokohari, (2007) tried to focus on the areas of China's experience of economic growth and poverty reduction, including the contribution of international assistance and its relevance for other developing countries.

Ramsey & Abrams, (2013) discussed about the increasing trend of production, processing, storage, marketing facilities and income of smallholders of Nigeria. The beneficiaries are economically active for smallholders who are participating in commercial agriculture.

Mellor & Paul, (2010) tried to examine the critical elements of policy change required to reach the objectives of agricultural transformation and combined aspects of experiences of other developing countries including Ethiopia.

The paper argued that a high agricultural growth rate has far-reaching positive implications for increasing employment and accelerating poverty reduction facts. High agricultural growth also helps to avoid rapid urbanization with large slum populations. In order to achieve agricultural growth with adopting new crops inclusively traditional varieties and with positive economy-wide linkages, however, it is necessary to engage "middle farmers" who are large enough to adopt new technologies and produce significant marketed surplus to have spending patterns that drive a vibrant rural non-farm sector. Finally, public and private investments in road, electricity and telecommunications are also needed to reduce marketing costs and enable growth in rural market towns and secondary cities, and provide social services to rural people has been discussed precisely.

Sarkar, (2014) studied on contract farming and resulting agricultural transformation. In this article the author highlighted on transformation of agriculture into agri-business. The author also studied the dynamics of agricultural capital through contract farming, which provides impetus to the agricultural transformation in West Bengal and India.

Goswami et al, (2010) have tried to trace the role of agricultural information management as a factor of agricultural departure to transformation and which is so important in ensuring food

security and sustainable development taking the cases of West Bengal. More works regarding this issue are to be initiated in West Bengal.

The works done by **Nindi, (1993)** presents the agricultural structural change and discusses options to characterize different ongoing patterns of change.

These structural changes result from implementing modern technologies at small farm level. Through the implementation of new policies these changes may get a greater pace. He also looked into the future characteristics and picture of the African agri-business of tomorrow by examining the present trends and implications. The paper examined agricultural transformation, land trade, prospects for increasing farm land, and using contact farming in African agriculture.

Nicod and Salomon (1999) analyzed in detail about the environmental impact of agricultural transformation on the karstic regions of France. This journal highlighted the facts of recent transformation of extensive agriculture into intensive agriculture in karst plateau of France and as a result of such transformation various environmental problems have been arisen in the said region. Such agricultural transformation affects the hydrological function, morpho-climatic process, soil health and finally causes the rural depopulation in the karst area.

To study the spatio-temporal analysis and land use land cover changes in their study area **Von et al., (2016)** studied about the causes and impacts of agricultural transformation and land use changes with special references to Indonesia. To show the land use change and agricultural transformation, the authors used GIS, remote sensing, and cross-sectional household data. In present research work the researcher also applied the GIS and remote sensing data to show the land use change due to agricultural transformation in Uttar Dinajpur district. The author also studied in detail the major causes and impacts of agricultural transformation and land use change in Indonesia. Their prime focus was centered on the socio-economic and ecological aspect of the study area. To show major impacts of agricultural transformation the author applied regression analysis.

Velmurugan and Saijad (2009) analyzed the land use change in Dehradun district of Uttarakhand for last two decades. They tried to explain the role of population growth, urbanization and industrialization in land use land cover change in Dehradun district. To show the land use land cover change in Dehradun district they used remote sensing and GIS techniques as a prime tool. They also prepared change matrix to analyze the land transformation. The present

research work also deals with the fact of agricultural transformation in Uttar Dinajpur district. In present research work the land use land cover change has been analyzed by using remote sensing and G.I.S techniques.

Singh and Rongmei, (2013) analyzed the land use changes in the eastern part of Loktak lake after the completion of Loktak hydroelectric project and its impact on the socio-economic lifestyle of the inhabitants. The study was based on both primary and secondary data. The authors took 1970 and 2011 as the base year. The change detection has been analyzed by using satellite images of LISS-III and Google Earth imageries. The primary data has been collected through questionnaire method. The impact of spatio-temporal changes of wetlands on the inhabitants of the study area has been studied through household survey.

Sen, (2009) analyzed the crop combination, crop diversification and productivity index of Bardhaman district. In his paper he noted the changing pattern of crop combination and crop diversification during the period of 1996 to 2007. He also pointed out that in many blocks of Bardhaman district there was a trend of shifting the cropping pattern from traditional to commercial crops.

Sanyal and Niranjan, (2017), analyzed in detail the land use land cover change in Kanpur Dehat district of Uttar Pradesh especially the peripheral agricultural land which has already been converted into urban sprawl. To identify the major changes in land use land cover higher resolution remote sensing data has been used. To assess the spatio-temporal changes in land use land cover LISS-III image has been used taking 2006 and 2012 as base year. A change detection mode using ERDAS imageries has been used to detect the changes over a period of time. In the present research work to show the spatio-temporal changes in land use land cover in Uttar Dinajpur district the high resolution satellite imageries have been used significantly.

Parihar, (2018), analyzed in detail the crop combination and crop diversification in the north-western part of India during the period of 1980-81 to 2010-11. Based on secondary data, the following study has been done in Punjab, Haryana and Rajasthan. To show the crop combination and crop diversification the author applied crop combination method of J.C. Weaver (1954) and crop diversification method of J.Singh (1976) respectively. As far as the present research work is concerned the following method of crop combination by weaver has been applied.

Chakraborty and Mistri, (2017), discussed about the pattern of crop combination, concentration and diversification in Bardhaman district, West Bengal. The study has been done using secondary data of District Statistical Handbook. To analyze the crop combination the author applied the method of J.C.Weaver (1954) and the method of Singh and Dhillon (1984) as prime methodology. The crop diversification in Bardhaman district has been presented using the method of J.Singh (1984).

Jana, (2017), through his study tried to analyze the crop combination and cropping intensity of Daspur-I block, Paschim Medinipur, West Bengal. The data has been collected through field survey and various secondary sources. On the basis of the obtained data a number of graphs, images have also been prepared. To analyze the crop combination through the method of J.C.Weaver (1954), the entire region has been divided into several agricultural regions.

Kumar, **(2017)** tried to analyze the cropping pattern, crop ranking and crop combination in the Somb river basin. On the basis of secondary data and geospatial techniques the author made a zonation of crops accounting the share of net sown area. The crop combination method of J.C. Weaver (1954) and further modified by Doi (1959) have been applied and finally a number of thematic maps have been prepared through Arc GIS (version 9.2). The author also attempted to prepare crop-wise thematic maps, ranking the cultivated crops in the Somb river basin area. To study the crop combination in the same area Geo- coded IRS-P6 FCC merged LISS-III model was used.

To analyze the trend and pattern of agricultural transformation **Vos, (2018)**, tried to explain the scenario of agricultural transformation and its impact on the economy of South and South East Asian countries during last six decades or more. In this book he also analyzed the trend and pattern of agricultural transformation in South and South East Asia. He also pointed out the impact of agricultural transformation as structural change and poverty alleviation in different countries of South East Asian region.

Haque et al., (2010), tried to analyze the trend and pattern of crop diversification in eastern India, including West Bengal. They also highlighted the major constraints of agriculture in the study area. They also suggested few remedial measures to overcome such constraints and ensure enough possibility of rural growth. To show the degree of crop diversification in the study area

the authors have used Simpson's Index of Diversification (SID) and the Index of Crop Diversification by Bhatia (1965).

Ferroni, and Zhou, (2017), discussed in detail about the role of private sector in Indian agricultural transformation. In recent era especially after the green revolution the role of private sectors in Indian agriculture has accelerated a greater pace through investment in agricultural technology, plant genetics, seeds, fertilizers, pesticides, research work etc. The increasing trend of private investment in Indian agriculture fosters the process of transformation from traditional to commercial crops. Such transformation has a greater role in creating employment opportunities, rural development and eradicating poverty. This article also showed the share of private sector in Indian agriculture during the period of 1980-2013.

To analyze the perception of farmers regarding agricultural transformation:

Kareem and Kinbile, (2015), tried to underline the perception of the farmers regarding the impact of agricultural transformation in Nigeria. To fulfillment of their study they applied a number of statistical techniques such as mean, chi-square, Spearman's rho rank correlation and regression analysis broadly based on the primary data.

1.10 Conclusion

The current chapter has concentrated on the idea of agricultural transformation, issues with the present study, the geographical background of the study area, the research hypothesis, and the objectives and methodologies of the investigation. This chapter also discusses the review of relevant literature that is either directly or indirectly linked to the subject at hand. Although the data analysis procedures were explored further in the succeeding chapters as per the study's relevance.

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