Chapter 1

Introduction

Agriculture continues to be an important sector of Uttar Pradesh economy. About two-third of the work force in the state is employed in agriculture and the sector contributes more than one-fourth to the gross domestic product of the state. Not only for the state of Uttar Pradesh, agriculture sector of the state occupies an important position for the country as it contributes one-third of wheat production, one-seventh of rice, about 40 percent of sugarcane, 40 percent of potato and about one-fifth of the foodgrain production to the country as a whole (GOI, 2014). Therefore, the performance of agriculture in the state has not only significant bearing for the people in the state but also have significant implication for food security of the country as a whole. Available evidence indicates that the status of agriculture development in Uttar Pradesh is not much better than the average performance of the country as a whole. Furthermore, in spite of having best quality land in the country and abundant availability of water resources, agriculture in the state failed to match the spectacular performance of agriculture experienced by its neighbouring states of Punjab and Haryana (Bhalla and Singh, 2012). Available evidence suggests that the agriculture in the state is marked by wide inter-district disparities in growth and development (Bhalla and Singh, 2012). Available evidence also suggests that performance of Indian agriculture suffered deceleration during the post reform period. Even this evidence is not uniform across spatial units. While the state of Gujarat, Bihar, Maharashtra performed exceptionally well during this period, agriculture performance suffered reverses in most of the remaining Indian states including Uttar Pradesh (Bhalla and Singh, 2012).

Many researchers examined agricultural performance in Uttar Pradesh, but we have not come across any comprehensive analysis of temporal and spatial dimensions of agricultural performance at the district level for the state. Evidence suggests that the available district wise studies are either focussed at the country as a whole or examined limited issues at the district level or are focussed at micro level analysis for a limited number of districts or are limited in coverage of crops or confined to a limited time period (Brown, 1971; Bhalla and Alagh, 1979; Bhalla and Tyagi, 1989; Bhalla and Singh, 2001, 2009, 2020, 2012; Kumar and Jain, 2013; Shaffi, 1984; Jain, 1990; Prabha, Goswami and Chatterjee, 2010; Raman and Kumari, 2012; Shafiqullah, 2013). The present study is a modest attempt of in-depth analysis
of the temporal and spatial dynamics of agricultural performance of Uttar Pradesh at the district level during the last five decades.

1.2. Motivation for the study

The region and district level analysis of agricultural development in a big state like Uttar Pradesh is of crucial importance on the following accounts:

1. First and foremost requirement in designing and implementing any strategy for development and modernization of agriculture is the information regarding what constraint the development of some regions/districts and what enables some others to grow rapidly and forge ahead of others. Planners and policy makers must focus their attention on the left behind districts by drawing fruitful lessons from the districts that successfully reached a higher level of development. Only comprehensive and most updated information can be very useful to address these issues.

2. Most of the studies target state as unit for measuring disparity and neglect variations within states. Such efforts lead to limited success in achieving the objectives of balanced development. This is mainly because in a country like India, where some of the states are larger than even many nations, it is very important to analyze the factors responsible for disparities at the disaggregate level and design policies accordingly.

3. The wide inter-regional disparities can disturb the peace and harmony in a state or in any of its region. The sense of being left out and poor living conditions fuel the feelings of being ignored and deprived among the population in backward regions. Many times people in the backward regions demand for separate state as has happened in the recent past when Uttaranchal, Jharkhand and Chhattisgarh were demanded and created as separate states on similar grounds. Sometimes, sense of being ignored and deprived also leads to violence and domestic disturbances, as the country is currently facing in some regions and states. The Naxalite movement, Gorkha land issues and demand for separate Telangana owe their origin in under development and sense of deprivation. Such disturbances lead to wastage of precious human and economic resources to contain domestic discontentment. The diversion of resources further aggravates the problem of underdevelopment and poverty and leads to wastage of huge amount of money to maintain peace and harmony in such disturbed regions. To pass on aspiration of the people and for containment of such serious problems, extent and
causes of underdevelopment must be known and addressed by appropriate policies and programs.

4. Any growth process cannot be inclusive if it continues to bypass some regions and certain segments of the society. Therefore, to address our policies and programs for attainment of (i) an inclusive growth as a main aim of the Twelfth Five Year plan with, (ii) the objective of balanced regional development adopted by the planners since long time back and (iii) for alleviation of poverty and to provide decent level of living to people depending on agriculture, policies and programs must be focused on the development of the agriculturally backward regions. Identification of such policies and programs again lies in the district level information on crops grown, their actual and realized potential, use of modern inputs and availability of social and economic infrastructure are of crucial importance. This again requires the latest available information on the performance of agriculture at the district level.

Besides these crucial issues any district level information on agricultural development is also important or two other grounds:

1. With increased emphasis on district level planning, extent, pattern and sources of agriculture development at the district level is an essential prerequisite in designing appropriate policy initiatives for agriculture development.

2. The slowdown of agriculture growth in general and developed regions in particular and rising prices of many agricultural commodities like pulses and edible oils is threatening livelihood of poor and food security of the country. However, available evidence suggests prevalence of unexploited potentials of agricultural development in many parts of the country including Uttar Pradesh. Many initiatives under National Food Security Mission have already been implemented in identified districts and many others are required to be initiated in remaining ones. District level information is prerequisite in identifying such programmes not only for agricultural development but also for inclusive and sustainable growth.

Before we directly identify the key objectives and hypotheses for our present study, it would be fruitful to have synoptic view of different perspectives for agricultural development, to have a peep into different phases of agriculture development and a brief review of empirical evidence on agriculture development at the sub-state (regional/district) level. This has been undertaken in the subsequent paragraphs.
1.3. Agricultural development: Some models

A rich literature, both theoretical and empirical, on processes of structural transformation of economies from low level of development and predominant agrarian in structures to modern agriculture and predominant services sector is available. This literature has articulated agriculture’s role as the precursor to the acceleration of industrial growth from England in the mid 18\textsuperscript{th} century to Japan in the late 19\textsuperscript{th} century, and much of Asia in the late 20\textsuperscript{th} century (Bairoch, 1973; Timmer, 1988; Diao et al, 2005). The discussion on the role of agriculture in structural transformation has evolved from the time of classical theorists, such as Lewis (1954), who viewed economic development as a process of transfer of resources or factors of production from the low productive agricultural sector to a modern industrial sector with higher productivity. However, many others, including Schultz (1964), Mellor (1966) and Ruttan and Hayami (1984), argued that agriculture play a central role in transition of agrarian economies through various forward, backward and consumption linkages. They argued that ignoring agriculture development can prove counterproductive to industrialization as happened in India and many other developing countries during early 1960s.

Numerous models/approaches have been proposed by scholars for agriculture development. Some of the well-known models in this context are: the Frontier or Resource Exploitation Model, the Conservation Model, the Urban-Industrial Impact Model, the Diffusion Model, Schultz Model and the Induced Innovation Model. The Frontier or Area Expansion Model is relevant in land abundant countries where public investments in transportation and rural infrastructure, rather than yield increasing innovations, have been major sources of agricultural growth. The pursuit of the Frontier Model has led to the destruction of tropical rainforests and the possible consequence of global warming that raise the questions whether continuous area expansion represents a cheap way of expanding agricultural output. The growing environmental concern therefore led to the development of Conservation Model. The model emphasized the evolution of a sequence of increasingly complex land and labour intensive cropping systems, the production and use of organic manures and labour intensive capital formation in the form of drainage, irrigation and other physical facilities to more effectively utilize land and water resources. The model is relevant in many countries such as Somalia, Botswana, Chad and Mali where extensive pastoral grazing is practiced with few external inputs. However, the historical records reveal that these low-input models are capable of producing agricultural growth of only around one percent per year. The major challenge faced by this model is the need to develop technologies that can generate higher
rates of agricultural growth in order to meet the increasing demands for agricultural products resulting from population and income growth.

The Urban-Industrial Impact Model was first of all given by Thunen (1826). The rationale of Urban-Industrial Impact Model was to develop more effective input and product markets in areas of rapid urban-industrial development. Industrial development stimulate agricultural development by expanding the demand for farm products, supplying the industrial inputs needed to improve agricultural productivity and drawing away surplus labour from agriculture. The policy implications of the Urban-Industrial Impact Model appeared to be most relevant for less developed regions of highly industrialized countries or lagging regions of the more rapidly growing less developed countries. The Diffusion Model rests on the empirical observation of substantial differences in land and labour productivity among farmers and regions. The route to agricultural development in the model was through more effective dissemination of technical knowledge and a narrowing of the productivity differences among farmers and among regions. The Diffusion Model provided the major intellectual foundation of much of the research and extension effort in farm management and production economics. During 1960s, the limitations of the Diffusion Model as a foundation for the design of agricultural development policies became increasingly apparent as technical assistance and rural development programs, based explicitly or implicitly on this model, failed to generate either rapid modernization of traditional farms and communities or rapid growth in agricultural output.

The most influential thesis on transformation was put forth by Schultz (1964). He referred backward agriculture as traditional agriculture. The traditional agriculture was further referred as efficient but poor due to limited technical and economic opportunities. According to him, modernization of a traditional agriculture requires that the farmers must be provided with opportunities to invest in factors which incorporate the potentialities of science and technology along with public investment in human capital. He was probably the first to put emphasis on provision incentives to the farmers through subsidies, access to new and more productive factors of production and human resource development. The central idea of the Schultz thesis was that the profitability in the use of factors as the key to agricultural transformation for the farmers trapped in a traditional agriculture. The agricultural development policy in the Schultz formulation had two principal emphases: one concerned with the quality and availability of the non-human factors, and the other with the development of the abilities of the traditional farm people. He strongly argued for the need of
the policies and programs for the provision of the non-human factors emphasized on research, science and technology and a system of distribution of factors that would make the profitable factors accessible to farmers. For long term sustainable technological transformation, Schultz emphasized on initiation of the programs and policies for the improvement of human abilities centered on education, training, extension services and investment in human agents through formal and informal systems.

Schultz Model is incomplete as a theory of agricultural development. Typically, education and research are public goods not traded through the marketplace. The mechanism by which resources are allocated among education, research and other public and private sector economic activities was not fully incorporated into the model. It did not explain how economic conditions induce the development and adoption of an efficient set of technologies for a particular society. Neither, it attempted to specify the processes by which input and product price relationships induce investment in research in a direction consistent with a nation’s particular resource endowments. The model also ignored the role of institutions in the development process, (Hayami and Ruttan, 1985).

The limitations of Schultz Model, led Hayami and Ruttan (1985) to develop an Induced Innovation Model of agricultural development. They emphasized that the impulses for technical and institutional changes are endogenous to the system. Their model is based on the notion that countries can pursue alternative paths of technical change and productivity growth in agriculture. The changes in relative factor prices, reflecting changes in relative factor scarcities, play a determining role in guiding the search for new agricultural technologies and institutions. Technology can be developed to facilitate the substitution of relatively abundant hence cheap factor for relatively scarce expensive factors of production. For example, the constraints imposed on agricultural development by an inelastic supply of land in economies such as Japan and Taiwan can be offset by the development of high yielding crop varieties designed to facilitate the substitution of fertilizer for land. The constraints imposed by an inelastic supply of labour in countries like United States, Canada and Australia can be offset by technical advances leading to the substitution of animal and human labour with machinery. Hayami and Ruttan (1985) argued that due to differences in relative factor prices, Japan and United States followed different technological paths but achieved the same long term compound rate of agricultural growth of 1.6 percent per annum over the 1880-1980 period. The classical problem of resource allocation, which was rejected as an adequate basis for agricultural productivity and output growth in the Schultz Model, was treated as central to
the agricultural development process. Under conditions of static technology, improvements in resource allocation represent a weak source of economic growth. The efficient allocation of resources to open up new sources of growth is essential to the agricultural development process. For the induced innovation mechanism to guide technological change along an efficient path, two key conditions must be met. First, the changes in factor prices must reflect changes in relative factor scarcities. Second, the researchers in both the private and the public sectors must adjust their research programs in response to changes in factor prices. A strategic implication of the model was that different nations can pursue different technological paths in response to differences or changes in relative resource endowments and factors prices over time. But to this, the countries need well functioning product and factor markets to signal resource scarcities and a set of incentives that will induce researchers to respond to those scarcities. Hayami and Ruttan’s (1985), concept of induced institutional innovation states that as relative price change, incentives are created for certain groups in society to push for institutional changes that would allow the groups to benefit from the changing factor prices. For example, growth in the labour force may lead to pressures to change the institutions governing remuneration of agricultural labour from a fixed share of the harvest to a daily wage. The theory also focused on the factors affecting the supply of and demand for such institutional innovations.

1.4. Agricultural development in India: Experience of five decades

Agricultural development in post-independent India took place in three distinct phases. These are (i) Pre-Green Revolution phase (1947-1965), (ii) Green Revolution phase (1966-1990), and (iii) Reform phase (1991 onwards).

The first phase of agricultural development began after independence. From recording of dismal performance of less than one percent annual growth over half a century (1901-1947), agriculture in independent India rebounded and began to grow at more than 3 percent per annum (Bhalla and Singh, 2001). This had happened despite serious setback due to partition of the country in 1947 and transfer of fertile and irrigated land to Pakistan. Upon the serious food crisis during late 1950s, the government invited the Ford Foundation team to suggest the initiatives to resolves the crises. Ten point’s programmes recommended by the team of experts laid the foundation for modernisation of Indian agriculture. Rather than thinly spreading resources in a vast country like India, the team recommended intensive efforts in limited areas. Where, besides using modern inputs, appropriate price incentives were
recommended to be created for the farmers. Consequently, the recommended programme was initially started in the form of ‘Intensive Agriculture District Programme’ (IADP) in selected 15 districts in the country in 1960. The success of the IADP led to its expansion in the broader areas in the form of ‘Intensive Agriculture Area Programme’. Besides the intensification programme, many other policy initiatives were also undertaken during this period that contributed immensely in preparing a fertile ground for subsequent (Green) revolution in Indian agriculture. These includes: (i) expansion of surface irrigation facilities through investment in multi-purpose irrigation projects (like Bhakra Dam), (ii) land reforms including abolition of intermediary absentee landlordism (Zamindari System) and providing the land to the tillers, protection of tenant farmers through tenancy reforms (fixing land rents, providing security to land tenure and ownership rights under certain conditions), redistribution of land among small and landless agriculture workers by putting ceiling on land holdings and consolidation of scattered land holdings, (iii), setting up of Agriculture and Rural Development Cooperatives (ARDC) in (RBI) for supply of institutional agricultural credit, (iv) setting up of the ‘Agriculture Price Commission’ for recommending government the minimum support prices, (v) establishment of Food Corporation of India for implementing the minimum price support, (vi) Community Development Programme for dissemination of scientific knowledge at the village level and (vii) strengthening and establishment of agriculture R&D system by opening up agricultural universities in major states.

However the adverse weather conditions during the early 1960s and two wars in 1962 and 1965 with China and Pakistan resulted in aggravating the agriculture crisis and food insecurity in the country that attained serious dimension in 1985 when country begin to be labelled as ‘ship to mouth’ economy.

Learning a lesson from very successful experiment of agricultural transformation in Mexico, the Government of India invited Dr Norman Borlaug, the father of new HYV technology to India and suggest the ways and means to implement the same in the country. The field trail of the Mexican variety of wheat developed by him proved highly successful in Indian conditions. Subsequently, India imported the HYV seeds from Mexico and chemical fertilizers and other plant protection material from other countries. The spectacular results of the new HYV seed-chemical fertilizer-irrigation resulted in remarkable improvement in wheat yield and wheat production in the country, which began to be popularly known as the ‘Green Revolution’ in Indian agriculture. Phenomenal expansion of institutional credit upon
strengthening of cooperative credit, nationalisation of 14 private sector banks and earmarking 18 percent credit for agriculture sector under purity lending scheme, contributed immensely for diffusion of new technology and its adoption by small and marginal farmers, who otherwise would not have benefitted from new developments. The breakthrough in wheat yield was followed by similar technological developments in rice production upon importing of HYV rice seed developed by International Rice Research Institute, Manila, Philippines. Besides new technology and credit, many new institutions were established for making available good quality seeds and other modern inputs to agriculture as well as for phenomenal expansion of rural infrastructure, including electrification for irrigation purposes, rural road network and other agricultural markets. In the beginning, the fruits of new technology were confined to the selected regions in Punjab, Haryana and western Uttar Pradesh in the north and some coastal districts in the southern India only (Bhalla and Singh, 2001). However, the new technology made big intrusion in the eastern and central Indian states during 1980s. The green revolution technology matured during 1980s and its benefits were widespread across length and breadth of the country. Furthermore, during 1980s, Indian agriculture witnessed diversification in agriculture that resulted in fast growth in non foodgrains output like milk, fishery, poultry, vegetables, fruits, etc. which accelerated growth in agricultural Gross Domestic Product during 1980s (Chand, 2003). The hallmark of the green revolution was that by the late 1970s, India achieved self-reliance in the foodgrains production, overcoming the painful memories of the agrarian crisis of the 1960s (Venkateswarlu, 2008). There was considerable increase in subsidies and support to agriculture sector during this period, while public sector spending in agriculture for infrastructure development started showing decline in real term but investment by farmers kept on moving on a rising trend (Mishra and Chand, 1995; Chand, 2001). However, it is widely known that the impact of green revolution varies widely across different regions of the country. There was increase in disparities at the regional, district and state level due to differences in natural and physical resource endowments, infrastructure development including marketing opportunities and institutional setup, within which the farming community operates.

The third phase, post reform period, began from 1991 after the initiation of economic reform process in the Indian economy. The process of economic reforms was initiated to liberalize the economy and integrate it with the world economy. The 1991 reforms focused mainly on the industrial sector, with dismantling of industrial licensing, removal of import licensing, tariff reductions and relaxation of rules for foreign investment. Agriculture was bypassed in
the terms of direct reforms, except with trade liberalization and relaxation of some controls on export of agricultural commodities. However, policies like currency devaluation, reduction in industrial protection and a shift towards marked determined exchange rates affected agriculture indirectly (Ahluwalia, 2000). The reforms also weakened the institutional support structures in agriculture and the protection to agriculture from predatory imports. Liberalization policies led to substantial decline in public investment in agriculture and hence deceleration in public sector capital formation in agriculture. Financial sector reforms resulted in significant decline in the priority sector credit lending to the agriculture sector. The agriculture sector in India failed to derive the expected benefits from liberalization. As a matter of fact, when compared with the immediate pre-liberalization period (1980-1990) agricultural growth in India recorded a visible deceleration during the post-liberalization period (1990s), (Bhalla and Singh, 2009). More specifically, this deceleration in agriculture during 1990s was attributed to the reduction in and/or stagnation of public expenditure on agricultural infrastructure, defunct extension services and biased economic reforms (Thamarajakshi, 1999; Balakrishnan, 2000; Dev, 2000; Vyas, 2001; Rao, 2003; Kannan and Sundaram, 2011). The only positive impact of the reforms was improvement in terms of trade for agriculture and opening of some opportunities such as benefits from trade and specialization, widening choices in new technology including bio-technology, increase in private investment in irrigation and marketing infrastructure like storage and transport (Ahluwalia, 2000; Dev, 2009).

Besides, economic liberalization during this phase, signing of the Uruguay round of General Agreement on Tariffs and Trade (GATT) in 1994 and subsequent implementation of the same under World Trade Organization (WTO) were initiated. The Agreement on Agriculture (AOA) under World Trade Organization aimed at reduction in trade distorting policies on domestic and export subsidies, replacing quantitative restrictions on trade with tariff and reduction in tariffs to encourage more and free trade. It was projected that trade liberalization and implementation of Agreement on Agriculture would bring large benefits to the developing countries. It was a step towards reform in agricultural trade expecting that though most of the Indian agricultural products enjoy comparative advantage, signing of World Trade Organization would further improve its competitive edge in international market (GOI, 1994). Institutions like WTO were considered essential for providing a level playing field to developing countries in international market (Rao, 2001). Reduction of production and export subsidies and rolling back of non-tariff barriers by the developed countries in
compliance to the WTO requirements would provide welcome stimulus to agricultural exports from India, specifically exports of high value labour intensive agricultural and allied sector products (GOI, 1994; Bhalla 1995). Integration of domestic markets with the international markets was expected to improve the domestic terms of trade in favour of agriculture, reduce the distortions of domestic prices and inefficiency in allocation of resources. Consequently, it was hoped to boost production and productivity of Indian agriculture (Rao, 1994; Singh, 1995). On the contrary, some scholars feared that liberalisation of trade could destabilise the domestic prices (Chand and Jha, 2001). Serious doubts were also raised regarding the capabilities of the resource poor, subsistence and unorganised farmers to withstand the competitive environment of the modern markets dominated by the powerful organised groups (Rao, 1994). The post World Trade Organization trade liberalization helped India to achieve small increase in agricultural exports, whereas it resulted in sharp increase in imports of some commodities. The main reason for this adverse effect was unprecedented decline in international prices which was caused by the attempts by almost all the countries to push exports at the international level and declining public investment in agriculture, unabated degradation of natural resources, weakened support systems resulting from feeble financial positions of state governments, unresponsive research system and near breakdown of the agricultural extension services at the national level. Once again, a major step taken towards the agricultural development did not give the expected results and now the challenge to policy makers is how to protect Indian agriculture from the impending World Trade Organization threat, enhance the competitiveness of Indian farming and make a viable and self sustaining enterprise to improve and ensure livelihood security of the farmers.

The slowdown in agricultural sector is a matter of serious concern as it retards the overall growth in the economy like India, where little less than half of the population in the country still depends on agriculture for their livelihood (GOI, 2014). Moreover agriculture slow down may seriously impede the employment generation and poverty alleviation in India as there is almost one to one correspondence in agricultural growth and reduction of rural poverty (Mellor, 2000). Under these circumstances, higher agricultural growth is vital not only for ensuring food security at macro and micro levels in general and in agriculturally lagging states like Uttar Pradesh in particular.
1.5. Empirical evidence: A synoptic view

Though a comprehensive review of available literature on national and sub-national level of the study on the topic is to be undertaken in next chapter, yet a synoptic view of selected studies on the topic concerned at all India level in general and on the state of Uttar Pradesh in particular is presented here to get a brief overview of the available information on the topic. This is essential to identify the gaps and to provide rationale to the present study.

There are number of studies examining the agricultural performance at district level for the country as a whole. Brown (1971) was probably the first to undertake comprehensive district level study for the period 1956-57 to 1965-66. Thereafter, Gordon (1974) analyzed the association between agriculture output and sources of agriculture growth for the year 1960-61. Then, Bhalla and Alagh (1979) undertook district level study for the triennium ending 1962-65 to 1970-73, analyzing the level and growth of agriculture sector and also classified the districts into high, medium and low growth categories. Bhalla and Alagh (1979) study was further extended by a number of scholars: Dev (1985) extending to 1975-78, Bhalla and Tyagi (1989) to 1980-83, Bhalla and Singh (2001) to 1990-93, Bhalla and Singh (2010) to 2003-06 and recently Bhalla and Singh (2012) extended it to 2005-08. In addition to agriculture growth and development, sources of agriculture growth as well as district wise labour productivity was also examined in these studies. In addition, Singh (2007) carried out district level analysis for 581 districts for the triennium ending 1990-93 to 1999-2002. Chand, Garg and Pandey (2009) analyzed agriculture productivity and linkage of agricultural productivity with poverty for 551 districts for the period 2003-04 and 2004-05. Thereafter, Kumar and Jain (2013) analyzed the level of agricultural productivity, agriculture growth, sources of agricultural growth and instability in agriculture production at the district level (388 districts) for the period 1990-91 to 2007-08. These studies were carried out at the district level for the country as a whole. Moreover most of these district level studies are for initial and end triennium averages.

Goswami and Chaterjee (2010), Pandey and Reddy (2012), Raman and Kumari (2012), and Shafiquallah (2013) also carried out district level study in Uttar Pradesh, but these studies analyzed the level of agriculture development only and some of them examined linkages between agriculture productivity and poverty. There is no state level study for Uttar Pradesh to examine dynamics of growth and productivity at the district level that covered both pre and post reform period. The present study on five decades of agricultural performance at the district level in Uttar Pradesh is a modest attempt in this direction. In addition to analyzing agriculture growth and level of agriculture development, we also propose to analyze growth and development of agriculture workers productivity at the district level in Uttar Pradesh during 1960-61 to 2010-11.

1.6. Objectives

The main objectives of the present study are:

1. To analyze the temporal pattern of agricultural performance in Uttar Pradesh during different policy regimes (Pre-green revolution, initial phase of green revolution, mature phase of green revolution, initial post reform period and new millennium phase) over the last half a century (1960-61 to 2010-11).

2. To examine the spatial (district and region) pattern of agricultural performance (level of development, output growth and disparities) in Uttar Pradesh over 1960-61 to 2010-11 period.

3. To identify the sources and constraints of agricultural development at the district level in Uttar Pradesh.

1.7. Hypotheses

Given the theories and empirical evidence on the main objectives, we propose to test the following hypotheses in the subsequent chapters.

1. Temporal pattern
i) Changing policy regimes made significant impact on temporal variations in agricultural performance in Uttar Pradesh.
ii) Changing technological, institutional and market environment led to diversification of cropping pattern in the state from low productivity and low value coarse cereals, pulses and oilseeds towards more remunerative wheat, rice and horticulture crops.

2. **Spatial pattern**
   i) Given the wide regional disparities in natural and human resource endowments, growth and development of agriculture vary considerably across districts and regions in Uttar Pradesh.
   ii) Given the regional disparities, the temporal pattern during different policy regimes may vary considerably across regions and districts in Uttar Pradesh.

3. **Regional disparities**
   i) With the spread of new technology and policy initiatives for backward regions, we hypothesise the convergence of inter-district disparities in Uttar Pradesh.

4. **Sources of agricultural performance**
   i) Differences in physical and human resource endowments (land and human resources), use of modern technology (chemical and mechanical) and physical facilities (road, irrigation) are hypothesised to be responsible for inter-regional disparities in agricultural performance.
   ii) Agro-climatic conditions, such as rainfall, soil quality and other idiosyncratic features play an important role in inter-district differentials in agriculture development.

**1.8 Data and methodology**

**1.8 (i) Data sources**

To carry out the objective and test the proposed hypotheses, the present study planned to make use of three types of data sources. First, is the state level data on agriculture output for all crops grown in the state during 1960-2010 compiled by the Central Statistical Organisation (CSO) for all states in the country. Second, is the data set on area and production of different crops at the state and district level compiled by the Directorate of Economics and Statistics (DES), Ministry of Agriculture, Government of India. Third, is the
data on various inputs, infrastructural facilities, human resources and various agro-climatic indicators obtained from different individual agencies/ministries compiling information on these accounts. These are:

i) Fertilizer Association of India (FAI) for district wise data on chemical fertilizers consumed from 1960-2010.


iii) The Census of India information has been used for district wise number of agricultural workers and level of literacy in Uttar Pradesh from 1961 to 2011.

iv) The publication of Indian Metrological Department (IMD), Pune has been used for district wise rainfall in Uttar Pradesh for the study period.

v) The Agricultural Census Survey information is used to estimate the structure of land holdings in terms of district wise proportion of small and marginal farmers in Uttar Pradesh.

vi) Various publications of Ministry of Irrigation and Water Resources and Season and Crop Reports of Uttar Pradesh are used for compiling statistics on proportion of area under irrigation for the study period.

vii) Data on district wise road length has been obtained from Statistical Abstracts of Uttar Pradesh.

viii) The district wise poverty data has been taken from study by Chaudhuri and Gupta (2009).

Given these data sources, there was some missing information for some years and on some indicators. In that case, the gaps were filled by having data from Statistical Abstracts of Uttar Pradesh for various years, district wise Sankhyikiya Patrika (SP), published by Economics and Statistics Division (ESD) of Planning Department, Government of Uttar Pradesh and Chandlok (1990), India Database information.
1.8 (ii) Methodology

The research methodology followed to carry each of these objectives and to test the proposed hypotheses is to be explained at relevant places in subsequent chapters. However, a brief information on the same is as follows:

(i) **Coverage of districts**

The study proposes to examine various issues at three broad levels namely- for the state as a whole, for regions of Uttar Pradesh and for all districts in the state. Since the study propose to cover the period of last five decades from 1960-2010, therefore it covers districts which constitute combined state up to 2000 and bifurcated in the form of two states, Uttar Pradesh and Uttarakhand currently. For consistency of temporal data, we included all the district units in these two states. Over the study period, many new districts were created as the number of districts in the state increased from 54 to begin with (includes both plain and hill districts), in 1960 to 85 in 2010. When any new district is created, no effort has been made by the official agencies to create the past information on agricultural performance. Therefore, the only situation left was to club the newly created districts into their erstwhile parental unit. In many cases, a district was created by drawing area from two/three districts. Its area was therefore allocated in the same proportion. Following this procedure, the study propose to examine the performance of agriculture for 47 district units (including hills) from 1960-2010.

(ii) **Coverage of crops**

The state level analysis is based on the information on output for all crop sector for which consistent information was generated by Central Statistical Organisation (CSO). However, similar information for all crops is not compiled by any other designated official agency including Directorate of Economics and Statistics (DES), Ministry of Agriculture. The Directorate of Economics and Statistics, Ministry of Agriculture compiles district wise information for 35 main crops grown in the country on regular basis. Therefore, district wise analysis of agriculture production is based on 35 crop sector which covers almost 90 percent of the gross cropped area in the state. We jacked up the value output for 35 crop sector for the whole crop sector by assuming that the yield of the left over crops was same as the average yield of 35 crop sector. To estimate the value output of the total crop sector, we used the
constant 2010-11 prices which was taken from the implicit price of the National Accounts statistics for the relevant year.

(iii) Methodology

Agricultural performance at different levels is to be compared on three main accounts: (i) the compound average growth rate has been used to measure the growth performance of agriculture for different time periods to study the magnitude and direction of agricultural performance in Uttar Pradesh, (ii) the concept of land productivity is to be employed as an indicator of agriculture development in the state. The land productivity is defined as value output per unit of net sown area in that particular year for a particular geographical unit, (iii) for measurement of labour productivity and its growth, concept of labour productivity is defined as value output of the total crop sector per worker employed in agriculture during that particular year. The agriculture workers information includes both male and female workers as well as main and marginal workers employed in agriculture sector.

The changing temporal pattern of growth in area, production and yield is to be examined both by comparing simple average growth rates as well as by including slope dummy variables in the time trend growth equations.

The regional and inter-district disparities are to be examined following the two main approaches: first is by comparing the temporal inequalities in terms of indicator of inequality which includes- Gini coefficient, share of top to bottom quintile in production and ratio of top to bottom quintile in agriculture labour/land productivity. Besides these indicators, changes in inter-district disparities in agriculture development are also to be examined by testing for sigma convergence, beta unconditional, beta conditional and club convergence.

The role of various sources of agricultural performance is to be examined using tabular analysis, graphical analysis, bivariate analysis and multivariate regression approaches. In the later case, the Random Effect Panel Data and Fixed Effect Panel Data Models would be used on the pooled district data set for the years 1980-83, 1990-93, 2000-03 and 2008-11. The data for sixties and seventies are not to be included because of non-availability of consistent and reliable information on some variables. The Panel Data Models have been chosen specifically because of its known advantage over cross section and time series data and its ability to
control many district level attributes that are not included in the model but are significant determinants of the dependent event (Hsiao, 2003). The models used and their associated dimensions are to be discussed at the relevant place in the concerned chapter.

1.9. Organization of the thesis

Findings of the study are to be presented as follows:

Chapter 1: Introduction
Chapter 2: Review of Literature
Chapter 3: Agricultural Performance in Uttar Pradesh: Temporal Dynamics
Chapter 4: Pattern of Agricultural Growth in Uttar Pradesh: Variations Across Districts and Agro-Economic Regions
Chapter 5: Dynamics of Agricultural Development in Uttar Pradesh: Variations Across Districts and Agro-Economic Regions
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