CHAPTER – 1

INTRODUCTION:
ROLE OF AGRICULTURAL PRODUCTIVITY IN ECONOMIC DEVELOPMENT

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1.1 Introduction:

Agriculture plays an important role in both a developed and underdeveloped country. It plays a significant role in the economic development of a nation. Agricultural sector forms the base for the development of any economy.

Agricultural sector is considered as the primary sector in almost all the underdeveloped countries of the world. It is considered as the primary sector because development of an economy to a large extent depends upon the development of this sector. In most countries it is called the key sector of development which, if developed properly, may open avenues of development of other sectors of the country. The problem of development is not new to human society. Their experiences reveal the importance of agriculture.

The main difference between underdeveloped and developing countries lies in the existence of surplus labour in agriculture. The countries which successfully utilise these surplus labours succeed in their effort at economic development (Lewis, 1958). Agriculture not only supplies food and shelters to the majority of the people of underdeveloped countries, but also provides the necessary means for the industrial development of the country.

Agricultural sector forms the base for the development of any economy. Industrialization of an economy might be an ultimate goal, but agricultural sector provides the necessary basic network for Smooth Industrialization. Immediate increase in the level of agricultural productivity and income is not only a social necessity but paves the way for industrial orientation and healthy environment needed for industrial development.

Agriculture plays a most strategic role from several points of view. The importance of agricultural Sectors lies in various fields of the economy. It is a source of providing food articles to feed people. It has a share in the country's export and is the source of raw material for various industries, such as, jute, textile and sugar, etc. Further, a major part of the country's population and labour force affect the country’s livelihood and earnings.
The role of agriculture in the economic development of any country, rich or poor, is borne out by the fact that it is the primary sector of the economy, which provides the basic ingredients necessary for the existence of mankind and also provides most of the raw materials which, when transformed into finished products, serve as the basic necessities of the human being. Agriculture plays the most strategic role on following grounds i) Agriculture supplies food and provides many of the raw materials for industries. ii) Agriculture is the supplier of production factors such as capital and labour. iii) Agriculture must generate export surpluses in order to earn the foreign exchange. iv) Agriculture increases national income.

For the survival and development of the increasing population, adequate amount of food grains and other non-food items have to be produced and procured. However, there has been a war between the rate of production and the rate of consumption. Besides, with an increasing purchasing power in the hands of the people, the structure of consumption keeps on changing. However, the target is food self-sufficiency.

Analysing the role of agriculture, economic historians observed that there are no cases of successful development of a major country, where agricultural prosperity did not accompany industrial development.

According to Rostow (1962), agriculture plays a distinct, but multiple roles in the transitional process of the “take off” stage to a self-sustained growth of an economy.

Dutta (1996) argued that industrialization is possible only when agriculture has reached a high level prosperity so as to create self-sufficiency in food, to create a surplus for capital formation and to increase the demand for secondary product. It is also observed that at the head of all sciences and arts and at the head of civilization, progress stands not on the militarization of science that kills; not on commerce, the art that accumulates; but rather progress depends on agriculture which is the mother of all industries and the maintainer of human life.
Therefore, agriculture cannot only be regarded as merely an occupation or business proposition for the vast majority of people, but it is also a tradition, a way of life, which for centuries has shaped their thoughts, outlooks and culture (Dora L. Costa, Lerman Zvi, Biton David (2003))

1.2 Importance of Agriculture in Economic Development:

For the survival and development of the increasing population, adequate amount of food grains and other non-food-items have to be produced and procured. However, there has been war a between the rate of production and the rate of consumption. Besides, with the increasing purchasing power in the hands of the people, the structure of consumption keeps on changing. However, the target food self-sufficiency now largely replaced by the Food Security implies (a) Adequate Production (b) Enough purchasing power and (c) Efficient mechanism of delivery. Agriculture has become science-based and knowledge-linked. Agriculture has become an enterprise. It is no longer a mere way of life for survival. The concern before us is to change the whole character of performance based on scientific principles and economic laws.

Agricultural contributions to development:

The discussion of economic contribution of agriculture is normally made with reference to

(a) Product contribution
(b) Exchange contribution
(c) Market contribution

(a) Product Contribution:

One can look at product-contribution of agriculture from four angles. Agriculture does ‘Product contributions’ (1) by supplying food stuffs and raw materials to other expanding sectors in the economy, (2) by providing an ‘Investible surplus’ of savings to support investment in another sector, (3) by selling for cash a ‘marketable surplus’ that will raise the demand of the rural population for products of other sector and (4) by reducing foreign-exchange
constraint through exports or by saving foreign exchange through import substitution.

(b) Market Contribution:

A sector makes a contribution to an economy when it provides opportunities for other sectors to emerge or for the economy as a whole to participate in the trade and economic flows. We may call this contribution as the market type, because the sector provides such opportunities by offering part of its product on domestic and on foreign markets in exchange for goods produced by the other sectors. Then, agriculture makes a market contribution to economic growth by (1) purchasing some production items from other sectors at home or abroad; (2) selling some of its products, not only to pay for the purchases but also to purchase consumer goods from other sectors or from abroad or to dispose of the product in any other sector than consumption within the sector. In all these ways, agriculture makes it feasible for other sectors to emerge and grow and trade flows make it feasible for the agriculture sector to operate more efficiently as a producing unit and use its product more effectively as a consuming unit.

(c) The Factor Contribution:

The ‘factor contribution’ occurs when there is a transfer or loan of resources from the given sector to others. Then if agriculture itself grows, it makes a product contribution. If it trades with others, it renders a market contribution. It transfers resources to other sectors. These resources being productive factors make factor contribution.

In this conventional interpretation, the development process is viewed as structural transformation that takes place in an economy in which agricultural employment and output dominate.

Of course, there are practical difficulties experienced by industrial sector.

1.3 Place of Agriculture in Indian Economy:

Agriculture plays an important role in the Indian Economy. It is the principal source of livelihood for majority of the population in the country. It
provides huge amount of wage goods required by non-agriculture sectors and most of the raw materials for the industrial sector.

Agriculture provides not only food and raw-materials but also employment opportunities to a very large proportion of the population in India. The share of agriculture in total employment slightly declined from 60% in 2001 to 50% in 2011. (Census 2011)

The major portion of the total population is living in the rural areas. Agriculture is the main income generating factor in rural India (Sing, 1981).

Thus, the development of rural areas should receive topmost priority and it requires obviously the development of agriculture. Thus, the fate of Indian people largely depends on agriculture.

Though the contribution of Agriculture and Allied Sector in the Gross Domestic Product (GDP) of the country has been steadily declining over the years and has reached about 18 percent in 2010-11, it still remains the principal source of livelihood for more than 50 percent of the nation’s population (Census-2011).

India possesses only 11 percent of world’s arable land but it has to feed about 18 percent of the world population. To provide food and livelihood security, the Government has been making all out efforts through various schemes to improve the agricultural productivity.

Agriculture is a critical sector of the Indian economy. Though its contribution to the overall Gross Domestic Product (GDP) of the country has fallen from about 30 percent in 2000-01 to less than 19 percent in 2010-11, a trend that is expected in the development process of any economy, agriculture yet forms the backbone of development. An average Indian still spends almost half of his/her total expenditure on food.

Being both a source of livelihood and food security for a vast majority of low income, poor and vulnerable sections of society, its performance assumes greater significance in view of the proposed National Food Security Bill and the ongoing Mahatma Gandhi National Rural Employment Guarantee Act
(MGNREGA) scheme. The experience from BRICS countries indicates that a one percentage growth in agriculture is at least two to three times more effective in reducing poverty than the same growth emanating from non-agriculture sectors. Given that India is still home to the largest number of poor and malnourished people in the world, a higher priority to agriculture will achieve the goals of reducing poverty and malnutrition as well as of inclusive growth.

Since agriculture forms the resource base for a number of agro-based industries and agro-services, it would be more meaningful to view agriculture not as farming alone but as a holistic value chain, which includes farming, wholesaling, warehousing (including logistics), processing, and retailing. Further, it may be noted that in the last two Five Year Plans, it is clearly mentioned that for the economy to grow at 9 per cent, it is important that agriculture should grow at least by 4 per cent per annum.

Achieving an 8-9 percent rate of growth in overall GDP may not deliver much in terms of poverty reduction unless agricultural growth accelerates. At the same time ‘Growth with Inclusiveness’ can be achieved only when agriculture growth accelerates and is also widely shared amongst people and regions of the country. All these factors point to just one thing, that agriculture has to be kept at the centre of any reform agenda or planning process, in order to make a significant dent on poverty and malnutrition, and to ensure long-term food security for the people.

Agriculture has shaped the thoughts and feelings of the Indian people from centuries back. Agriculture supplies food to the growing number of our people and provides scope of employment, supplies raw-materials for industrial development. It expands the capacity to absorb the monetary flow of industrial investment, absorbs to a large extent the labour force of the country and above all helps in earning foreign exchange through exports.

Agriculture is the only major source of food supply for a huge size of population and also for the millions of cattle in the country. In the recent years India has become more or less self-sufficient in respect of food supply and the import of food grains has been very small. The food grains production in 2004-05
accounts for 198.36 million tonnes, which is considered to be more than self-sufficiency level and the production further rose to 244.78 million tonnes in 2010-11. Further, Agriculture provides larger employment opportunities to the people in India. It absorbs a very high proportion of working population. The share of agriculture in total employment slightly declined from 60% in 2000-01 to 50% in 2010-11. Agriculture also contributes a major portion of the Indian national income. According to the national income committee and central statistical organisation (C.S.O.) in 2000-01, 35.7 percent of national income is contributed by agriculture. But in 2009-10 its contribution declined by 25 percent.

1.4 Share of Agriculture in Gross Domestic Product (GDP):

Agricultural sector plays a very important role in the economy of India. Two important facts must be emphasized here, firstly, agriculture contributes even now a major share of the national income in India, secondly, the share of agriculture in national income has been coming down continuously and the shares of the manufacturing and service sectors are decreasing. Agriculture dominates the economy to such an extent that a very high proportion of working population in India is engaged in agriculture.

Broadly speaking, the proportion of agricultural goods which are exported may amount to 50% of our export. Agriculture is the main support for India’s transport system and manufactures with agriculture content contribute extra 20% or so, and the total comes to 70% of India’s exports. This has a great importance for the economic development of the country. Agriculture is the main support for India’s transport system i.e. road, railways etc. Indian agriculture has been the course of supply of raw materials to leading industries like cotton and jute textile, sugar, etc.

Figures provided by the Central Statistical Organization (CSO) reveals that between 1950-51 to 1960-61 the share of agriculture in G.D.P. has been in the range of 55 to 52% though it was declining but as it gathered momentum, the share of agriculture indicated a sharp decline and reached a level of 26% in 2000-2001.
The percentage share of agriculture & allied sectors in GDP has been declining gradually with the passing of years. From 19 per cent in 2004-05, the percentage share of agriculture & allied sectors in GDP dropped to 18.3 per cent in 2005-06 and then to 17.4 per cent in 2006-07. It further dropped to 16.8 per cent in 2007-08 and 15.8 per cent in 2009-10.

Share of agriculture in the Gross Domestic Product (GDP) has dropped by nearly 5 per cent in the last eight years to 14 per cent, due to higher growth in other sectors. Agriculture & Allied sectors which used to contribute 19 per cent of GDP in 2004-05 has come down to 14 per cent in 2011-12 at 2004-05 prices, according to the government data. The percentage has been declining gradually with the passing of years. From 19 per cent in 2004-05, the percentage share of agriculture & allied sectors in GDP dropped to 18.3 per cent in 2005-06 and then to 17.4 per cent in 2006-07. It further dropped to 16.8 per cent in 2007-08 and 15.8 per cent in 2008-09 before reaching 14 per cent in 2011-12, the data showed.

The decline is on account of comparatively higher growth in GDP of non-agriculture sectors, official sources said. But, capital investment in the sector has shown improvement. As per official figures, Gross Capital Formation (GCF) investment in agriculture sector (at 2004-05 prices) has increased from Rs. 69,148 crore in 2004-05 to Rs 1,30,907 crore in 2010-11.

Besides, the agriculture sector has shown an average growth rate of 3.3 per cent annually in the Eleventh Five Year Plan period ending in March 31, 2012 as compared to 2.4 per cent per annum during the Tenth Plan. Food grain production has also shown an increase from 217.28 million tonnes in 2006-07 to 257.44 million tonnes in 2011-12, it said. As per UN's body Food and Agriculture Organisation (FAO), India accounted for 2.3 per cent share in the world's total land area and 17.5 per cent of the world’s population.

1.5 Contribution of Agriculture to Net State Domestic Product (NSDP) (At Current Prices) from 2000-01 to 2009-10:

The agriculture sector occupies a very important place in the economy of the state. Agriculture forms the backbone of the state’s economy. Agriculture is the main source of livelihood of majority of the population of the state.
According to 2001 census, about 69 percent of the total working force is being engaged in agriculture and allied activities. The contribution of agricultural sector in Net State Domestic Product (NSDP) of Assam at constant (1993-94) prices was 34.79 percent and at current prices was 35.09 percent in 2000-2001.

Development of agricultural sector assumes great importance for an economy like ours as nearly 53 percent of the state’s total working force is by and large engaged in agricultural activities. The contribution of agriculture to Net State Domestic Product (NSDP) at current prices and constant prices works out to 30.09 percent and 28.91 percent respectively in 2004-05.

**TABLE – 1.1**

**Contribution of Agriculture to Net State Domestic Product:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount(In Lakh)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-01</td>
<td>973507.00</td>
<td>34.66%</td>
</tr>
<tr>
<td>2001-02</td>
<td>1017538.00</td>
<td>33.17%</td>
</tr>
<tr>
<td>2002-03</td>
<td>1054989.00</td>
<td>31.48%</td>
</tr>
<tr>
<td>2003-04</td>
<td>1094156.00</td>
<td>30.65%</td>
</tr>
<tr>
<td>2004-05</td>
<td>1162297.00</td>
<td>30.09%</td>
</tr>
<tr>
<td>2005-06</td>
<td>1206609.00</td>
<td>28.84%</td>
</tr>
<tr>
<td>2006-07</td>
<td>1316962.00</td>
<td>27.87%</td>
</tr>
<tr>
<td>2007-08</td>
<td>1437907.00</td>
<td>26.20%</td>
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<td>2008-09</td>
<td>1648458.00</td>
<td>26.09%</td>
</tr>
<tr>
<td>2009-10</td>
<td>1947109.00</td>
<td>25.26%</td>
</tr>
</tbody>
</table>

Sources: 1. Glimpses of Agriculture 2006
2. Assam Agriculture 2008 breaking new grounds …
3. Assam Agriculture 2010…reaping a rich harvest
   Department of Agriculture, Assam
In 2000-01 the contribution of agriculture to Net State Domestic Product (NSDP) was 34.66% which is decreased to 33.17% in 2001-02. The contribution was 33.17% in 2001-02 and 31.48% in 2002-03. The contribution was again declined to 30.65% in 2003-04 and 30.09% in 2004-05. The contribution was 28.84% in 2005-06 which was declined to 26.20 in 2008-09 and it remained almost the same i.e. 25.26 in 2009-10.

Although surplus production of Rice, food grains and vegetables has been observed during the last few years, there was no concomitant rise in the contributions of the agriculture sector to the NSDP. Rather decreasing trend in contribution has been observed since 2000-2001. The probable reasons for such a decreasing trend are:

a) The prices of agricultural commodities have not shown any appreciable increase during the last few years and

(b) Whatever contribution made by surplus production was over shadowed by the rising contributions of secondary and tertiary sector to NSDP.

1.6 Agriculture Development in India:

Since India is the second largest populous country in the world, there is a great need to concentrate on the agricultural production to ensure food security to the large population. If agriculture is neglected, it is not possible to import required food grains from abroad because India is suffering from inadequate balance of payments. Achieving self-sufficiency in agricultural production is necessary for the agrarian economies with large populations like India.

The Government of India introduced the High Yielding Varieties (HYV) programme during the agricultural year 1966-67 with the main objective of covering maximum area under High Yielding Varieties of five crops viz., Rice, Wheat, Jowar, Bajra and Maize to increase production in order to achieve self-sufficiency in food grains. The introduction of High Yielding Varieties (HYV) programme led to higher productivity in food grains and this achievement is named as “Green Revolution” in the history of Indian Agriculture. The impact of Green Revolution on Indian agriculture resulted in the achievement of self-
sufficiency in food grains by the year 1976. However, Indian Agriculture is backward compared to other developed countries, especially in terms of productivity. (Productivity of Rice in India is 2240 kg. per hectare during 2010-11 whereas in Egypt it is 9731 kg. per hectare during 2008-09.) It indicates that India is backward in adopting modern agricultural technologies, developing required infrastructure and institutions for the development of agricultural sector.

After observing this situation, the Government of India established the Regional Rural Banks for providing financial facilities to the farmers to purchase and use modern agricultural inputs such as fertilizers, pesticides and irrigation pump sets for development of productivity of crops in their fields.

The central government established “Cotton Technology Development Mission (1978) and six private banks were nationalized in the year of 1980. The introduction of these facilities resulted in the higher production of food grains in the year 1981-82. This achievement was termed as the “Second Phase of Green Revolution” in the history of Indian agriculture.

The agriculture sector has performed impressively in terms of increasing productivity and intensity of cultivation. It is by no means a small achievement that the food grain availability per capita at country level has increased to high level over the last six decades, in the face of an assault of population pressure and declining per capita land availability. In the same period, irrigation availability has doubled and cropping intensity has increased significantly at the country level. This could be possible due to the cutting edge of science, coupled with fast adoption of technology by the farmers, and above all, the government decision to accord a high priority to agriculture by making large plan investments in infrastructure. As a result of technological developments and their effective dissemination, the total food grains production increased from 52 million tones to 236 million tones in between 1950-51 and 2007-08. Unlike in the past, crisis situations of drought or flood are now considerably well managed without any panic or large-scale imports. On the contrary, India faced successfully the worst drought of the century in the year 1987-88 which speaks of the resilience of Indian agriculture.
During the post-green revolution period, area under major cereal crops would ordinarily be changing substantially from year to year. The major technological improvement in agriculture sector is accompanied by an upward trend, both in its area and yield. Factors promoting growth of agriculture are usually the factors bringing about change in the crop composition of agriculture.

An important dimension of agricultural growth is the spatial variations which is very relevant in a vast country like India, giving a wide range of crop-soil-weather conditions. It is observed that the states recording above national average annual growth in food grain output were predominantly Punjab, Madhya Pradesh, Bihar, Haryana, Uttar Pradesh and West Bengal. The states of Gujarat, Kerala and Maharashtra had witnessed negative rates of growth in 1980s as compared to the preceding decade 1970s. While the rate of total food grain output for the country as a whole has increased from 2.31 per cent (1967-68 to 1977-78) to 2.68 per cent (1977-78 to 1988-89). The considerable year to year variations in food grain output occur on account of inherently adverse agro-climatic situation persisting in certain areas of the country.

The post-green revolution period till the end of 1980s witnessed reliance on high productivity regions and productivity augmenting techniques, which were often short-term resource exploitation measures leading to instances of water-logging problem, soils and other resource related problems. Growth in agriculture would, thus, have to be achieved through the adoption of a disaggregated approach which gives due attention to the inherent differences of environment.

Even though self-sufficiency of food production has been achieved, the population of India still lacks access to balanced food, particularly in backward regions of the country. It is a matter of grave concern that even though cereal production has kept pace with the increasing requirements and average per capita intakes of cereals have remained satisfactory, there has been a fall in the per capita consumption of pulses. This is because the Government of India neglected many backward regions and non-cereal crops for development during the green revolution period.
The Green Revolution was successful only in the regions and states where there are ample irrigation sources and fertile lands. It was not beneficial in the regions and states with poor irrigation sources and dominated dry land agriculture or rain fed agriculture. Hence, it can be observed that the Green Revolution has developed disparities among regions, crops and sections of people.

After independence, the per capita availability of protein food (pulses) and pets (oil food) declined continuously. As a result, nutrition food crisis occurred in the country. To get rid of the problem the Government of India established the “Oilseeds & Pulses Technology Mission” in the year 1986. Similarly another attempt is also made to utilize the ground water facility for agriculture development and stabilization, which was “Million Wells Programme” in the year 1988-89.

The new economic policy announced on July 24, 1991 has bypassed the agriculture sector in terms of direct reforms, except trade liberalization. The economic reforms provided relaxation of export controls over agricultural products. After the introduction of economic reforms the public investment has declined continuously in the agriculture sector and the subsidies also declined on agricultural inputs in the country. As a result agriculture became a costly activity. As a consequence, the farmer’s attitude changed towards commercial crops. With a more liberalized regime, Indian agricultural commodities, excluding oil seeds, have become more efficient exportable or more efficient import substitutes. Another objective of the National Agricultural Policies is ‘growth that is demand-driven and caters to domestic markets and maximizes benefits from exports of agricultural products in the face of challenges from economic liberalization and globalization’. Even after the implementation of 10th Five Year Plans, India has not reached the goal of ‘Balanced Regional Growth’ in Agriculture.

After the Green Revolution of the 1970s which enabled India to achieve self-sufficiency in food grains, agricultural growth has slowed - from 3.5 per cent in mid 1980s to 1990s to less than 2 per cent in mid 1990s to 2000s. Slow agricultural growth and the consequent widening of the gap between rural and urban incomes has become a major cause for concern. The Government of India is therefore placing high priority on reducing poverty by raising agricultural productivity.
1.7 Conceptual Framework:

Agriculture productivity is a very confusing concept in the field of agricultural economics. It has several dimensions and in fact is a very vide concept. It is however significantly different from mere agricultural production. Agricultural production means total produced amount in a particular area, in a particular period. It can be increased by increasing cultivated area and increasing labour inputs. But in an area which lacks such a scope of increasing production by increasing area, agricultural production may be incorporating the same plot of land and use of most modern inputs like HYV seeds, fertilizers etc. Thus agricultural productivity may be defined as the ratio of agricultural output collectively or individually.

Agricultural productivity or simply productivity is not, however, an absolute concept rather a relative concept. Sometimes it is considered as the overall efficiency with which the production system works while others define it as a ratio of output to resources expended separately or collectively, (Munir 1992). Mohammed Sofi defines agricultural productivity as the ratio of the index of total agricultural output to the index of total input used in farm production (Sofi 1984), K.K. Dewett (1996) explains agricultural productivity as “productivity expresses the varying relationship between agricultural output and one of the major inputs like land or labour or capital, other complementary factor remaining the same ……”. It may be borne in mind that productivity is a physical rather than a value concept.

This problem however gets special attention of many economists at the 23rd annual conference (1964) of the Indian society of agricultural economies. Some economists suggested that the yield per acre should be considered to indicate agricultural productivity.

A number of objections were raised against this view because it considered only land, which is just one factor of production, while other factors are also responsible and therefore, it was arbitrary to attribute productivity entirely to land and express it per acre of land. It was suggested, for instance, that productivity could also be measured in terms of per unit of labour and different
regions compared on that basis. Finally after a thorough discussion it was generally agreed that the yield per acre may be considered to represent the agricultural productivity in a particular region and that other factors of production are considered as the possible cause for the variation while comparing it with other regions.

Pandit (1965) expresses the significance of the term productivity in these words “productivity is defined in economics, as the output per unit of input ……….. the art of securing an increase in output from the same input or of getting the same output from a smaller input”. He further suggested that increase in productivity whether in industry or agriculture is generally the result of a more efficient use of some or all the factors of production, viz., land, labour and capital.

Sazon (1971) defines productivity as a physical relationship between output and input which gives rise to that output. According to Horring (1964), however, productivity in broad terms denotes the ratio of output to any or all associated inputs in real terms.

Though the term productivity is used widely, there are clear differences of opinion in defining it. Rao (1962) rightly commented that “productivity is a difficult theme, both conceptually and in terms of measurement and any definition that one adopts is bound to meet with some objections.” Balakrishna (1953) also pointed out that “productivity is an elusive concept; that does not lend itself either to a clear-cut definition or easy computation.” Acharya (1974) viewed the agricultural productivity in terms of yield per hectare of land cultivated. Bhattacharjee (1972) viewed the term productivity as the output per unit of input in farm business.

The concept of productivity was first used in the industrial sector to express overall efficiency, in the performance of industries. Here productivity means the physical volume of output attained per worker.

The productivity concept in the agricultural sector is equated to agricultural efficiency. Increase in agricultural production through increase in the
area under cultivation is not viewed as a mark of either efficiency or development, but it is only a growth in the classical sense. In the words of the eminent agricultural economist S.R. Sen, “if increase in production comes about mainly as a result of extension of average, it is generally accompanied by instability”.

Therefore, increase in farm output per unit of resources used is said to be necessary and it is in this context that the concept of productivity in agriculture is gaining importance.

It is more realistic, though in a narrow sense, that, “agricultural productivity” stands for “yield per acre of different crops”. For producing crop, cultivable land is an important and basic input, but the supply of land is comparatively fixed or inelastic. So, we are to depend on improving the productivity of land. It only means that output per unit of land must have to be increased; it is possible when maximum returns are obtained for different units like land, labour, capital, water, and fertilizer etc., applied to land. The sole thing or the key to agricultural productivity lies, therefore, on optimum utilization of the various inputs. V.K.R.V. Rao emphasizes that “productivity is a physical rather than a value concept and describes the changing relation between output and one of the major inputs like land, labour, and capital.”

There are several alternative techniques in measuring productivity. The simplest and most commonly used measure of productivity is to choose “net output (or net value added) in a sector, or in the economy, as numerator and the quantity of the three factors (land, labour, capital), as the denominator and obtain ratio of the former to one of the factors.” We then get a measure of average productivity of land, labour or capital.

It may be measured in terms of productivity per unit of input, viz. (a) productivity per unit of land (b) productivity per unit of labour and (c) productivity per unit of capital invested. Of these three methods, the first method is generally accepted as a proposition for measuring agricultural productivity; and it is defined as “yield per hectare of different crops.” But it may be argued that
land is not the single factor in measuring agricultural productivity. There are other factors like human labour and other inputs are equally responsible for agricultural productivity. So, it becomes necessary to look on the measures as per unit of labour or capital. If we look from the view point of total factors than there are two approaches in measuring total factor productivity. One is based on the exact index number approach and the other is based on production function or cost function approach.

Agricultural productivity, which means average yield per hectare, is affected by cropping pattern and cropping intensity. Cropping pattern is indicated by the share of different crops in the gross cropped area, which may undergo agricultural year change over time in response to change in economic, technological, or other environmental factors. Cropping intensity on the other hand is the total cropped area as the percentage of the net area sown gives a measure of land use efficiency or intensity of cropping which refers to the number of crops raised on a field during an agricultural year (Das, 1984).

Like all other economic terms, ‘productivity’ has also aroused many conflicting interpretations. Sometimes the term ‘productivity’ has also been used incorrectly or interchangeably with ‘production’. In reality, production refers to the volume of output in relation to resources expanded (Munir, 1992). It should be borne in mind that productivity is a physical rather than a value concept (Stamp, 1960). Some economists suggested that the yield per acre should be considered to indicate agricultural productivity. There are different concepts of productivity and different ways of measuring it where land, labour, and capital are taken as various aspects of agricultural productivity but special attention is given to land productivity. In fact, land productivity is the simplest but in some respects the most useful aspect of agricultural productivity (Munir, 1992).

Thus, diverse views appear in the definition of agricultural productivity. The chairman of the international commission on agriculture typology, Kostrowicki (1966) invited views on this problem by sending a questionnaire to over 100 scholars throughout the world, which embodied the following two questions.
1. What methods of measuring intensity of agriculture should be applied in typological studies of various orders?

2. What method, measures and indices should be used to define land, labour and capital productivity of agriculture in typological studies of various orders?

About fifty geographers from all over the world responded and suggested various approaches to the measurement of agricultural productivity and intensity. The chairman of the commission while evaluating the different views pointed out that a special study for testing various methods and techniques to be used in the studies of various scales were needed.

After summing up the above studies and definitions, it can be argued that agricultural productivity is the ratio of output to its factor inputs.

Thus land, labour and capital which are the essential factors of agricultural production become an important ingredient of agricultural productivity. Thus agricultural productivity comprises three components viz. land productivity, labour productivity and capital productivity. Land denotes the area with different natural attributes, labour represents all the human services other than decision making and capital denotes the non-labour resources employed by the former.

**Land Productivity:**

Amongst all the conventional factors (Land, labour and capital) land is viewed as the most important. The chief characteristics of land are that its supply unlike labour and capital is fixed. In areas of high density of population productivity of land is of utmost important. It closely indicates yields of crops in terms of output. In an area which experiences limited land resources, the primary way of raising production is to raise yield per unit of land. This however doesn’t mean only raising of yields of individual crops. It encompasses the whole output of a farm of country in relation to the total area of farmland. This may be raised also by changing the pattern of production towards more intensive systems of cultivation or towards higher value crops.
Labour productivity:

Productivity of land derives its significance from the primary importance in supplying food and determining the volume of production. The productivity of labour is of great significance in determining the incomes of agricultural labour. Labour productivity, however, is somewhat more complex than land productivity. It takes into account all sorts of labour that contributes to agricultural production, the labour that is used directly on the farm as well as that used indirectly off the farm in producing the material and services used on agricultural production (Dovrings-1966). The labour input may be expressed as the total number in the labour force or in order to take into account the intensity of labour as the number of man-hours worked in agriculture. Similarly the total agricultural output may be taken as the gross farm output or it may be taken as the value added by labour and other factors in the agricultural sector by the value of fertilizers, pesticides, fuels and other inputs from outside the agricultural sector which are subtracted from the value of the output in order to determine the net contribution of the agricultural sector.

Labour productivity in agriculture has two important aspects. First, it profoundly affects national prosperity i.e. the national income. Secondly, it principally determines the standard of living of the agricultural population (Yates-1960). Therefore, if any nation or region aims at achieving the first objective it needs to increase the agricultural productivity and if it intends to achieve the second objective, labourers may be paid more than the existing price permits.

Capital productivity:

Measurement of capital productivity is however more complicated. This is so because diversified capital is used in diversified ways in agricultural production. The important ways in which capital is used in agricultural production are such as, purchase of land, reclamation, drainage, farm building, mechanical power, machinery and equipments, livestocks, feeds, seeds, fertilizers, crop protection, chemicals etc. There are some items which have long term effects and some indirect effects and only some which have directly visible
effects in agricultural production. Therefore the problem is to identify what the
types of expenditure incurred are and in what proportion they are to be added for
calculating capital cost for determining capital productivity. Further the quality of
each type of capital also creates problem in identifying the degree of its effects to
agricultural production.

1.8 Agricultural Productivity and Economic Development:

Agriculture plays an important role in the economic development of the
country. The essential condition for the development of national economy is the
development of agriculture.

Agricultural productivity is the index upon which the entire agricultural
system depends. It is a measure, which indicates the primary role of agriculture in
the economic life of a nation. It is however significantly different from
agricultural production. While the later indicates total amount produced, the
former indicates the ratio between total output to its inputs used wholly or
separately.

The importance of agricultural productivity can hardly be over
emphasized. It plays a vital role in the economic development of a region. It can
be viewed as a measure of efficiency with which the agricultural system works
and hence variation in agricultural productivity reflects the variation in the use of
agricultural resources of any region. In areas where majority of the population is
engaged in agricultural activities, differences in agricultural productivity indicate
differences in economic progress. Thus agricultural productivity can be
considered as a major component of regional development (Munir, 1992).

The main difference between under developed and developing countries
lies in the existence of surplus labour in agriculture. The countries which
successfully utilise these surplus labours succeed in their effort at economic
development (Lewis, 1958).

Agriculture plays an important role in the economic development of the
country. The essential condition for the development of national economy is the
development of agriculture.
According to Nurkse (1962), the surplus population in agriculture should be removed and based in newly started industries. Similarly, Kuznets (1965) has rightly pointed out the opinion that in the case of successful development of major countries, a rise in agriculture productivity has either proceeded or accompanied industrial development. Japan’s experience in the initial stages of development proves this fact.

In areas where agricultural production cannot be possible through horizontal expansion of land, it is possible to increase production by increasing vertically, which closely indicates the increase of productivity by using more land area under HYV seeds, fertilizers and within the purview of such other modern ingredients of production.

Productivity may also be increased by using less input. But the former method has an edge over the later. Thus by increasing productivity total output may increase, the system which is gainfully applied in the present day area of high density of population. This is a net social gain, particularly for the highly populated areas of the country.

Historically it is true that no country has moved from chronic stagnation to take-off stage of economic development without first achieving a substantial gain in agricultural productivity.

In this respect, the industrialization and agricultural development need not be in conflict as is sometimes thought by many. In most of the developing economies agricultural sector is burdened with unlimited supply of manpower. This needs to be transferred to industrial sector and has to be provided with food, clothing etc. which require higher agricultural productivity, and higher marketable surplus. And there should be a continuous process of feed-back in a growing economic system.

In India, agriculture being the most important sector, the First Five Year Plan gave a high priority to agriculture and built up the essential infrastructure of major irrigation. Sustained development efforts have significantly reduced over the years the vulnerability of the agricultural sector to weather factors. Intensive
cultivation of land has made the country more or less self-sufficient in food in spite of population explosion.

Though the term productivity is used widely, yet there are clear differences of opinion in defining it. There are several alternative techniques in measuring productivity. The simplest and most commonly used measure of productivity is to choose net output in a sector or economy, as numerator and quantity of the three factors (land, labour and capital), as the denominator and obtain ratio of the former to one of the factors. We then get a measure of average productivity of land, labour or capital. In measuring agricultural productivity there are several problems. In the industrial sector the problems are not so acute. In the industrial sector, labourers are classified, and a record is kept for the accounting purpose. But in agriculture, such classification and records of labour inputs are still absent, or it may be said to be in an incipient stage. Due to this reason perhaps, agricultural sector prefers area of land, to labour unit as a measuring rod in computing productivity. Though in some cases soils are homogeneous, the inputs vary in quantity and quality from field to field, from crop to crop and from season to season. Again when crops vary, the heterogeneity of inputs becomes complex. Unlike in industries, a large part of output in agriculture is unexplained by inputs due to the dominance of weather, i.e. rainfall in different regions. Other measurement problems include prices of output, supply of factors including human factors and management or organization.

In this context, the question of land ownership pattern arises. The number of small holding and the incidence of fragmentation are increasing owing to increase in population and subdivision of land under the law of succession. Hence, the question arises how to improve the productivity per hectare as well as per capita and what can be done to induce increasingly large number of farm workers to shift to non-farm occupations.

We have already noted that the concept of productivity is of considerable importance as productivity is an index of economic welfare. It is more important than production because the differences in the economic conditions of advanced
and underdeveloped countries are more due to the differences in productivity among them rather than in their volumes of output.

To sum up, in a country like our India, whose population density is high and extensive cultivation is hindered by several unavoidable factors, agrarian revolution has to depend almost exclusively on improvements in productivity.

In this context, not only quantitative increase in productivity, but also the quality aspect must be remembered.

In most of the developing economies, agricultural sector is burdened with unlimited supply of manpower. It is said that “it has to release manpower for industrialization. For such labour, transferred to the industrial sector, agriculture should also provide food, clothing and our essential consumption goods. This would naturally call for higher agricultural productivity.”

In the overall economic progress, the role and functions of agricultural growth have figured prominently in development theories where role and function of agriculture came to be analysed in depth. As a result, it was realized that industrialization and agricultural development are not conflicting alternatives, but complementary ones. “Effective development plans must embrace both goals. Raising agricultural productivity and inducing a marketed surplus of farm products must be a major concern, as development of most of the linkages between the two sectors will give effect to the interdependence required between them in a modern industrial economy.”

The “grass-root” school of economic development, which came into fashion as a reaction against the emphasis on industrialization at any cost, lays stress on policies to raise the level of productivity in agriculture as the best long-run development strategy. It is said that, “those who stress the role of industrialization generally underestimate the importance of agricultural sector in developing economies. But the two need not be in conflict. Agriculture and industry compete for national resources. But this does not mean that those who emphasize the need for agricultural expansion should necessarily be opposed to industrialization.” If, for example, low productivity is associated with a high ratio
of labour to land, productivity could probably be increased substantially by small applications of capital in the form of irrigation scheme, fertilizers, etc., together with a gradual run down of the work-force as the output growth starts to increase.

1.9 Profile of Hailakandi District:

Hailakandi district is situated in the southernmost part of Assam. The district is surrounded by the river Barak in the north and Mizoram in the South, Cachar district and Mizoram state in the east and Karimganj district in the entire west. It was a civil sub-division of Cachar district till September 1989 and has attained the district status in October 1989. Total geographical area of the district is 1327 Sq. KM. The major proportion of the geographical area of the district is put into agricultural uses. Net area under different crops in the district works out to 44,670 hectare (33.6%), of which 36500 hectare (82%) is used for paddy cultivation.

As per 2011 census, it has a population of 659260. It comprises two notified towns viz. Hailakandi Town (district headquarters) and Lala Town, and one industrial township viz. Panchgram. In Hailakandi district there is a Municipal Board governing Hailakandi town and a Town Committee governing Lala. It has five development blocks viz. Algapur, Hailakandi, Lala, Katlicherra and South Hailakandi development Block. There is a Mahkuma Parishad/Zila Parishad covering these 5 Development Blocks. There are a total of 62 Nos. of Gaon Panchayat and 334 nos. of Revenue Village. There are a total of 7 Nos. of A.D.O. circles and 63 nos. of V.L.E.W Elaka.

Nearly half of the district consists of forests. Out of the remaining half, 33.2% is under cultivation. Rice is the main crop. There are two reserve forests in Hailakandi District viz. Inner Line Reserve Forest and Katakhal Reserve Forest, covering an area of 741 Sq. km. As one enters the district lush green sprawling fields with varied vegetations give an impression of prosperity to the visitor. Nature’s beauty, diversity in human resource and simplicity of the people are the hallmarks of the district. People with varied languages, religious and cultural
hues co-exist in the district which reverberate an ambience of communal amity in the district.

Development of farm forestry by bringing wasteland into use is of great significance. It not only fulfills fuel and wood requirements of the people but also ensures supply of raw materials for the forest-based industries besides maintaining ecological balance. The forest resource base of Hailakandi district comprises 2 reserve forests viz., Inner line reserve forest and Katakhal reserve forest. It has a total of 27 forests which comprise 55.8 per cent (74115 ha) of the district’s total geographical area. The Hindustan Paper Mill situated at Panchgram depends on bamboo of the forests as its raw materials.

1.10 Relevance of the Study:

Agricultural productivity is a multidimensional concept, which includes technological advancement, effective management of available resources and organizational set-up for the agricultural production. There are different variables which determine to increase agricultural production; they can be grouped as infrastructural, technological and institutional.

Agricultural productivity is taken as the most important indicator to show the spatial pattern of agricultural development in a region. A study of agricultural productivity would help perspective agricultural development plans on a rational basis to lessen the regional disparities. Studies on crop productivity are so important in a country where food requirements need constant attention due to the rapid growth of population.

The state of Assam is mainly divided into two valleys, i.e., the Brahmaputra Valley and the Barak Valley. The Brahmaputra Valley, which forms the northern part, is the larger in size comprising 71.7 percent of the total geographical area of the state. On the other hand, the Barak Valley region, which forms the southern part, is comparatively smaller in size, constituting 8.9 percent of the geographical area of the state though it contains 11.22 percent of the population as per 2011 census.
The Barak valley in the state of Assam is comprised of three districts namely, Cachar, Karimganj and Hailakandi. Hailakandi district is situated in the extreme southern part of the state and also in the Barak valley. The population of the district has been increasing at an alarming rate.

A study on agricultural productivity is so important in Hailakandi district where food requirements need constant attention due to the rapid growth of population.

The populations of the district have been increasing at an alarming rate. According to 2001 census the population of the district is 5.43 lakhs. According to 2011 census the population of the district is 6.59 lakhs. The decadal variation is 21.42 percent whereas in Assam it was 19.58 percent.

The unusually high growth of population has made it all the more necessary to increase the food production, in order to feed the rising number of population. Agriculture takes the responsibility of supplying the food grains to such a high proportion of population, which necessitates an increase in the agricultural production. But there is a little scope to increase agricultural production by expanding land due to limited availability of land. Hence, agricultural productivity takes the dominant role in supplying food to the growing population.

Since the present productivity of agriculture is very low, improving the agricultural productivity can be a very useful solution towards the supply of food and creation of meaningful employment and in the long run can support agro based industry in the district.

However, as the pressures on land have been increasing with the growth of population, labour productivity is declining over the years. Therefore to provide at least a reasonable return to the farmers, it is necessary to increase agricultural productivity.

Agricultural production and productivity is of utmost importance in so far as the growth of industrialization is concerned. Basing on the abundance of
agricultural product, there is a growth of industries. More industries directly depend upon agricultural output and hence agricultural productivity of the region.

Among the other factors, shortage in agricultural production and productivity is responsible for such a low degree of industrialization in the district. Hence for the development of industrialization in the district much attention should be given to increase agricultural productivity in the district. It will not only make the district self-sufficient in food but will also help in reducing serious unemployment problem in the district by providing employment opportunities.

Agriculture is the primary source of income of the people of Hailakandi District. Industrialization is very low in Hailakandi district. As a result the majority of the people directly or indirectly depend upon agriculture for their livelihood. The economy of Hailakandi district is agro-based, with 70 percent of the work force being engaged in agriculture and other primary activities and 90 percent of the population directly or indirectly depends on agriculture for their livelihood as per 2011 census.

Rice is the major crop in Hailakandi district. More than 80 percent of area under cultivation in Hailakandi district is covered with rice. The productivity of rice in Hailakandi district is not at all satisfactory as compared to the all India level. The yield rate in Hailakandi District during 2009-10 was 1900 Kg per Hectare whereas in India it was 2249.00 Kg per hectare (Census-2011). In Punjab the yield rate is 3828.00 Kg per hectare. It is almost double than Hailakandi district. Not surprisingly, therefore, the district today stands far behind the all India standard in terms of use of improved agricultural practices and also in agricultural productivity.

Thus, a study of agricultural productivity in the context of Hailakandi district is relevant to identify the factors that are responsible for lower agricultural productivity in the district. The present study relating to the analysis of the growth trends of productivity, the assessment of the present state of
agriculture in comparison with agriculture elsewhere is useful for gathering the broad overview of agriculture in Hailakandi district.

The outcome of the study may be greatly useful to economists, policy makers, planners, researchers, students, Govt. Authorities, Banks, agriculture scientists, workers, Agricultural Department and other related organizations to help the farmers to increase productivity of the district and the financial institutions to take policy decision on investment in agrarian change in the District.

Since the economy of Hailakandi district is agriculture dependent, building a strong agricultural base is of utmost importance for the district. Improving the agricultural productivity can be a very useful solution towards the supply of food and creation of meaningful employment and in the long run can support agro based industry in the district. Relative geographical isolation, weak industrial base vis-à-vis low agricultural productivity necessitates undertaking studies relating to the formation of a strong agricultural sector. Proper identification of all these factors goes a long way in sustaining agricultural development in the district. Thus a study of agricultural productivity in the context of Hailakandi District having large scale unemployment, low industrialization and agricultural backwardness is relevant.

Agriculture sector employs the major portion of working population of the district. Since the pace of industrialization is very low in the district in comparison to the state level, agriculture provides employment to such a high proportion of population of the district. Therefore, agriculture plays a vital role in the economic development of the district.

Apart from these industrial inputs of agriculture, the district possesses jute, coconut, sugarcane etc., the output of which may help in the growth and development of small-scale industries in the district. It appears from the above discussion that despite enough potentialities for the growth and development of agro based industries in the district, it lacks adequacy of agro-based industries.
Though the district is not devoid of manufacturing units, its relative geographical isolation handicaps it for a programme of large-scale industrialization. The prospect of economic development of the district therefore depends mainly on the growth of agriculture and allied activities. Agriculture in Hailakandi district, as it stands today, is predominated by small farms growing mainly rice. As per Agricultural Census 2011, 53.09 percent of the farms were in the size class of below one hectare. The average size of operational holding works out to be 1.62 hectares, which contains some amount of upward bias due to the large holdings of the tea estates. In 2010-11 rice crops constituted 88.56 percent of the gross cropped area (excluding the area under plantation and tree crops) of the district. The agriculture is almost entirely weather dependent, the irrigation cover being limited to only 5.9 percent of the gross cropped area till 2009-10. Not surprisingly, therefore, the district today stands far behind the all India standard in terms of the use of improved agricultural practices and also in agricultural productivity.

1.11 Objectives of the Study:

1. To Understand the Trend of Agricultural Productivity in Hailakandi District.

2. To Understand the Agricultural Development so far in Hailakandi District.

3. To Analyse the Relationship Between Farm Size and Productivity in Paddy Cultivation.

4. To Identify the Problems of Agriculture in Hailakandi District.

1.12 Hypotheses of the Study:

The study is conducted with the following null-hypotheses.

1. The Trend of Agricultural Productivity in Hailakandi District is at par with other Leading Districts of Assam.
2. Size of the Holdings has no Impact on Productivity.
3. Adoption of New Agricultural Technology is Scale Neutral.
4. Existing Infrastructural and Institutional Facilities Hinder the Diversification of Agriculture.

1.13 Data Source and Methodology:

Selection of the Study Area:

There are 7 (seven) Agricultural Development Offices (A.D.O. Circles) in Hailakandi District. To keep the representativeness of the entire district in view, the samples from all the A.D.O. circles of the district were taken. The A.D.O. circles are very large and geographically heterogeneous in nature. Thus, efforts have been made to ensure that the farmers from different locations of the area are selected. For this purpose we adopted multi-stage sampling.

From each of the 7(seven) A.D.O. circles, 3 (three) VLEWs have been selected randomly and from each of the selected VLEW one village has been selected randomly for field survey. The selections of VLEW and village were done randomly.

Selection of the Samples:

In order to select the samples representing all types of cultivators in the district, marginal, small, medium, and large cultivators from each selected village, the complete list of cultivators according to size class was obtained from the ADO Circle’s records of each selected village. Then, the details of agricultural land in use in each village have been collected. The ownership patterns of the farmers on the basis of the size of the holdings have been prepared. Then about 10 (ten) percent of farm households representing all farm
size holdings in each selected villages were selected at random. In this manner, from all the 21 selected villages of the district, 342 farm households have been selected which constituted the whole sample of the field study.

**Methods of Data Collection:**

To meet our objective and testing hypotheses we have collected data from both primary and secondary sources. Accordingly a field survey was taken up during 2009-10 in the selected areas of the district. Primary data have been collected through field investigation. Field investigation includes observation of field, personal interview, information collected from respondents.

Information for secondary data have been collected from published and unpublished materials such as books, journals, reports, documents, articles, thesis and different publications by different institutions and govt.

The primary data relating to the cultivation of each farm household in the sample have been collected through structured questionnaire from a senior member (usually the head of the household) of the farm family. This schedule was finalized after a number of pre-test in the field survey. The enquiry has been conducted for detail investigation into the principal crop (paddy) -varieties of both local and HYV etc. For studying general trend of Agricultural productivity, however, almost all the determinants of productivity such as farm size, HYV, fertilizer, irrigation and technology have been taken into consideration.

**Methods and Tools of the Analysis of Data:**

**For Objective-1 and Hypothesis-1:** We have collected data about the productivity (yield rate) of agricultural production of Hailakandi district and other 10 (ten) leading districts of Assam (in terms of highest productivity) during the period 2000-01 to 2009-10 from secondary sources. In this connection, productivity of rice, during the period under study has been analysed based on tabular and graphical analysis. We have fitted trend lines and trend equation of the form $y = a+bt$ relating productivity of rice for Hailakandi and other ten leading districts (in terms of highest productivity) of Assam. The first hypothesis has been tested by comparing the trend of productivity of rice of Hailakandi with
the trend of average productivity of other leading districts during the period of ten years.

For objective-2: We have collected data about the progress in the coverage of area under High Yielding Varieties (HYV) of seeds, consumption of fertilizers, irrigation facilities during the period from 2001-02 to 2009-10 from secondary sources as mentioned above. The analysis of these determinants of agricultural development has been made based on tabular and graphical analysis. We also fitted trend line of these determinants of agricultural productivity.

For objective-3 and Hypothesis-2: we have collected the farm size and amount of paddy production of each and every sample farmer through field survey.

In this study, we have measured productivity by applying the following formula:

\[
\text{Productivity} = \frac{\text{TP}}{\text{NSA}} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots
Where Y - stands for productivity and
X - stands for HYV.
α - is intercept and β is co-efficient
U - is the random error term.

3) Regression of Productivity on Irrigation:
The model is specified as follows:
\[ Y_i = \alpha + \beta X_i + U_i \]  
\( i=1, 2, 3 \ldots, \ 342 \)
Where Y - stands for productivity and
X - stands for irrigation.
α - is intercept and β is co-efficient.
U - is the random error term.

4) Regression of Productivity on Fertilizer:
The model is specified as follows:
\[ Y_i = \alpha + \beta X_i + U_i \]  
\( i=1, 2, 3 \ldots, \ 342 \)
Where Y - stands for productivity and
X - stands for fertilizer.
α - is intercept and β is co-efficient.
U - is the random error term.

5) Regression of Productivity on Technology:
The model is specified as follows:
\[ Y_i = \alpha + \beta X_i + U_i \]  
\( i=1, 2, 3 \ldots, \ 342 \)
Where Y - stands for productivity and
X - stands for technology.
α - is intercept and β is co-efficient.
U - is random error term.
Multiple Regressions:
Besides the two variables of regression models as specified above, we applied multiple regressions taking Productivity as dependent variable and farm size, technology, HYV, irrigation and fertilizer as independent variables. The model is specified as follows:

\[ Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + U_i \]………………………… (7)

\( i=1, 2, 3 \) …………., 342

Where \( Y \) - stands for productivity,
\( X_1 \) - stands for farm size,
\( X_2 \) - stands for technology,
\( X_3 \) - stands for HYV,
\( X_4 \) - stands for irrigation and
\( X_5 \) - stands for fertilizer.
\( \alpha \) - is intercept and
\( \beta_1, \beta_2, \beta_3, \beta_4 \) and \( \beta_5 \) are co-efficient.
\( U \) - is the random error term.

For Testing Hypothesis-3 we have collected farm size and technology used for agricultural production from each sample farmer during the year 2009-10 through field survey. In order to measure the technology used, we took five agricultural equipments namely, wooden plough, tractor, power tiller, pump set and sprayer. Then each sample household was assigned 1(one) on each equipment if used. Thereafter, the total score of each sample household out of five was calculated to obtain the technology used.

After calculating technology we applied Pearsonian correlation and regression in SPSS 10. Here we take technology as a dependent variable and farm size as an independent variable. In this connection the model is specified as follows:
\[ Y_i = \alpha + \beta X_i + U_i \] 
\[ i = 1, 2, 3 \ldots \ldots , 342 \] (8)

Where \( Y \) - stands for technology and
\( X \) - stands for farm size.
\( \alpha \) - is intercept and
\( \beta \) - is co-efficient.
\( U \) - is random error term.

For objective-4: and Hypothesis-4 We have collected data and information about the problems and infrastructure of Agriculture in Hailakandi District such as Land Holding Pattern, availability of Technology, irrigation facilities, area under High Yielding Variety (HYV) of seeds, area, production and yield rate of agricultural production, Fertilizer Consumption, Credit Facility, Agricultural Marketing in Hailakandi district from the sample farmers during the period 2009-10. The primary data collected for this objective has also been analysed on the basis of tabular and graphical analysis.

For testing Hypothesis-4 we applied regression involving percentage of crop diversification as the dependent variable and infrastructure (technology, irrigation, fertilizer and credit) as explanatory variables. Accordingly we have tested the hypothesis-4.

\[ Y = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} \] 
\[ i = 1, 2, 3 \ldots \ldots , 342 \] (9)

Where \( Y \) - stands for crop diversification
\( X_1 \) - stands for technology
\( X_2 \) - stands for irrigation
\( X_3 \) - stands for fertilizer
\( X_4 \) - stands for credit
\( \alpha \) - is intercept and
\( \beta_1, \beta_2, \beta_3, \text{ and } \beta_4 \) - are co-efficient.
\( U \) - is the random error term.
1.14 Layout of the Thesis

After this Introductory Chapter, the other chapters are as follows:

Chapter-2 Review of Literature:
This Chapter reviews existing studies on the topic of the research.

Chapter-3 Physical and Economic Characteristics of the Area under Study:
This Chapter contains Physiographical and Socio-Economic characteristics of the study.

Chapter-4 Trend and Development of Agricultural Productivity in Hailakandi District:
This Chapter analyses the status of agricultural development in the study area.

Chapter-5 Problems and Prospects of Agricultural Productivity in Hailakandi District:
This Chapter analyses problems and prospects of agricultural development in the study area. This chapter also analyses the status of modern agricultural infrastructure and related aspects in the study area.

Chapter - 6 Findings and Discussions:
This Chapter contains analysis based on findings using statistical and econometric tools.

Chapter - 7 Conclusions and Suggestions:
The chapter contains summary, conclusions and suggestions of the study.