Chapter -1
INTRODUCTION

1.1 Introduction:

India is the seventh largest and second most populous country in the world. Agricultural sector plays an important role in the economic development of India as a large size of its population lives in rural areas. It is a major source of livelihood for millions of people in India. Approximately 54.6 percent of the population depends on agriculture either directly or indirectly. The annual agricultural growth rate was 3.7 percent and total food grain production stood at 264.77 million ton in 2013-14. Agricultural sector contributed 18 percent to India’s GDP and 13.79 India’s exports in 2013-14.

Agricultural and allied sectors are considered to be the mainstay of the Indian economy. They are the important source of raw material and generate demand for many industrial products, particularly fertilizers, pesticides, agricultural implements and a variety of consumer goods.

Agriculture and allied industry is further divided into several segments, namely: horticulture and its allied sectors (including fruits and vegetables, flowers, plantation crops, spices, aromatic and medicinal plants); fisheries sector; animal husbandry and livestock; and sericulture. India's varied agro-climatic conditions are highly favorable for the growth of large number of horticultural crops, which occupy around 10 per cent of gross cropped area of the country producing 160.75 million tons.

India is the second largest producer of fruits and vegetables in the world. It is also the second largest producer of flowers after China. It is also a leading producer, consumer and exporter of spices and plantation crops like tea, coffee, etc. while sericulture is an agro-based cottage industry. India is ranked as the second major raw silk producer in the world.
1.2 Conceptual framework:

1.2.1 Cropping pattern:

Cropping pattern refers to the acreage distribution of different crops in any one year in a given farm area such as a district, water agency, or farm. Thus, a change in a cropping pattern from one year to the next can occur by changing the relative acreage of existing crops, and/or by introducing new crops, and/or by cropping existing crops.

The cropping pattern of a region reveals the proportion of area of land under different crops at a point of time, the rotation of crops and the area under double cropping. The cropping pattern changes in space and time. In fact, no cropping pattern can be good and ideal for all times to come.

The cropping systems of a region are decided by and large, by a number of soil and climatic parameters which determine overall agro-ecological setting for nourishment and appropriateness of a crop or a set of crops for cultivation. Nevertheless, at the farmer’s level, potential productivity and monetary benefits act as guiding principles while opting for a particular crop/cropping system. These decisions with respect to choice of crops and cropping systems are further narrowed down under the influence of several other forces related to infrastructure facilities, socio-economic factors and technological developments, all operating interactively at micro-level. These are infrastructure facilities: irrigation, transport, storage, trade and marketing, post-harvest handling and processing etc.

Socio-economic factors: Financial resource base, land ownership, size and type of land holding, household needs of food, fodder, fuel, fibred and finance, Labor availability etc. Technological factors: Improved varieties of seeds, cultural requirements, mechanisation, plant protection, access to information, etc.
The prevalent cropping system of any locality is, therefore, the cumulative result of the past and present decisions by individuals, communities or governments and their agencies.

The cropping pattern plays a vital role in determining the level of agricultural production and reflects the agricultural economy of an area/region. A change or shift in cropping pattern implies a change in the proportion of area under different crops which depends, to a large extent, on the facilities available to raise crops in the given agro-climatic setting. The natural, social, economic and historical factors determine the cropping pattern of a region. The cropping pattern also changes in consonance with the government policies and technological innovations especially in agriculture. It is, however, pertinent to mention that in most of the areas it is the availability of water more than any other input which determines the nature of agricultural production. Cultivators in regions and localities without sources of water-supply to supplement rainfall are constrained in their choices of cropping patterns and have to suffer enforced adjustments when the rains are abnormal, either in their timing or in their quantity. Hence the state of agriculture of a region depends vitally upon the security and flexibility provided by irrigation facilities.

Crop rotation means not growing the same crop in the same place year after year, depleting the soil of the nutrients needed to grow that crop. It also includes letting the ground lie fallow some years to let it recover, or growing crops for the purpose of replenishing soil nutrients.

Rotating crops can help maintain soil fertility and reduce the need for chemical fertilizers and pesticides. Most corn and soybeans are grown in rotation with each other or other row crops. The most predominant wheat rotation is wheat-fallow-wheat, while monoculture is the most common practice in cotton. The primary factor determining a farmer’s choice of cropping pattern is the rate of return; other contributing factors include agro climatic conditions, farm programs, conservation programs, and environmental
regulations. Crop rotations, generally will prevail over monoculture, only if more profitable.

Cropping intensity is defined as a ratio between net sown area (NSA) and gross cropped area (GCA). It thus indicates the additional percentage share of the area sown more than once to NSA. It may be measured by the formula-gross cropped area/net sown area x 100. The intensity of cropping, therefore, refers to raising a number of crops from the same field during one agricultural year. The index of cropping intensity is 100 if one crop has been grown in a year and it is 200 if two crops are raised. Higher the index, greater is the efficiency of land use.

The cropping intensity has direct correlation with assured irrigation which enables farmers to go for multiple cropping and use higher dose of fertilizers and HYV seeds. Hence, besides irrigation, fertilizers, early maturing high yielding variety of seeds, selective mechanization such as the use of tractors, pumping sets and seed drills, etc., plant, protection measures through the use of insecticides, pesticides etc. do have role in affecting the intensity of cropping.

The level of cropping intensity is determined by several factors. The most important factor is the availability of water from natural (rainfall) and or man -made resources (irrigation).

1.2.2 Types of cropping systems

Cropping systems are designed to mimic nature and bring diversity into our farming systems. Cropping systems include:

1) Crop rotation: Crops are changed in the field from year to year according to a planned sequence rather than the same crop being grown in the same field. The crop rotation can include both annual and perennial crops which are seeded for several years.
2) Multiple Cropping: Two or more crops grown in the same field within a given year. Annual and perennial plants can be organized in fields together. Another example might be planting rows of fruit trees with cereal grains or vegetables in between and windbreaks planted around the field perimeter.

3) Strip-Intercropping: Two or more crops are planted in the same field in alternate rows. The two crops generally have their main production period at different times of the year. This system more evenly uses water throughout the growing season, and ensures some level of productivity during the dry season by the more drought tolerant crops. For example, wheat or peas can be spring sown in one-meter strips with an adjacent fallow one-meter strip area. Later this area can be planted with two rows of corn.

4) Planting for Genetic Diversity: Using several varieties of seeds in the same field can be a good strategy to increase crop diversity and reduce vulnerability to disease and insect outbreaks.

5) Mixed cropping: It is growing of two or more crops simultaneously intermingled without any row pattern. It is a common practice that the seeds of different crops are mixed in certain proportion and are sown. E.g.: Kharif Groundnut + Jowar, Cotton + Mesta (Ambadi), Jowar + Mustard or Wheat + Mustard.

6) Sequence cropping: It is growing of two or more crops in sequence on the same piece of land in a farming year. It may doubles (2 crops), triple (3 crops) or quadruple (4 crops). E.g.: Cotton – Groundnut, Jowar – Wheat, Mung – Rabi Jowar, and Hybrid Jowar – Gram. Etc.

7) Relay Cropping: It refers to planting of succeeding crop before harvesting the preceding crop like a relay race where a crop hands over the land to next crop in quick succession. Ratoon cropping or ratooning refers to revising a crop with regrowth emanating from roots or stalks after harvest of the crop. E.g. Sugarcane or Jowar ratooning.

8) Efficient cropping systems: The efficient cropping system for a particular farm depends on farm resources, farm enterprises & farm technology. The farm
resources include land, labor, water, capita; and infrastructure. When land is limited, intensive cropping is adopted to fully utilize available water & labor. When sufficient and cheap labor is available, vegetable crops are also included in the cropping system as they require more labor. Capital intensive crops like sugarcane, banana, turmeric, ginger, etc. find a place in the cropping system when capital is not a constraint. In low RF (less than 750 mm/annum) mono-cropping is followed & when RF is more than 750 mm intercropping is practiced. With sufficient irrigation water, triple, quadruple cropping is adopted when other climatic factors are not limiting. When the farm enterprise includes dairy the cropping system should contain fodder crops as a component.

1.2.3 Classification of crops:

Cash crops are plants grown or managed, harvested and sold for cash rather than for subsistence. They are grown for grains, fruits, flowers, foliage, stems, roots, latex or any plant organ which may be consumed or utilized directly (e.g. fruits, vegetables, cut flowers and cut foliage) or processed into such products as fiber, rubber, sugar and biofuel.

These are sold for cash either in the domestic market or exported abroad, and may be a food or non-food crop. For the ordinary farmer, the term is applied literally. Any crop can be a cash crop if it can be harvested and converted to cash for personal and/or family needs. Examples of such crops which are managed out of natural stands are bamboo and sweet palm or kaong.

In contrast, subsistence crops are those which are grown to be consumed by the farmer and his family or to be fed to the farmer’s livestock. Literally, the term is applicable where there are farmers who prefer to grow their own crop for sustenance and not for marketing.

The principal subsistence crops are the staple crops like rice, corn, root and tuber crops and some pulses. However, they are also often marketed, partly or in whole. For
example, many traditional farmers grow rice both for family consumption and for marketing. In this case the farmer grows rice both for cash and for subsistence.

Four other special terms are often used in describing cash crops: export crops, industrial crops, plantation crops and high value crops.

Export crops are intended for the foreign markets.

Industrial crops are plants grown to provide materials for industrial processing and production of non-food products such as biofuel, rubber, starch, industrial oil, aromatic compounds, botanical pesticides, tannins and dye. They are to be processed into industrial products and hence the harvested raw materials must necessarily be sold to the processors.

Plantation crops are plants grown in large tracts of land under intensive culture. The products are exported rather than used for local consumption.

High value crops are plants grown for food, beverage and other products with high buying prices in both local and foreign market. These include many fruits, vegetables and commercial crops.

The farming methods applied in cash crop farming vary from farmer to farmer and from country to country, but always with the intent of earning substantial profit.

Most crops are now grown mainly for cash generation and profit in developed countries.

In many tropical countries, crops which are commonly grown for cash include cassava, coffee, cacao, tea, sugar cane, rubber, coconut, oil palm, banana and pineapple.

In temperate countries, the most dominant crops include grain crops (corn, wheat) and oilseed crops (soybean) as well as some vegetables and herbs.
1.2.4 Classification of Crops According to Life Cycle

Life cycle is the period from germination to harvesting. The crops are further subdivided into four groups.

1. **Annual Crops**: They complete their life cycle once in a year or a growing season, during which, the vegetative and reproductive stages are completed e.g. maize, rice, cowpea, millet, vegetables, cotton, groundnut, etc.

2. **Biennial Crops**: They complete their life cycle once in two years or two group seasons. In the first year, they undergo the vegetative stages where leaves and roots are produced in abundance, the plant also elongates. But during the second year, the plants undergo reproductive stages where flowers, fruits and seeds are produced e.g. carrot, lettuce, cabbage, ginger, cassava, etc.

3. **Perennial Crops**: They complete their life cycle once in three years. In the first two cycles once in three years, they undergo vegetative stages while in the last years, the reproductive stages are completed e.g. rhizome, sugarcane, banana, plantain.

4. A perennial plant that can survive for thirty years and above is called permanent crop e.g. cocoa, kola, mango, oil palm, rubber, coconut, etc.

5. **Ephemerals**: They are crops that complete their life cycle once in three or four months and can undergo two or three life cycles in a year e.g. tomato.

1.2.5 Patterns of crop diversification:

Crop diversification means growing a variety of crops in an area, not just one. If one crop fails in a given year, the area can still survive. The growth and spread of predators is limited.

In relation to agricultural development, “diversification” is probably one of the most frequently used terms in the recent decade. Traditionally, diversification was used more in the context of a subsistence kind of farming, wherein farmers grew many crops on
their farm. The household level food security as also risk an important consideration in diversification. In the recent decade, diversification is increasingly being used to describe increase in area under high value crops. In this perspective it is conducive to explain what exactly diversification is? Diversification originated from the word “diverge”, which means to move or extend in a different direction from a common point. In this sense diversification is the opposite of concentration, therefore, most of the techniques of measuring diversification actually measures concentration in the system. In economics, diversification refers to a situation in which decrease in the dominance of an activity, alternately results in depiction of increase in the share of many activities in the system.

Extending the same notion to agriculture, it means increase in the share through withdrawal of a resource and to allocate it with other alternatives. Diversification is therefore measured with concentration ratios. The concentration indices however do not explain the alternate definition of agricultural diversification that is, increase in the share of high value crops in agriculture. The notion of ‘high value’ has emerged after liberalization of trade in agriculture. This largely refers to those commodities for which exports were liberalized during the mid-1990s and differences between domestic and international prices were high at least during the initial period of trade liberalization. The high value range of crops is definitely wider than fruits and vegetables. The study therefore measures diversification with the changes in the percent of non-food crops at the aggregate level. This will also contribute to the recent debate on food versus non-food crops in the country.

1.2.6 Crop Diversification in the Indian Perspective:

With the advent of modern agricultural technology, especially during the period of the Green Revolution in the late sixties and early seventies, there was a continuous surge for diversified agriculture in terms of crops, primarily on economic considerations. The crop pattern changes, however, were the outcome of the interactive effect of many factors which could be broadly categorized into the following five groups:

a) Resource related factors covering irrigation, rainfall and soil fertility.
b) Technology related factors covering not only seed, fertilizer, and water technologies but also those related to marketing, storage and processing.

c) Household related factors covering food and fodder self-sufficiency requirement as well as investment capacity.

d) Price related factors covering output and input prices as well as trade policies and other economic policies that affected these prices either directly or indirectly.

e) Institutional and infrastructure related factors covering farm size and tenancy arrangements, research, extension and marketing systems and government regulatory policies.

Obviously, these factors are not watertight but inter-related. For instance, the adoption of crop technologies is influenced not only by resource related factors but also by institutional and infrastructure factors. Similarly, government policies - both supportive and regulatory in nature - affect both the input and output prices. Likewise, special government programs also affect area allocation and crop composition. More importantly, both the economic liberalization policies as well as the globalization process exert strong pressures on the area allocation decision of farmers, essentially through their impact on the relative prices of inputs and outputs. Although the factors that influence the area allocation decision of farmers are all important, they obviously differ in terms of the relative importance both across farm groups and resource regions. While factors such as food and fodder self-sufficiency, farm size, and investment constraints are important in influencing the area allocation pattern among smaller farms, larger farmers with an ability to circumvent resources constraints usually go more by economic considerations based on relative crop prices than by other non-economic considerations. Similarly, economic factors play a relatively strong role in influencing the crop pattern in areas with better irrigation and infrastructure potential. In such areas, commercialization and market networks co-evolve to make the farmers more dynamic and highly responsive to economic impulses.

What is most notable is the change in the relative importance of these factors over time. From a much generalized perspective, Indian agriculture is increasingly getting influenced more and more by economic factors. This need not be surprising because
irrigation expansion, infrastructure development, penetration of rural markets, development and spread of short duration and drought resistant crop technologies have all contributed to minimizing the role of non-economic factors in crop choice of even small farmers. What is more, the reform initiatives undertaken in the context of the ongoing agricultural liberalization and globalization policies are also going to further strengthen the role of price related economic incentives in determining crop composition both at the micro and macro levels. Obviously, such an evolving economic environment will also ensure that government price and trade policies will become powerful instruments for directing area allocation decisions of farmers, aligning thereby, the crop pattern changes in line with the changing demand-supply conditions. In a condition where agricultural growth results more from productivity improvement than from area expansion, the increasing role that price related economic incentives play in crop choice can also pave the way for the next stage of agricultural evolution where growth originates more and more from value-added production.

1.2.7 Consequences of Crop Pattern Changes:

Turning now to the socio-economic and environmental consequences of crop pattern changes, the Green Revolution technologies have fomented, among other things, an increasing tendency towards crop specialization and commercialization of agriculture. While these developments have positive effects on land/labor productivity and net farm income, they have also endangered a number of undesirable side effects like reduced farm employment and crop imbalances. Although the expansion of commercialized agriculture has fomented new sets of rural non-farm activities and strengthened the rural-urban growth linkages, it has also weakened the traditional inter-sectoral linkages between the crop and livestock sectors. Besides, crop pattern changes also lead to serious environmental consequences that take such forms as groundwater depletion, soil fertility loss and water logging and salinity - all of which can reduce the productive capacity and growth potential of agriculture over the long-term. A classic example is the rice-wheat system in Northwestern India replacing traditional crops like pulses, oilseeds and cotton.
1.2.8 Agricultural Prices:

Food and agricultural commodity prices in India are primarily determined by domestic demand and supply factors influenced by domestic price policy. The nature of markets facing the agricultural commodities and imperfections in these markets also influence the price transmission and the final consumer prices. India meets the bulk of its large food demand through domestic production, barring few commodities like edible oils and pulses.

Agricultural prices cover prices of agricultural products (output prices) and prices of requisites for agricultural production (input prices) at various stages of marketing. In India, the main objective of the Government's price policy for agricultural produce, aims at ensuring remunerative prices to the growers for their produce with a view to encourage higher investment and production.

Towards the end, minimum support prices for major agricultural products are announced each year which are fixed after taking into account, the recommendations of the Commission for Agricultural Costs and Prices (CACP). The CACP while recommending prices takes into account all-important factors, viz.


Of all the factors, cost of production is the most tangible factor and it takes into account all operational and fixed demands. Government organizes Price Support Scheme (PSS) of the commodities, through various public and cooperative agencies such as FCI, CCI, JCI, NAFED, Tobacco Board, etc., for which the MSPs are fixed. For commodities
not covered under PSS, Government also arranges for market intervention on specific request from the States for specific quantity at a mutually agreed price. The losses, if any, are borne by the Central and State Government on 50:50 basis. The price policy pays rich dividends.

1.2.9 Agricultural Exports:

Trade policy reforms have provided an opportunity to Indian exporters to export agriculture products to overseas markets. However with increased concern regarding health and safety of human, plant and animal life, countries are putting in place stringent legislations for quality. Indian exporters are required to improve their processing and packaging facilities to meet international quality standards. Though there has been some diversification in products exported and spread of destinations, bulk of India’s agricultural exports still conforms to traditional items.

The establishment of WTO was expected to improve the economic condition of the farmers through increased agricultural exports all over the world, including India. The Indian farmers were expected to receive two important benefits namely, greater market accessibility and improved prices for their products. In order to assess the results of these expectations, two types of indices have been constructed. To measure the degree of market accessibility quantity index has been prepared and to measure the extent of improved prices, price index has been prepared. Both the indices (quantity and price) for different commodity groups show an overall improvement in Indian agricultural exports with some exceptions.

In 2002-03 the value of quantity index of traditional items improved to 147.35 and further grew to 150.23 in 2003-04. After this the traditional exporter did not look back except in 2008-09 and the quantity index for traditional items reached 335.11 in 2009-10. As far as the prices of the traditional agricultural products are concerned, some stability is being maintained by market forces. An improvement in the prices of traditional agricultural exports was observed in the very next year of the establishment of
WTO. There was an overall improvement in the prices of traditional items over the period from 1995-96 to 1999-00.

No doubt the prices paid to the traditional items of agricultural exports have not declined in the international market in comparison to the prices before the establishment and working of WTO, but the process of continuous improvement in the prices of these items was disrupted in 2000-01. The export of the non-traditional agricultural products is of recent origin in India. We have got an edge in the production as well as export of these items over others. The Agreement on Agriculture under WTO paved the way for greater market accessibility of these items in the international market.

1.2.10. Agricultural Subsidies and Public Expenditure

Subsidies on inputs have had their roots in green revolution. At that time, extensive subsidies were given on hybrid seeds, fertilizers, pesticides and the like. The main aims of subsidies were two – one was to keep cost of the food grains at the minimum and avoid food inflation, second is to ensure income security of the farmer. While this policy has helped a lot to secure food sufficiency, yet it has many unintended negative impacts. It has resulted in overuse of inputs as inputs costs don’t represent adequate market costs, farmers are unable to respond to market signals. They continue to use skewed mix of inputs as costs are borne by government.

Government provides subsidies to agricultural sector in the direct and indirect form. For encouraging agriculture production and attaining self-sufficiency, the government provides various incentives together with price supporting schemes. Among the agriculture production incentives, subsidies are considered to be the most dominant device to quicken the growth of agricultural production. Most of the subsidies provided are designed to recompense the high cost of production and to stimulate the use of modern inputs. The subsidy is very important for progression of farmers in India.

It has been observed that agriculture subsidies are one of debatable issues in the world. Since many decades, every district provides huge subsidies to agricultural sector for its development. This has undoubtedly facilitated its improvement. But now every country
tries to reduce the level of agriculture subsidies to reduce the burden on the economy. Economics, experts & governments have different opinions regarding impact of agriculture subsidies. According to economics, it is detrimental to the economy and hence it is not be encouraged. Agriculture experts, however argue that agricultural subsidies are really beneficial for growth of agriculture sector.

Subsidies are among the most powerful instruments for manipulation or balancing the growth rate of production and trade in various sectors and regions and for an equitable distribution of income for the protection of weaker sections of society. The support and procurement prices for more agricultural production are some of the important measures, which are done to protect the interests of farmers. During the last decade subsidies provided by government of India have grown at a very rapid rate.

The fundamental rationale for public resource allocation in and for the agricultural sector derives directly from the basic rationale for public investments in general and, even more generally, from the core reasoning underlying public-sector intervention in the economy. The government should undertake policies affecting the economy. This is because economic inefficiencies brought about by market failures can be corrected through public-sector involvement (through public production, subsidization, or regulation). Moreover, undesirable levels of inequality or undesirably low material welfare among the poorest segments of society can also be remedied through public policy.

1.2.11 Impact of WTO on Agriculture:

With the integration of world economies, farmers in particular do not have a level playing field. This is particularly true with respect to farmers with small holdings. Globalization has brought in a variety of agricultural produce at cheaper prices and this has affected the farmers’ lives and the food security of the nation. The emerging price fluctuations have acted as a disincentive to producers. Foreign producers and leaders are making their presence felt and there is lack of information among Indian farmers. Added
to this, infrastructure bottlenecks aggravate the worsening situation. There is also difficulty in organizing the small and marginal farmers. To get the benefit from participating in international agriculture, the remedy lies in consolidating and organizing small and weak farmers into groups to provide support to each other in terms of facilities required. Cultivation of horticulture and floriculture need to be speeded up. The traditional trade has to be strengthened and investments are to be made in trade related activities. Information dissemination is of utmost importance. Development of commodity based trade hubs is an important area of expected policy change. There is a need for formulating short, medium and large term strategies to enhance export performance. To achieve all this, the State Government must clearly participate in policy discussion at the Centre with the Ministry of Commerce. Identification of commodities requiring particular attention like coffee, silk and others is needed. Farmers should be involved in the formation and strengthening of commodity boards. Understanding the phytosanitary and specific safeguard measures is of utmost necessity. There is an urgent need for revitalizing the WTO Cell to disseminate information and establishment of nodal offices of KAPPEC.

1.2.12. WTO Agriculture Agreements:

Though the WTO Agreement on Agriculture (AOA) came into force with effect from January 1, 1995, it was only in the preceding couple of years that the agreement got to be seriously debated in India. Following the virtual removal of the quantitative restrictions (QRs) on agricultural imports with effect from 2001-02, several concerns have been raised by farmers' groups in India, regarding their fate in the post-QR phase. Largely these reactions explain the hike in customs duties on a wide range of agriculture products in the union budget for 2001-02. It is also noteworthy that the Exim policy of 2001-02, sought to hedge this liberalization with its own systems of 'checks and balances'. This was done despite removing QRs on practically all agricultural commodities. India has also taken up certain important concerns, relating to food and livelihood security in the current round of negotiations on the AOA. It is apparent that the government of India has followed a two-pronged strategy to address the trade
liberalization issues flowing from the AOA. While the first plank of the strategy hinges on tough negotiation positions on the AOA, with a view to seeking special dispensation for agricultural sector in developing countries, the second plank of the strategy has been to adopt national level measures to minimize the likely damages arising from import liberalization on the country's agriculture sector.

Major Points of the Agreement on Agriculture:-

- The AOA covers five major areas under WTO, like market access, domestic support and export competition, trade related investment measures (TRIMS) and Trade related Intellectual Property Rights (TRIPS).
- Non-Tariff barriers such as quantitative restrictions are to be replaced by tariffs to provide the same level of Production.
- Developed countries need to reduce their tariffs by an average of 36% over a period of 6 years and developing courtiers to comply similarly by 24% over a period of 10 Years.
- Minimum level of access for imports of agricultural Products (as a share of domestic consumption) should not be less than 3%. This minimum level is to rise to 5% by year 2000 for developed countries and 2004 for developing countries.
- Developed countries have to reduce their aggregate measure of support (AMS) by 20% over 6 years and developing countries have to comply similarly by 13% over a period of 10 years. Least developed countries are exempted from this.
- The agreement distinguishes between types of subsidies and defines three kinds of subsidies viz., prohibited, actionable and non-actionable subsidies.
  a) Prohibited subsidies: These cover the subsidies having direct influence on trade.
  b) Actionable subsidies: Include those subsidies having adverse effects on the prospects of the other signatories.
  c) Non-actionable subsidies: These can be either product specific or non-specific subsidies involving assistance to industrial subsidies. These also include subsidies provide to disadvantaged regions to participate in the main stream of development.
- ‘Green box’ and ‘Blue box’ measures provide subsidies to be excluded from AMS.
- Peace Provisions aim at the reduction of the likelihood of disputes of challenges on agricultural subsidies.
- Special safeguard provisions provide safeguards against sudden price troughs in domestic market and surges in imports affecting the interest of farmers.
- Agreement on trade related aspects of investment measures (TRIMS): This seeks to ensure that countries do not insist on ---- in order to create artificial advantage and affect the trade interest of other countries (Article of 111 of GATT).
- Agreement on Anti-dumping: No country will be allowed to (dump the produce in the country of destination by creating an artificial price differential.
- Agreement on customs valuations: This gives customs administrative right to request further information on the imports wherever they have doubt about the accuracy as well as the declared value of the imported goods.
- Agreement on pre-shipment inspection: A review process is allowed under this agreement for the inspection of the goods prior to the shipment
- Agreement on safeguards: This allows the member countries take safeguard actions against any specific incidence in order to protect the domestic industry from serious effects. Safeguard measures would not be applicable to a product from a developing country member, if the share of developing country in the imports of the product does not exceed 3%. This will be done if the developing country having less than 3% import share collectively accounts for not more than 9% of the total imports of the product concerned.
- Agreement on Trade Related Intellectual Property rights (TRIPS) recognizes that there are varying standards of protection and enforcement of intellectual property rights (IPRS). It is necessary that there is standardization in the regulations across the countries.
1.3 Review of Literature:

The review of literature provides a useful background for the study. Moreover, it helps in understanding the various issues relating to the research problem. Review of literature has thrown light on specific problems, besides identifying the research gap. Moreover, it provides guidance to formulate the research objective.

This study covers various, books, articles, working papers, empirical papers, journals besides the internet. The various literatures have highlighted the issues, and facilitated suggestions, findings related to cropping pattern.
(Note: Review of Literature will be discussed in the second chapter.)

1.4 Objectives:

- To study the trends in area, production and yield of selected agricultural crops before and after WTO period in India and Karnataka.
- To measure the impact of WTO on cropping pattern and diversification in India in general and Karnataka in particular.
- To assess the influence of WTO on Cropping Pattern across the Divisions in Karnataka.
- To examine the impact of WTO on agricultural exports in India and Karnataka.
- To study the impact of WTO on agricultural prices in India and Karnataka.
- To analyze the influence of WTO on agricultural expenditure and subsidy by the government.

1.5 Hypotheses:

- There is a paradigm shift of agricultural land from food to non-food crops during WTO period.
- Agricultural Exports have become more volatile under WTO regime.
- Agricultural Prices have become more unstable under WTO regime.
1.6 Database and Methodology

The present study is based on secondary sources. The sources of secondary data has been collected from different reports such as various economic survey reports Directorate of Economics and Statistics, Ministry of Agriculture and Co-operation Government of India and Karnataka, Handbook of Statistics on Indian economy, Directorate General of Economic Intelligence and Services reports-Calcutta, Ministry of Finance, Department of Economic Affairs, Economic Division, Government of India; Annual Reports, Ministry of Chemicals And Fertilizers, Department of Fertilizers Government of India. The data has also been collected from various articles, journals, internet sources like krishworld.com, kissanworld.com. Etc.

Appropriate statistical and econometrics tools have been used to obtain the results by using E-views and SPSS statistical packages.

To measure the impact of WTO on trends in area, production and yield of agricultural crops, paired sample ‘t’ test has been used to know the mean differences and significant value of selected agricultural crops before and after WTO establishment. (From 1974 to 1995 considered as before establishment of WTO and 1996 to till date deliberated as after WTO)

\[ t = \frac{\Sigma d}{\sqrt{\frac{n(\Sigma d^2) - (\Sigma d)^2}{n - 1}}} \]

Where \( \Sigma d = \) Sum of the differences and \( d_i = X_i - Y_i \)

Where \( X_i \) represents before WTO and \( Y_i \) represents after WTO regime.

\( i = 1, 2, 3 \ldots \), \( n \) represents number of observations

\( n-1 \) represents degrees of freedom

To measure the impact of WTO on cropping pattern and diversification in national and state level the study used a dummy variable regression model where the dependent
variable is the area under food and non-food crops and also selected crops. In all the models the independent variable is time, which is divided as before and after WTO period by assigning Zero for the period 1974-1995 and one for 1996-2016.

To measure the impact of WTO on cropping pattern the following dummy variable regression model was used.

\[ Y_t = \beta_1 + \beta_2 T_t + \varepsilon_t \quad \text{t}=1,2,\ldots,n \]

Where \( Y_t = \) area under agricultural crops (for individual crops and all combined crops)
\( T_t = \) Dummy variable (representing the time before and after W.T.O period) which takes the value 1 if \( Y_t \) corresponds to time (after WTO) and 0 if \( Y_t \) corresponds to the time (before WTO). \( \beta_2 \) measures the difference in the area under agricultural crops for period of study(before and after WTO). If \( \beta_2 \) is not statistically significant and has negative sign, it indicates that area has decreased and if it is positive and statistically significant, it shows an increase in the area.

To estimate the volatility in agricultural exports and prices at the national and the state level, the study used Arch and GARCH Model where the dependent variable is selected agricultural commodities. in all the models the independent variable is time and coefficient covariance is computed using Bollerslev-Wooldridge.

To measure the volatility in agricultural exports and prices the following GARCH model(bollerslev) is used:

\[ \text{GARCH} = C(1) + C(2) \text{RESID}(-1)^2 + C(3) \text{GARCH}(-1) \]

Or

\[ \sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 \]

This shows that, the conditional variance of \( u \) at time \( t \) depends not only on the squared error term in the previous time period, but also on its conditional variance in the previous time period. This model can be generalized to a GARCH (p,q) model in which there are p lagged terms of the squared error term and q terms of the lagged conditional variances.
From the above model if $\alpha_1$ and $\alpha_2$ is positive, it suggests that volatility was high in the previous period; it will continue to be high in the current period, indicating volatility clustering. If $\alpha_1$ and $\alpha_2$ are Zero, then there is no volatility clustering.

1.7 Scope of the Study:

The scope of the study reveals that the areas to be covered, in the present study. The impact of WTO on agriculture is either positive or negative. The present study tries to analyze the impact of WTO on agricultural sector at the national and state level. The study takes into consideration a detailed analysis on area, production and yield of agricultural crops from 1974 till date. The study intends to analyze average change in area, production and yield of food crops, commercial crops and other selected agricultural crops before and after the establishment of WTO. It will also analyze the impact of WTO on agricultural exports, agricultural prices, subsidies and expenditure on the agricultural sector at both the national and state level.

1.8 Limitations of the study

1. This study has considered only selected agricultural crops/commodities and not all agricultural crops/commodities.
2. The study is focused on only Karnataka state not any other state in India.
3. The study has considered the data for only a period of 40 years to analyze the cropping pattern before and after WTO period.
4. In this study to analyze the total commercial crops at the national and state level, the study has taken into consideration only major commercial crops on the basis of their significance in the total agricultural area and production.
5. The study employs the dummy variable regression model for only the area under agricultural crops.
6. The study has not taken season wise or variety wise crops; it takes aggregate pooled data.
7. For agricultural exports in Karnataka, data is collected for the period 2001-2016 only.

8. Only wholesale prices have been considered to analyse the agricultural prices. At the national level, the wholesale prices indices have been considered for selected commodities, but at the state level, the wholesale prices have been taken.

9. The study has analyzed agricultural public expenditure at the national level and state level, but subsidies have been taken at the national level only.

10. Finally the study is based on only secondary data.

1.9 Chapter Design:

The study is presented in eight chapters

The first chapter is an introductory chapter, which includes a brief introduction, conceptual framework, and statement of the problem, objectives, hypotheses, scope of the study, database and methodology, limitations of the study and the design of the chapter.

The second chapter is devoted to review of literature, which includes studies relating to cropping pattern and diversification, Studies relating to WTO impact on agricultural exports, studies relating to impact of WTO on agricultural prices, studies relating to influence of WTO on agricultural expenditure and subsidy.

The third chapter includes an analysis of area, production and yield of agricultural crops, in India and Karnataka.

The fourth chapter measures the impact of WTO on cropping pattern and diversification of area under agriculture crops in India and Karnataka.

The fifth chapter focuses on the influence of WTO on cropping pattern across the divisions in Karnataka.

The sixth chapter deals with agricultural exports and agricultural prices in India and Karnataka.

The seventh chapter focuses on agricultural expenditure and subsidies by the government at the national and state level.

Finally the eighth chapter presents the summary, findings, suggestions and concluding remarks of the study.

At the end, the references and annexures have been cited for information.