DOMESTIC AND EXPORT COMPETITIVENESS OF MAJOR AGRICULTURAL COMMODITIES IN INDIA WITH SPECIAL REFERENCE TO TELANGANA

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FOREWORD

The encouraging results of goal-oriented Green Revolution, White Revolution, Yellow Revolution etc. enthuse the agricultural fraternity of the country to set a new goal for 'Agri-Export Revolution' which is not only the need of the hour but also a compulsion to strengthen and revitalize the economy of the country. Liberalization of world trade in agriculture has opened up new vistas of growth. This new economic regime, initiated since early nineties, has led to resetting of the goals of Indian agriculture towards global competitiveness and export orientation without compromising the basic premise of self-reliance. India enjoys competitive advantage in several commodities for agricultural exports because of near self-sufficiency of inputs, relatively low labour costs and diverse agro-climatic conditions. These factors have enabled export of several agricultural commodities over the years. In the basket of agricultural exports, commodities like rice, maize, bengal gram, chillies, cotton have emerged as an important commodity group in the recent past decade. While India holds an important position in the export market for a set of these traditional agricultural commodities, new areas and new commodities are likely to emerge such as live animals and animal products, fruits, vegetables, floriculture, medicinal plants and processed agricultural products. In the next decade, India is likely to witness changes in the export pattern of these commodities due to both internal and external constraints. One of the major internal constraints is mounting cost of production. Similarly, one of the most important external constraints include excessive subsidization by importing countries makes Indian commodities less competitive in the international market. In light of these impending changes, this report examined both domestic and export competitiveness of major agricultural commodities of India in general and Telangana in particular. This report focused on analyzing the growth dynamics of area, production and productivity of crops, export performance, domestic and export competitiveness, growth in exports and imports, changing trade direction of major agricultural commodities during both pre and post-WTO regimes etc. In the context of gaining global access through enhancing the exports of agricultural commodities from India with the advent of trade liberalization, this study is certainly a contributing one. I complement the researchers, Dr. K. Nirmal Ravi Kumar, Director (Agricultural Marketing) and Dr. K.C. Gummagolmath, Director (Monitoring & Evaluation) team in

choosing this research study, using relevant methodologies to analyze the trade related aspects of major agricultural commodities in India and with special reference to Telangana and suggesting policy guidelines for promoting their domestic and export competitiveness. I am sure this publication will be valuable to farming community, different stakeholders of agri-supply chain, agricultural scientists, exporters, students at large and those dealing with planning and promoting agricultural exports.

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CONTENTS

ABBREVIATIONS USED

BI	Balassa Index
CACP	Commission for Agricultural Costs and Prices
CGRs	Compound Growth Rates
COC	Cost of Cultivation
COP	Cost of Production
CV	Coefficient of Variation
DMPs	Domestic Market Prices
FPOs	Farmers Producers' Organizations
GSDP	Gross State Domestic Product
GAS	Gross Area Sown
GVA	Gross Value Added
HYV	High Yielding Variety
IPs	International Prices
LFI	Lafay Index
LPG	Liberalization-Privatization-Globalization
LP	Linear Programming
MEIS	Merchandise Exports from India Scheme
m. tonnes	Million Tonnes
MSP	Minimum Support Price
NPC	Nominal Protection Coefficient
RCA	Revealed Comparative Advantage
RMA	Relative Import Advantage
RSCA	Revealed Symmetric Comparative Advantage
RTA	Relative Trade Advantage
SPS	Sanitary and Phyto-Sanitary
TE	Triennium Ending
TPM	Transitional Probability Matrix
WTO	World Trade Organization

I. INTRODUCTION

Economic reforms and trade liberalization policies have been widely adopted by developing countries to improve their position in world trade. Since 1991, India entered the Liberalization-Privatization-Globalization (LPG) phase to overcome its debt crisis, food shortage and at the same time to gain from net agricultural exports, as it enjoys comparative advantage for majority of the agricultural commodities. With the advent of this LPG phase, more focus is now given towards export promotion through enhancing both domestic and export competitiveness of agricultural commodities. Emphasis on cost-effective and quality production of agriculture gained more significance. With the emergence of World Trade Organization (WTO) in 1995, it was expected that India would be benefited through multilateral trade, as it enjoys comparative advantage with reference to majority of the agricultural commodities and also fulfill the import requirements like pulses, edible oils, technology etc. In this context, a number of studies investigated the effects of trade liberalization on export performance of agricultural commodities in India. Many studies have identified positive effects of trade liberalization on export performance of majority of the agricultural commodities. In the post-WTO regime, Indian agricultural commodities exports performance has undergone paradigm shift through the tremendous structural and qualitative changes (Kehar Singh and Inder Sain, 2003). India is the second most populous country with the fifth largest economy occupying only 13th position in world trade and earning 623 billion dollars of merchandise trade and 294 billion dollars of services trade. In India, agriculture exports have significantly increased by multiple folds from Rs. 60.12 billion to Rs. 2266 billion and registered impressive growth rates during 1990-91 to 2016-17. However, there is huge trade deficit of US$184 billion (US$330 billion of exports and US$514 billion of imports) in 2018. It is now exporting 7500 products to 190 countries and importing 6000 products from 140 countries, enjoying trade surplus with USA, UK, Bangladesh, Sri Lanka, Nepal, UAE, Hongkong, Singapore, Netherlands, Germany, Belgium, Vietnam, Malaysia, Italy etc., and having trade deficit with China, Saudi Arabia, Iraq, Iran, Switzerland, South Korea, Indonesia, Australia, Qatar, Nigeria etc. India's agricultural exports in 2018 were valued at 38.74 billion US dollars and they accounted for 11.76 per cent of the total exports from India. Main agricultural exports were marine products, basmati rice, beef, non-basmati rice, cotton, oilseed meal, spices etc. The agricultural

imports into the country in 2018 were valued at 20.35 billion US dollars and they constituted only four per cent of total imports. Main imports were edible oils, pulses, spices, cashews etc. India's share of world exports was 0.53 per cent in 1994 before the WTO came into existence and this share was increased to 1.71 per cent in 2019. India's share of world imports in 2019 reached 2.5 per cent from about 0.7 per cent in 1994.

With these increased international trade opportunities, the competitiveness of the agricultural commodities also has become an important dimension. In general competitiveness defines the ability of a country to produce and distribute products that can compete in the international market and which simultaneously increase the real incomes and living standards of the producers. However, due to the lack of level playing field among the member nations in the WTO and with increased subsidization to agricultural commodities especially by developed nations, the export competitiveness of majority of agricultural commodities from India is under threat. This is so because, for majority of the agricultural commodities in India, the Cost of Cultivation (COC) is on the rise continuously due to sharp increase in prices of resources like seeds, fertilizers, pesticides, implements, machinery etc., and wages of agricultural labour. On the contrary, the productivity and output of almost all the crops is more or less stable and consequently, the Cost of Production (COP) is on the rise. This further escalated the Domestic Market Prices (DMPs) of commodities over and above the International Prices (IPs) thus, affecting the export competitiveness of majority of agricultural commodities. In general, the competitiveness of agricultural commodities in domestic market is said to be favorable, if they are marketed at the prices that are considerably higher than the COP plus storage, transportation and other marketing charges. Similar, a country is said to be export competitive with reference to a commodity, if its DMP (ie., COP + profit margin) is less than the IP. Thus, prices influence both domestic and export competitiveness of agricultural commodities in the market economy.

In the modern era of agri-business, export competitiveness of commodities is gaining more significance, as it fetches more foreign exchange to the exporting country. The export competitiveness of commodities is influenced by several factors like COP, MSP, DMP realized for the produce/commodity, transaction costs of the commodities up to the port for placing the commodity in the international market, quality of the commodity etc. The same factors are also applicable for the importing countries equally to withstand stiff competition from the imported commodities. In general, the COP of

the commodity (in the previous crop season) helps in determining the MSP, and the DMP realized for the commodity should be higher than MSP for having competitiveness in the domestic market. If the commodity is desired to be exported, the exporter has to incur several transactions costs like freight costs, insurance costs, storage costs etc., till the commodity is placed in the international market. On the imports side, the DMP of the commodity should be less than its import price (after imposition of tariffs), so as to protect the interests of domestic farmers in sustaining the production of the same commodity.

Realizing export competitiveness for the commodities will fetch several advantages to the country like earning significant amount of foreign exchange, slowly capturing the monopoly gains in the international market, quality enhancement of the commodities, planning towards importers' need-based exports, simplification and regulation of procedural formalities at ports for making the exports at rapid pace, strengthening the exports infrastructure at ports, analyzing the tariff levels on the commodities of importing countries and accordingly fixation of export prices, strengthening the trade relationships across the countries etc. These advantages in the liberalized trade regime direct the Government to formulate healthy trade policies favouring significant exports from the country. In fact, the trade environment at the global level guides the country to formulate cost-effective production strategies. Further, the Government should realize in advocating the MSPs to the crops keeping in view the price trends of commodities in the international market. This is because, MSP influences the COP of the commodity at the farmers' level. It is a known that, MSPs were recommended by the Commission for Agricultural Costs and Prices (CACP) to the Government of India based on the data collected on COP of crops at farmers' level by conducting Crop Cutting Experiments on sample basis. Based on CACP recommendations, the MSP will be announced by the Government in the ensuing season just before sowing the crop. It is disappointing to note that, the COP of commodities is increasing at rapid pace when compared with their productivity levels. But, in the competing countries (especially developed countries), the COP of commodities is on the decline due to excessive subsidization through Green and Blue box measures. As a result, the MSP announced by the Government of India based on the COP data may not reflect the realistic benefits at the farmers' level keeping in view of the open trade environment and benefits through gaining export competitiveness.

This is because, sometimes, the MSP of commodities were even higher than IP. For example, the average MSP of maize during post-WTO regime (1999-00) is Rs.580.00/qtl and IP during the same period is Rs. 556.12/qtl. This clearly implies that, maize is not export competitive even at MSP level. This is because, a higher MSP announced by the Government for a commodity will indirectly encourage and support the farmers to increase the COP of the commodity up to the level of MSP. This limits the farmers in adoption of cost-effective production technologies/strategies. Hence, the MSP should be recommended for the commodities taking into consideration their IP. Even though it may appear harsh at the farmers' level in the initial periods, but keeping in view the long term prospects and net trade position of the commodities, this must be followed and simultaneously a strong check should be imposed on inflationary price rise of inputs and other irregularities in trading the commodities.

Keeping in view of the importance of price competitiveness both in domestic and international markets, the price analysis of commodities is very important for two important reasons. First, it analyses the growth in MSP, DMP and IP of selected commodities over a period of time and this enables to understand the pace at which the prices are rising. Second, it helps to assess the instability in prices of selected commodities. Above all, this analysis is very important, because the trade reforms were at rapid pace in developing countries like India during the past 25 years and it is high time now to ascertain the comparative advantage for the commodities in the international market. In this context, the present study has been taken up to analyze the growth dynamics of area, production and productivity of major agricultural commodities, trends in export performance, trade direction over a period of time and export competitiveness of commodities from Telangana. This enables the researchers to formulate strategies for boosting both domestic and export competitiveness of selected commodities with reference to Telangana.

i. Specific Objectives of the study

- To analyze the growth in area, production and productivity of the selected commodities at All-India level and Telangana state.
- To analyze the growth in exports and imports of selected commodities at All-India level.
- To analyze the direction of trade of the selected commodities at All India level
- To analyze both domestic and export competitiveness of the selected commodities from Telangana.

ii. Scope of the study: The expected outcomes from the proposed research study are growth dynamics of area, production and productivity of selected crops, trends in MSPs, DMPs and IPs of selected commodities, prices instability in Telangana state, domestic and export competitiveness of selected commodities from Telangana and trade direction of selected commodities. The study also suggested the requisite strategies to be followed for boosting both domestic and export competitiveness of selected commodities from India with special reference to Telangana.

iii. Scheme of Chapterisation: The present study has been divided into the following seven major chapters:

I. Introduction
II. Context and Review of Literature
III. Data collection and Methodology
IV. Trends in area, production and productivity of selected crops in Telangana
V. Price analysis of selected agricultural commodities in Telangana
VI. Export performance of selected agricultural commodities from India
VII. Constraints and policy guidelines for boosting exports of selected agricultural commodities from Telangana
VIII. Summary and Conclusions

The introduction chapter presents brief background of the study. It highlights about the meanings and importance of domestic and export competitiveness of agricultural commodities. It further elaborates the specific objectives and scope of the study.

Second chapter provides an overview of the literature and the country context.

Third chapter elaborates the detailed methodology adopted for the study. The detailed list of various sources of data from secondary sources and tools of analysis employed has given in this chapter.

Fourth chapter brings about a detailed discussion about background agricultural scenario in Telangana, trends and growth pattern of area, production and productivity of selected crops during both pre and post-WTO regimes, district-wise growth dynamics of selected crops in Telangana and instability of area, production and productivity of selected crops

Growth in MSPs, DMPs and IPs, instability in prices, trends in export competitiveness of selected commodities from Telangana during both pre and post-WTO regimes are discussed in the fifth chapter.

Sixth chapter brings about a detailed discussion about export performance of selected agricultural commodities from India in terms of trends in agricultural exports and imports from India since LPG phase, destination-wise exports, growth rates of exports and imports, instability in exports and imports and trade direction of the selected agricultural commodities from India.

In the seventh chapter, constraints in the exports of selected agricultural commodities from India in general and Telangana in particular and the policy guidelines to boost the same are discussed in-detail.

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II. CONTEXT AND REVIEW OF LITERATURE

Review of literature provides information to the researcher regarding the previous works done in their area of research and thereby helps them in identifying the theoretical framework and methodological issues relevant to the study. It provides the researchers proper direction to carry out their research work and enables them to arrive at meaningful results. Therefore, the past studies were reviewed as per the objectives of this study. However, very few research studies have been carried out in the field of directions of trade of selected agricultural commodities and export competitiveness of agricultural commodities and in this context, this study is certainly a contributing one.

i. Growth in area, production and productivity of agricultural crops: The analysis of growth is usually used in economic studies to find out the trend of a particular variable over a period of time and used for making policy decisions. Sikka and Vaidya (1984) observed that though there has been increase of area, productivity and output of major crops, yet the increase in productivity and output has not been of the desired level. According to Venkiteswaran (1984), the increase in area under perennial crops was not only proportionate but also absolute and was mainly at the cost of area under food crops. The main reason for this chronic food deficit is that more than fifty percent of the cultivated area is allocated to the production of commercial crops. The gradual expansion of area by the non-food grains sector was mainly at the cost of food grains sector. Singh (1988) analyzed that a wide variation amongst the important economic regions in the existing level of agricultural production and productivity as also in the use of inputs. It is worth emphasizing that the agriculturally backward regions posses vast potential for development. Large flow of credit was pre-requisite for improving the use of modern inputs like fertilizers, High Yielding Variety (HYV) seeds, pesticides production and productivity of various crops in different region which could be achieved by encouraging regional specialization of crops. Singh and Singh (1989) reported that vegetables can also be grown under rain fed condition. Many important vegetables like tomato need partial irrigation for maximum productivity during drought condition. Singh (1993) stated that India is the second largest producer of vegetables in the world. The area and production of vegetable was about 4.0 million hectare and 45.0 million tones, respectively and the productivity were 10 tonnes/hectare in the year 1987-88. Atteri and Chand (1997) examined production, consumption and processing

scenario of vegetables in India. It was noted that Bihar, Orissa, Uttar Pradesh and West Bengal were the main vegetable producing states, which occupied 59 percent of the area and contributed about 56 percent of production of vegetables in India. Dahiya and Singh (1997) observed that the prospects for development of horticultural crops such as fresh fruits, mushrooms, floriculture, etc. are very bright since the state has several innate agro-climatic advantages. But apple farming is bedeviled by sharp fluctuations in production due to frequent attacks of several diseases and various other problems that could be attributed to weak efforts at educating the farmers. Kaul (1997) concluded that the area under the horticultural crops in 1994-95 was 14.5 m. ha with an annual production of 119.2 million tonnes. Fruits and vegetables together contributed 90.2 percent of this production and 65.8 percent of total area. The annual growth both in area and production of the horticultural crop has gained momentum. The total increase in area and production registered in 1994-95 over 1991-92 was 18.1 and 24.1 percent with an annual average growth rate of 4 and 8 percent respectively. Fruits, vegetables and also coconut have contributed maximum to this growth. Today India is the largest producer of fruits in the world, having a share of over 10 percent and second largest producer of vegetables with a global share of over 13 percent. Moreover, India leads the world in varietals collections of mango, numbering over 1000 with several man-made hybrids being added to the list. Floriculture and mushroom have emerged as fast growing commodities both for domestic and overseas markets. Ganeshmurty *et al.* (2001) studied location specific strategies for increasing vegetable production in Bay Islands. Vegetables are cultivated only in 3834 ha of land with the total production of 20500 metric tonnes. The average productivity of vegetables was very low (5.35 t/ha) as compared to the national average. Joshi et al (2003) observed that for small holders, vegetable production was an important source of income. It accounted for 66 percent share in the value of crop output. Vegetables contributed about 57 percent. Large farmers also gained much from vegetable cultivation. With about 28 percent of area under vegetable cultivation, about 46 percent in terms of value. Vegetables accounted for about 66 percent of the total value of vegetable production in the production portfolio of large farmers. Anonymous (2004) stated that Maharashtra tops in the tomato productivity that is 33.3 t/ha, followed by Karnataka with 28 t/ha as compared to all India average productivity of 17.4 tonnes/ha. This was primarily due to adoption of hybrid tomato technology in these two states on a large scale being promoted by

private sector seed companies. Saheen and Shiyani (2004) studied that the temporal change in area under different crops revealed significant increase in area under apple, cherry and walnut over time. Moderate to high significant growth was observed in area, production and productivity of all fruit crops for the period from 1974-2002 at state level. Higher instability in production in case of perennial fruit crops is generally the consequent of instability on productivity of the crop. The various factors like irregular rainfall, occasional drought spells, ultimately snowfall, invariable hailstorms and outbreak of pests and diseases could be probable reasons for the high instability in productivity of fruit crops. Goliat and Narayan (2007) reported that the horticulture growth has paramount importance in the way of providing nutritional security, reducing poverty level and generation of employment for the rural mass. It offers not only crop diversification for the farmers, but provides ample scope for sustaining large number of agro-based industries that provides employment in off-season. Kalamkar (2007) found that Maharashtra has the highest area and production in the country devoted to fruits and third largest area vegetables. During the last ten years, there has been significant increase in the area and production of horticultural crops in the state. Maharashtra has potential and plenty of scope to grow various horticulture crops. Different types of soil, diverse agro-climatic conditions, adequate technical manpower, well developed communication facilities, increasing trend in drip irrigation, green house use of cold chain facilities and vibrant farmer organizations offer wide opportunities to grow different horticultural crops in the state. Roy (2007) studied that the state registered a rapid rate of growth of output during 1977-95. While the rate of growth of food grains has been very high, the cropping pattern in most of districts has changed in favor of high-value non-food crops. He also found that the small farmers lagged in the adoption of modern technologies due to inadequate flow of institutional credit besides uncertainty and unfavorable tenurial conditions. Sharma and Pant (2007) observed that the temporal growth in area and production of horticultural crops in Rajasthan. The area under fruits, vegetables and spices has positive growth. The growth in area under fruit crops was negative between 1990 and 1995 and has gained momentum after 2000-01. The landscape of vegetable crops in Rajasthan is bright and their area has shown an increasing trend in the last 15 years. Bera (2008) observed that the area under different crops showed faster rate of increase in area, under horticultural crops compared to cereals for the same period and the percentage change in area of

fruits and vegetable during 1970-71 – 2005-06 indicated that in spite of a decline in net sown area by 1.9 percent the total cropped area has grown by 32.42 percent which helped the state to improve the percentage increase in area under vegetable and fruit crops witnessed the galloping acceleration by 136.3 and 117.3 respectively. In case of production also, the increase in vegetable and fruit was found to be greater than that of total cereals during the period 1991-92 to 2003-04. The annual compound growth rate of area, production and productivity of vegetables of major states of India shows that West Bengal is the only state which shows a positive growth rate in all aspect and in case of fruits except productivity (negative), growth is positive in area and production during 1991-92 to 2004-05. Birthal et al (2008) observed that despite deceleration in its contribution technology has remained an important source of growth in Indian agriculture. Also the diversification of agriculture towards horticultural crops has considerable potential to accelerate agricultural growth. Moreover the horticultural growth is an opportunity for small farmers to raise their income. Chand et. al. (2008) opined that diversification towards horticulture got real boost in the early 1990s which coincided with liberalization of economy. The growth rate in output of fruits and vegetables reached 6 percent and condiments and spices reached almost 5 percent. Those high growth rates in output of horticulture helped in raising growth rates of total crop sector from 2.03 percent in 1980s to 3.02 percent during 1990s despite deceleration in growth rates of cereals and pulses. The main factor underlying diversification in favor of fruits and vegetables has been higher returns relative to other crops. Rai et al (2008) observed that horticultural crops have maintained steady growth in terms of acreage, productivity and production during each of the Period1 -1980-90, Period II- 1990-2000, Period III – 1980-2006. On the other hand, cereals have witnessed negative growth rate in acreage. These crops could maintain positive growth in production on account of some improvement in productivity and production over years. Vegetable and fruit crops have added higher nutritional value as well as increase income and employment opportunity per unit area. The higher biomass production per unit of area has an added advantage in producing organic product. Sahu and Mahapatra (2008) reported that in the green revolution period India's agricultural growth rate was due to supply driven factors but in the post reform period demand driven factors are the driving forces. Urbanization increase in per capita income and changing consumer tastes and preferences have largely shifted the consumption demand from food grain to

high value commodities. Sharma and Kalita (2008) found that the growth of area, production and productivity for all the fruit crops in the state were positive and statistically significant. The production and productivity of the crops were increasing due to combine effect of area and productivity. Singh (2009) found that during the period 1970-2006, the increase in area under papaya and citrus was more than seven times followed by mango (approximately four times) where as in case of banana registered the highest compound growth rate of 6.53 percent followed by papaya (5.97%), mango (4.12%), banana (2.79%), and lowest in guava (2.36%). The production of papaya increased approximately 12 times followed by banana (7 times), citrus (4.5 times), guava (2 times) and lowest increase was observed in mango which was approximately 1.8 times only. He also observed that papaya registered the highest compound growth rate of (5.72%), citrus (4.44%), guava (1.92%) and lowest 1.34 per cent in mango as far as production is concerned. There has been negative growth in productivity in mango, citrus and guava fruit crops whereas the productivity of banana, papaya registered a positive compound growth rate of 2.94 and 1.8 percent respectively. Thirunarukkarasu (2009) observed that land reforms measures were essential to initiate tribal development in order to promote more unproductive utilization of land resources. The land reforms laws should be uniquely designed to suit to each tribal area in our country. In his study he found, no significant change in land use pattern and cropping pattern was found during then 1990-2000. It is due to inadequate distribution of lands through land reforms, the resultant change in socio- economic conditions of the tribal and the soil conditions in the Kalyan Hills. The study in an Agro-Economic Research Centre (2010) highlighted that the prospects commercial cultivation of vegetables in Assam is bright and the trend of vegetable production in the potential area is quite encouraging. The hybrid varieties is benefited the growers with higher return per unit of area. Development of marketing and good storage facilities, careful handling, quick transportation along with development of agro-processing and agri-business supportive services at private and public sectors and considered essential to make vegetable crop cultivation remunerative (Anonymous 2010). Saraswati et al (2012) studied the growth in the area, production and productivity of different crops in Karnataka by using the compound growth function for a period of 26 years from 1982-83 to 2007-08. Growth rates showed a significant positive growth in area under pulses, vegetables and spices and fruits while cereals showed significant

negative growth. The area under jowar, bajra, ragi and minor millets are experiencing a substantial annual decrement. The area under rice has recorded a mild annual increment. The growth in area under oilseeds and commercial crops was negative and insignificant. Similarly, the production of cereals, pulses, vegetables and fruits showed a significant positive growth. The production of oilseeds and commercial crops registered insignificant positive growth. The productivity of different crops recorded significant growth in the case of cereals, pulses and fruits. Productivity of oilseeds recorded moderately positive growth. The productivity of commercial crops registered insignificant positive growth and for vegetables the growth in productivity was insignificant and negative. Ramachandra et al (2013) studied growth in the area, production and productivity under different crops in Karnataka by employing the compound growth function. Growth rates showed a significant positive growth in area under pulses, vegetables and spices and fruits and nuts while cereals showed significant negative growth. The area under jowar, bajra, ragi and minor millets were experiencing a substantial annual decrement. The area under rice has recorded a mild annual increment. The growth in area under oilseeds and commercial crops was negative and insignificant. Similarly, the production of cereals, pulses, vegetables and fruits showed a significant positive growth rate. The production of oilseeds and commercial crops registered insignificant positive growth. The productivity of different crops registered significant growth in the case of cereals, pulses and fruits. Productivity of oilseeds recorded moderately significant positive growth. The productivity of commercial crops registered insignificant positive growth and for vegetables, the growth in productivity was insignificant and negative. Nethravathi and Yeledhalli (2016) opined that Karnataka has a typical composition having a large share of its area under highly diversified agricultural crops, higher growth in agriculture assumes great importance and is a matter of concern for policy planners and research scholars in recent times. The results revealed that Bengaluru urban had the highest CAGR which was 24.26 per cent in productivity in avare was significant at 5 per cent level. In Bengaluru Rural the highest CAGR was 22.26 per cent in productivity of avare (significant at 1%). Production of chrysanthemum had growth of 22.36 per cent was the highest annual growth and 4 per cent (area of tamarind) was found to be lowest instability for selected crops in Chitradurga. In Davanagere the highest CAGR was observed in productivity of tomato (9.12%). In Shivamogga district highest CAGR observed in production of

sunflower to an extent 29.57%. In Tumkuru area under green chillies was growing at rate of 34.46 per cent per annum. Area and production of cereals was observed negative growth but productivity had a positive growth. However, the growth in area, production and productivity of pulses have been increased significantly. Avinash and Patil (2018) in their study concluded that in Karnataka, the growth in area, production and productivity of pulses is positive in all the periods except productivity (-0.82%) in period-I (1980 to 1990). It is important to highlight that though the growth rates of productivity is found negative, but the production found positive in period-I. The country as a whole showed positive growth in area, production and productivity in all the periods but it is worth noting that the production and productivity found positive and significant in all the periods.

ii. Export performance of agricultural commodities:

a. Revealed Comparative Advantage (RCA) of agricultural commodities: In international trade literature, there are two prominent theories on comparative advantage: the Ricardian theory and the Heckscher and Ohlin (H-O) theory. Ricardo (1817), states that absolute production cost difference rather than comparative cost difference is the reason for international trade. However, the H-O theory states that the difference in factor prices across countries is the reason for international trade. In brief, the comparative advantage in classical trade theories is determined by pre-trade relative prices. In autarky, a country has comparative advantage in a particular good if the relative price of domestic goods is below its relative price in the world market. These pre-trade relative prices depend on the relative cost of production. Traditional measures of comparative advantage are based on the comparison of pre-trade relative costs. However, due to the absence of observable data on relative prices and/ or costs, Balassa (1965) has introduced an alternative approach to calculate comparative advantage. This is called the Revealed Comparative Advantage (RCA) index.

Balassa (1965) first calculated RCA index empirically. It had been changed several times (1977, 1979 and 1986). Balassa used post-trade data to calculate the RCA index. The index does not determine the sources of comparative advantage; rather, it tries to identify whether a country has Revealed Comparative Advantage or not. The formula is defined as a commodity's share in total national exports divided by its share

in total world export. If the RCA value of a commodity is greater than one, it indicates that a particular commodity has comparative advantage in exports. If the value is less than one, it indicates that the commodity is at a comparative disadvantage in exports. The RCA index has been widely used to analyse changes in trading patterns (Ferto and Hubbard 2003, Batra and Khan 2005).

Ballance et al (1987) give a simple theoretical relationship between the theoretical notion of comparative advantage and the practical measurement of comparative advantage that we obtain practically. The following diagram shows the relationship:

EC→CA→TPC→RCA.

The Vollrath (1991) index has been used for analyzing the differences in RCA among regions. Ferti and Hubbard (2003) examine the competitiveness of the agricultural sector of Hungary through the calculation of RCA index. A classification of indices as ordinal (assign the ranking by the degree of comparison to the products), cardinal (recognizes the level of comparative advantage or disadvantage for the country) and dichotomous (a type of differentiation in the binary form of products by comparative advantage or disadvantage) used. The study showed that RCA were useful as a binary analysis of comparative advantage, but less cardinal in identifying that particular group had no comparative advantage as Hungary.

Comparative advantages of each country illustrated by the relative price differences between the two countries. The lower relative prices show the higher comparative advantage between the countries. Akhtar et al. (2008) have examined the growth potential of Pakistan footwear industry by measuring the revealed comparative advantage and export performance in the globalized. By measuring through the RCA methodology, the study identified that in the years 2003-06, the footwear industry had converted it's the conditions from negative traded value to positive traded value as compared to the China and India. Kowalski (2011) identified that comparative advantage is an essential factor of trade, whereas the geographic and capital to labor coverage are important factors that explain the trends of business for the industry. There were some other studied factors like energy supply and credit aspects affect the comparative advantage of the country. Some regionally based study between Latin America and Caribbean (LAC) and sub- Saharan Africa (SSA) during the period 1995-2010 of the export category for five sub-sectors of merchandise has been measured by

revealed comparative advantage. Ufuk (2011) evaluated the recent proposed additive measure of Revealed Comparative Advantage index as an alternative to the Balassa (1965) index. He provides a framework to assess their applicability by means of their consistency across various dimensions. He found that these indices are less consistent with the level of deviation from comparative neutral level as cardinal and ordinal measures and that this less consistency is due to the inappropriate normalisation of those deviations. Burianová, and. Belová (2012) calculated the LFI index for trade with EU countries (especially trade with Germany, Slovakia, and Poland) and third countries, and the order of highest Lafay Index (LFI) values was determined. In 2011, in terms of the values of the LFI index, the following commodity aggregation chapters fared the best: CN 10 (cereals), CN 04 (milk and dairy products), CN 24 (tobacco and manufactured tobacco substitutes), CN 17 (sugars and sugar confectionery), CN 01 (live animals). In trade with Germany, the aggregations CN 12 (oil seeds and oleaginous fruits) and CN 22 (beverages, spirits and vinegar) are also in good competitive position. These indicators can serve as appropriate tools for the analysis of foreign trade, and the conducted analyses can be useful information regarding the opportunities for the success of selected commodities on foreign markets.

Further, Shahzad (2015) measured the RCA index for Clothing sector of India, Pakistan, and Bangladesh through Balassa Index for the study. The revealed comparative advantage showed that both India and Bangladesh were lagging in comparative advantage for textiles as compared to Pakistan. Whereas, in the case of clothing, Bangladesh dominated in term of high comparative advantage as compared to India and Pakistan. Yilmaz and Karaalp (2015) measured the revealed comparative advantage of Pakistan to global countries. The study identified that revealed comparative advantage was rising for India, stable for China and fluctuating for Pakistan. The findings reflect that carpet industry has the potential of growth over the years, and it can boost the export performance and employment of the country, considering the growth opportunities of cross border trade in the globalized scenario. Subhash (2016) analyzed the competitiveness of India's agricultural products in world markets. Four indices of Revealed Comparative Advantage (RCA) are employed at the four-digit level of Harmonised System (HS) of Classification for the period 2001 to 2013. Under live animal products, 7 out of 26 products showed Revealed Comparative Advantage. For vegetable products, 19 out of 58 showed strong Revealed

Comparative Advantage. For products like animal or vegetable fat and prepared foodstuff, 3 out of 16 and 8 out of 49 showed Revealed Comparative Advantage respectively. Vishal and Amit (2019) computed Lafay index for handloom commodities. They concluded that, silk and wool are more competitive in the perspective of import from the international market from 2008 to 2017 as compare to other commodities like cotton, carpet and other textile floor coverings, other made-up textile articles set, special woven fabrics and articles of apparel and clothing.

b. Growth in export trade and Direction of Exports

Bandopadhyaya (1982) analyzed the growth rate of India's share in world tea exports, using the simple linear trend equations. The reports revealed that Indian share in total world export of tea consistently declined during the period 1964-78. One of the causes attributed for the shrink in exports was the spurt in the demand for tea in the domestic market due to the population boom. Other associated attributes were low productivity, high cost of production and scarcity of suitable land and capital. Pal (1992) in his analysis on the agricultural exports from India during pre-liberalization period (1970 to 1989) observed that the compound growth rates of export earnings from all agricultural products comprising food and animal products, beverages and tobacco, crude materials and animal and vegetable oils was estimated at 6.67 per cent per annum. The growth of export earnings from fish and fish products was higher with an average annual rate of 12.26 per cent. While the export earnings from forest products was stagnant during the last two decades, the export earnings from agricultural products increased because of the rise in the unit value. Veena (1992) estimated the growth in export of Indian coffee for the pre-liberalization period (1965-1990) using exponential function. The results indicated that export of plantation type coffee exhibited a compound growth of 3.6 per cent annum while Arabica grew at a growth rate of 3.0 per cent. However, Robusta exports registered a marked increase of 10.7 per cent. Jalajakshi (1994) analyzed the growth of exports of shrimps (employing exponential model) from India for the pre-liberalization period (1966-91). Frozen shrimp recorded a positive growth rate due to high demand in the importing countries. Negative growth was observed for dried and canned shrimps which was attributed to the declining demand in the importing countries and increased cost of production in India. Negi *et al.* (1994) observed that country's horticultural exports increased at a compound growth rate of 14.8 per cent per annum during pre-

liberalization period between 1976-77 and 1990-91. The growth rate in export of potatoes was found to be positive (30.8%) while that of dry onion was negative (-3.9%) in value terms. However, it was 23.1 per cent and 9.7 per cent, respectively in terms of quantity. Mamatha (1995) evaluated the growth rates in production and export of selected spices (pepper, chillies turmeric and ginger) for the pre-liberalization period from 1970-71 to 1991-92 and reported that positive growth rates in both production and export of the selected spices were observed mainly due to the increased domestic production as well as increased demand for produce. Sale *et al.* (1997) reported that over the years, export of fruits and vegetables decreased from 95.8 per cent (1982-83) to 37.85 per cent (1991-92) in the total agricultural exports. They stressed that the present level of exports of vegetables were far below the potential that India possesses and suggested the need for devising appropriate policy measures for enhancing production of export quality products to derive the benefits of relatively higher prices in the international markets. Gupta (1998) reported that India's share in world export has increased over a decade from 1970 to 1994 on rice (0.6% to 6.6%), feeding stuffs for animals (1.6% to 3.1%) and cereals (0.1% to 0.9%). Similarly, the share of fruits and vegetables increased from 1.2 per cent in 1974 to 1.7 per cent in 1994. Further, it was observed that former USSR, UAE, United Kingdom, USA, Italy, Singapore, Indonesia, Republic of Korea, Belgium, Saudi Arabia, Holland and Nepal were the important destinations for Indian agricultural products. Thus, if India thinks of augmenting export earnings, it can safely give greater emphasis of agricultural exports and development of new markets should be the primary goal. Erthridge *et al.* (1983) studied the changes in the structure of Texas high plains cotton ginning industry using Markov chain procedures. All projections showed declining number of active ginning firms with large decline in number of small firms and increasing number of large firms. Fialor (1985) analyzed the market share of Ghanaian cocoa exports for the period of 1951-81 using the Markov model. He decomposed the total change in export into the overall market share effect, the direction of trade effect, and the individual market effect. It was observed that there was an overall contraction in Ghana's cocoa exports during this period to the tune of about 38,000 tonnes. Even though there was an expansion in exports due to increase in the overall market share effect as a consequence of increased world demand to the extent about 2,26,000 tonnes and another 15,000 tonnes due to the direction of trade effect; yet the loss through the individual market

share effect was large (2,78,000 tonnes) and this had resulted in the contraction of Ghana‟s export. Srivastava and Ahmed (1986) analyzed the direction of exports from India for the period 1960-61 to 1983-84. The countries such as USA, former USSR, Japan and erstwhile West-Germany had greater share in India's export and import trade. India's exports to the above mentioned five major countries declined over the period of study. The UK no more remained as the principal destination of Indian trade as it was in the pre- independence period. In 1983-84, USA emerged as one of the major trading partners of India. Veena (1992) analyzed the direction of Indian coffee exports in terms of importing country shares over the period 1965-90 using Markov Chain analysis. The projections indicated a declining trend in Indian coffee exports to the USA, Yugoslavia, Netherlands and other importing countries. The increased market shares of the erstwhile USSR in the 1970s and 1980s were subsequently threatened by economic and political upheavals in the region. Jeromi and Ramanathan (1993) noticed significant changes in the direction of pepper exports from India for the period 1975-90. It was observed that nearly 44 per cent of India's pepper exports were directed to former USSR, which constituted about eighty two per cent of the total pepper imports of that country. On the other hand, India not only failed to increase its exports to USA in tune with increased consumption in that country but also could not sustain the quantity exported during the earlier years. Instability was low in case of exports to former USSR, Italy and Canada and higher for Poland, USA and Czechoslovakia. Laxminarayana (1993) studied the direction of Indian silk exports by following first-order Markov process. The major importing countries considered for the analysis were USA, West Germany, UK, France, Italy and Japan. The exports to USA were stable and would remain highly loyal to Indian silk. The probability of exports to the UK, West Germany and Japan switching over to USA was unity, implying that entire quantity of exports to these countries would drift to USA over a period of time. Jalajakshi (1994) in her study showed the changing pattern of Indian shrimp exports between two periods, Period-1 covering the years 1970-80 and Period-II covering the years 1980-90. The study indicated that during Period-I, India could not retain its previous market share in the EEC countries. Nearly, 90 per cent of Indian share was diverted to Japan and seven per cent was diverted to UK. However, in Period-II, India could retain 11 per cent of its previous market share in the EEC countries due to the gradual acceptance of tropical shrimps in these countries. Veena *et al.* (1994) examined the changing directions of Indian coffee

exports in terms of importing country shares over the period 1965 to 1990 using Markov chain analysis. It was observed that India could not retain its previous market share to USA, Netherlands, former Yugoslavia and other importers. However, the actual quantity exported to all these countries has increased which was due to increased quantity of Indian coffee exports. India retained its market share to former West Germany, erstwhile USSR and Italy. The increased market share of USSR in the 1970s and 1980s was then threatened by the economic and political upheaval in the region. Diana (1997) used non-stationary Markov chain analysis to explore the linkages between sector specific policy and sector employment in Oregon, USA. Application of the technique to Oregon's forestry sector and national forest policy demonstrated that macroeconomic forces had statistically important effects on employment while national forest policy measures as timber sold or timbers cut did not. This result raised question about forest policy impact analysis and assumptions inherent in national forest policy implementation. Ajjan *et al.* (1998) analyzed the direction of trade of senna and periwinkle in India using Markov Chain analysis. The probability of Germany and USA retaining their import shares of senna in the years to come were estimated to be 0.8258 and 0.8188, which clearly indicated that these two countries would retain their import share in the same position as 1977. Mandanna *et al.* (1998) analyzed structural change in India's tobacco exports for the period 1980-81 to 1994-95 using Markov chain analysis. The study revealed that the USSR, the largest market for Indian un manufactured tobacco, had a high degree of loyalty for Indian tobacco during the period 1980-81 to 1985-86, but it diminished substantially during the period 1985-86 to 1994-95. The markets of Western Europe, Asia and the Middle East had taken the place of the USSR. Among the manufactured products, only cigarettes had a dominant presence in the export basket. The diversification of export market is clearly evident, necessitating efforts in the direction of brand building for Indian tobacco. The tobacco board of India can initiate this exercise. Measures should also be initiated to improve the export competitiveness of Indian tobacco in the world market. Srinivasamurthy and Subramanyam (1999) analyzed the direction of onion trade by using Markov chain model during the year 1980-81 to 1995-96. The major gainer among importers of Indian onion over a period of time was Malaysia which was having a transfer probability of 0.6459 from Saudi Arabia and 0.3488 from UAE; Sri Lanka, in addition to having high probability of retention of its own share, was also likely to gain from Saudi Arabia with

a moderate probability and a gain of 0.3488. On the other hand, Saudi Arabia which was having zero probability of retention of own share of exports of fresh onion was likely to gain to some extent from Bangladesh and other countries. Shivaraya (2000) studied the changes in trade directions of exports of selected vegetables using Markov chain analysis. The results of the study revealed that UAE and Malaysia were the loyal markets for the Indian onion. In case of potato, Sri Lanka and Nepal were found to be the most loyal markets whereas; Bangladesh and Nepal were the most stable importers of Indian fresh tomatoes. Angles *et al.* (2001) used Markov chain model for assessing the direction of trade and destination of Indian turmeric. The results of Markov Chain analysis showed that previous export share retention for Indian turmeric was high in UK (42.99%) and countries pooled under others category (58.77%.) The countries such as USA, Iran, Japan and UAE were not stable importers of Indian turmeric. The plans for export may be oriented towards those two and also plans should be formulated for stabilizing the export to other countries. Desai (2001) used Markov Chain model to analyze the trade direction of export of Indian fresh mango and mango products. Japan was one of the most stable countries, among major importers of Indian fresh mango as reflected by its high probability of retention (1.00). In the case of mango pulp, other countries had the highest probability of retention (42.90%) followed by Saudi Arabia (24.00%) while, Netherlands, UK, Kuwait and UAE were unable to retain their share as reflected by their probability of retention of zero. The transitional probability estimated for mango slices in brine showed that UK was the most stable country among major importers of Indian mango slices in brine which was reflected by its high probability of retention (0.782). Mahesh (2000) analyzed the structural changes in Indian tea exports by employing the first order Markov model. The transitional probability matrix indicated that the countries like United Kingdom, USSR, Iran, UAE, Saudi Arabia and other importing countries retained their previous shares of Indian tea while rest of the countries like Germany, Poland and USA could not retain their previous shares of Indian tea. Jayesh (2001) used Markov chain analysis to study the direction of trade and changing pattern of pepper and cardamom exports from India. The results of Markov chain analysis indicated that exports of Indian pepper were likely to be concentrated in USA and Russia. Similarly, cardamom export was likely to be concentrated in Japan and Saudi Arabia. A high dependence on one or two export markets would increase the trade risk in the long run. Hence, it was suggested to evolve

appropriate export promotion strategies to diversify the geographical concentration. Especially in case of cardamom exports, steps should be taken to enhance Indian exports to other countries of Middle East along with Saudi Arabia, since this region was the major consumer of cardamom in the world. Sananse et al. (2004) studied basmati rice export from export potential point of view and found that rice has greater competitiveness. Mahadevaiah et al. (2005) analyzed the dynamics of changes in the export of cotton from India by estimating the probability of retention and switching pattern by employing a first order Markov chain model. Purohit et al. (2008) used two state Markov chain model to find the probabilities of occurrence of dry and wet weeks and also carried out weekly analysis of rainfall at Bangalore. Indian spices exports have been able to record strident gains in both volume and value. Spices exports have registered substantial growth during the last five years, registering a compound annual average growth rate of 21 per cent in value and 12 per cent in volume (Spices board, 2013). Ansari & Khan, (2015) also employed compound annual growth rate and Balassa's revealed comparative advantage index to find export performance of agricultural commodities. The results revealed that India has comparative advantage in export of some agricultural commodities such as meat and edible meat, oilseed, coffee, wheat, rice and tea. Deepika et al (2015) observed that the countries which were stable destination for Indian spices export were Canada for black pepper, UK for chillies, Bangladesh for turmeric, UAE for cumin and Malaysia for coriander. The transitional probability matrix obtained indicated that most of the traditional importers have shown low retention probability which may be due to tough competition arising in spices trade and trade related barriers in the developed nations. Suresh and Mathur (2016) analyzed the growth performance of agricultural exports in India by using trend growth, percentage share, compound annual growth rate (CAGR) and Revealed Comparative Advantage (RCA) index. The author found that there was an improvement in the growth rate of export of agricultural commodities. The comparative advantage improved for some plantation crops but declined for rice and wheat. Shilpashree et al (2017) analyzed the pattern of export, import and balance of trade of sheep and goat meat in India. From the results, India is largest exporters of sheep and goat meat to the world. The country has exported 16.05 thousand MT of sheep and goat meat to the world for the worth of Rs. 425.63 crores during the year 2012-13. Domestic demand for the sheep and goat meat has also been increasing consistently, which may further preclude it to expand its

export. The study was also undertaken to find out the direction of trade of sheep and goat meat using Markov Chain Analysis. The results also revealed that India's previous export to the United Arab Emirates market was retained to the level of 17 per cent during the current period. India could not retain its previous import to Australia, Singapore and United Arab Emirates during the study period. The entire share of Australia was directed to Singapore whereas the entire share of Singapore was directed to other countries. India's previous sheep and Goat meat import to the Thailand market was retained to the level of 100 per cent during the current period. India's previous Sheep and Goat meat import to the other countries was retained to the level of only 18 per cent during the current period.

c. Export Competitiveness of Agricultural Commodities:

Studies measuring the competitiveness of agricultural commodities in India have relied extensively on the computation of Nominal Protection Coefficient (NPC), which is a ratio of the domestic to border price after making due adjustments. This technique has been used by Baldwin (1975), Bhagwati and Srinivasan (1975) and Roningen and Yeats (1976). With the assumption that the domestic price is distorted and the border price is a free trade price, the difference in these two prices shows the amount of total protection through the tariff and the non-tariff barriers in the output market. An NPC greater than one would mean that the commodity under consideration is protected (imports are restricted) and has potential for imports, whereas an NPC less than one would mean that the commodity is taxed (as exports are restricted) and has potential for exports. Freeing trade barriers would lead to integration of domestic and border prices leading to competitive equilibrium in the international markets. When there is no barrier to trade of any kind the domestic price is equivalent to the world price and NPC is equal to one. There are a few studies on the empirical measurement of protection on agriculture commodities in India but we do not come across many studies analyzing competitiveness of plantation commodities. Umapathi (1994) estimated export competitiveness of cotton in Chitradurga district. The NPC computed for DCH-32 cotton from 1983-84 to 1991-92 under exportable and importable hypothesis indicated an overall situation of antiprotection to cotton cultivation in the study area. The NPCs were found lower than one and implied that DCH-32 seed cotton would be an efficient export as well as an efficient import substitute crop. Maji (1996) estimated the NPC for Indian rice to be less than one indicating potential benefit from

export to obtain the higher international prices. Ravi and Reddy (1998) used NPC technique to work out the export competitiveness of jowar, maize, groundnut, sunflower, cotton and coffee from Karnataka under the importable and exportable hypothesis for a period of ten years from 1984-85 to 1994-95. The results revealed that among the six commodities, Karnataka lacked comparative advantage in most of the crops except cotton. The export potential of jowar, maize, groundnut and sunflower were found to be significantly low. Viswanath (1998) studied the competitiveness of rice in Karnataka during the year 1990-91 to 1994-95. The NPCs were estimated under importable and exportable hypothesis and results indicated that the NPC‟s for fine and medium quality rice was the highest compared to other zones. The NPC for fine and medium quality rice in Hilly Zone was 0.69 and 0.62 respectively, which were the lowest compared to other zones. The NPCs were below unity in all zones and thus domestic rice was an efficient import substitute. Tamanna *et al.* (1999) examined the export potentialities of fruits from India by using Nominal Protection Coefficient, which is the ratio of domestic price to the border price. On an average, the NPC value in mango (0.87), grape (0.59) and banana (0.49) were lower than one indicating their competitiveness in international market. Ashalatha (2000) analyzed the export competitiveness of Indian cashew using NPC technique. Under the exportable hypothesis the NPCs were found to be less than unity with an average value of 0.91, implying that the Indian cashew kernel is competitive in the international market and is an efficient export commodity. Mahesh (2000) studied the export competitiveness of Indian tea exports using NPC methodology. The results indicated that under importable hypothesis, the NPC was 0.71 and under exportable hypothesis, it was 0.98, implying that Indian tea exports were competitive and also good import substitute. Shivaraya (2000) studied the export competitiveness of Indian fresh vegetable using NPC technique. The results of the study revealed that all the vegetables considered-onion, potato, and tomato were competitive for their exports to other countries, since the NPC values were lower than one. Ali and Ahmad (2001) studied the export competitiveness of Indian meat industry. They concluded that export of bovine meat was constrained due to increased domestic demand resulting in higher domestic prices. The export of poultry meat was not competitive due to higher cost of production and higher domestic prices. Only bovine and pig meat was competitive in the global market. The potential reforms in the international trade and policy and implementation of WTO norms would

reduce restrictions on trade and protection of domestic meat industry. This may bring new greater competitiveness for different species of meat as producer prices in India were lesser as compared to other major countries. Jayesh (2001) examined the export competitiveness of pepper using NPC. The NPC of less than unity (0.817 for Sirsi and 0.849 for Calicut) indicated that pepper was competitive for its export to other countries from Sirsi (Karnataka) and Calicut (Kerala) markets. Kumar *et al.* (2001) concluded that exports of potato from India have been fluctuating and was quite negligible compared to the total potato production. The NPC for potato was largely above one (1.23) when the Official Exchange Rate (OER) was used, indicating marginal export competitiveness. The competition that a country offers in the international markets for its export depends on a number of factors. Deepika (2003) has estimated NPCs under importable and exportable hypothesis for given set of agricultural commodities like cashew, pepper, tea, coffee etc. NPC has emerged more than one under exportable hypothesis but less than one under importable hypothesis for cashew indicating that the commodities neither have an import threat nor export potential seen in terms of price differences. Ohlan, 2008 attempted to measure the impact of WTO on Indian agriculture and analyzed the competitiveness of Indian major crops for the time period 1994-95 to 2003-04 and brought out the fact that the competitiveness of Indian agriculture declined under exportable and importable hypothesis. Nagoor (2010) makes a price comparison for cardamom, tea and coffee and found that domestic price for coffee and tea is less than world price of coffee and tea and domestic price is greater than world prices of cardamom. Since 2008, India faced with a surplus of wheat due to excess domestic production which was due to domestic support policies that restrict India's world trade (National Trade Report, 2014). Hereby, we would expect that trade supporting policies and WTO provisions in this regard during economic have not been much supportive to enhance competitiveness of Indian wheat under exportable and importable hypothesis. Kanaka and Chinnadurai (2015) studied export competitiveness of groundnut in India and they concluded that, in the post WTO period, the competitiveness of groundnut improved significantly as supported by the estimates of NPC and DRC, which turned out to be less than one. However, results are in contradiction with the results of Reddy et al., (1998) and Ravi and Reddy (1998). Under exportable hypothesis it is assumed that Indian groundnut would compete with US groundnut in Europe (Rotterdam). The NPC's were above unity in the pre-WTO period

that relatively groundnut was not an efficient export crop. But during post WTO the magnitude of state subsidy in the form of fertilizer subsidy has come down drastically due to decontrol of phosphatic fertilizers and real prices of groundnut by and large have remained constant during this period. Perhaps these factors might be rendering groundnut competitive internationally in the post WTO period. Darekar et al (2015) in their study concluded about the existence of high instability in export of onion. The values of coefficient of variation in export of onion have come down during the post – WTO than Pre-WTO period. However, stability in export from India is more in case of Singapore, Sri Lanka, U.A.E., Saudi Arabia and Mauritius. Also, more instability in export was observed for Bangladesh, Kuwait, Nepal, Qatar, Oman and U.K. Onion has shown competitive disadvantage during the pre –WTO period, as values of NPC are more than one. But, during post – WTO period, the competitiveness has increased as in evident from the NPC values which turned out to be less than one. Sonu and Rajni (2018) opined that Indian wheat has not been competitive in a regular manner under both exportable and importable hypothesis. Indian wheat has been found to be competitive under importable and exportable hypothesis during the period 1991-92 to 2000-01 and during 2011-12 to 2015-2016, but not competitive during 2001-02 to 2010-11. So far as, export competitiveness of Indian wheat is concerned, the analysis reveals that there is competitive disadvantage in the wheat exports as compared to rest of world. Lamtule et al (2018) in their study revealed that during pre-WTO period Bangladesh, Portugal, Singapore, Spain, Sri Lanka, Switzerland, UAE, UK, and USA were highly unstable importers of Indian cotton. It is observed that during post-WTO period Bangladesh, Indonesia, Nepal, Portugal, Republic of Korea, Singapore, Spain, Sri Lanka, Switzerland and UAE were highly unstable importers of Indian cotton. While China and Japan were the most stable importers of Indian cotton during post-WTO period. The results of the NPC values for both the pre-WTO and post-WTO period indicated that the coefficients were less than one for all the years. It indicates that there was a more scope for export of cotton i.e. cotton was dis-protected in India. The average NPC value for pre-WTO period (0.34) and post-WTO period (0.38) indicated that the unit price of the Indian cotton in the domestic market was not much competitive in the international market.

d. Constraints in exports of agricultural commodities

Islam (1990) mentioned that the entry of horticultural produce in to export market was constrained due to the lack of specialized nature of export–related infrastructure, including strict quality and sanitation standards as well as established consumer preferences for specific products in particular markets. The author concluded that organization of an effective system of packing, processing, storage, transportation and distribution, both nationally and internationally, was crucial to success in horticultural exports. Chakrapani (1994) reported that no attention had been paid to develop the export of fruits and vegetables in India. Fruits and vegetables were exported from India mainly to UAE and UK during 1992-93. However, these products being perishable needed proper attention at all stages right from marketing. But, unfortunately sufficient attention had not been paid in this direction. Prasad (1994) identified the discriminating or distinguishing variables that influenced land use pattern and farming systems in Karnataka using simple correspondence analysis. This methodology was found useful to analyze categorical data such as individual districts arranged against cropping pattern and farming systems. The methodology is also used in other qualitative analysis processes like psychometric and environmental valuation of species. Vyas (2004) suggested the following preconditions in order to increase exports of fruits, vegetables, flowers, etc., (a) vertical integration of small holdings with appropriate secondary and tertiary organizations for input supply, quality control, marketing and processing (b) the infrastructure support in terms of communication, transport, cold storage, etc., and (c) development of economic and social infrastructure. Singh (2005) studied the post-harvest technology of mangoes and observed that in order to export fresh mangoes there was an urgent need to adapt a host of modern innovations in post-harvest technology. Measures suggested were harvesting at optimum maturity, washing, cleaning, waxing, fungicidal treatment, size and colour grading, sorting of fruits according to their varietal characteristics, removal of damaged, defective, diseased and pest-attacked fruits, pre-cooling and cold storage at the prescribed temperatures and relative humidity, transportation in well aerated and cooled wagons/trucks (for domestic market) and in refrigerated containers for distant export markets by ship and air cargo, delivery within the time schedule at contracted price and quality and strict adherence to phytosanitary standards. Rao and Gopal (2008) studied the export of horticultural crops from Andhra Pradesh and observed that mangoes and

onions were exported in large quantities to foreign countries. The major constraints in increasing export of fruits and vegetables to the international markets were poor quality, premature harvesting of the fruits leading to reduced shelf life and low sugar content, lack of adequate knowledge of the quality standards in international market by both farmers as well as the merchants, poor storage and transport facilities, carelessness in handling of fruits and vegetables at various stages of picking, packing and transportation. Thus, the author opined that the promotion of export of fruits and vegetables in the state needs dissemination of knowledge on international standards of quality, export policies, duties, subsidies and taxes, freight, etc., to all stake-holders from growers to exporters as well as strict supervision and control on quality for export. Gajanana and Subramanyam (2009) studied the main constraints in the production and marketing of anthurium in Karnataka and Kerala. Non-availability of required quantity and quality of planting materials, high cost of seedling and incidence of pest and diseases were the major constraints in the production of the flowers. As regards to marketing, absence of organized market was the major problem followed by non-availability and high cost of transportation. Besides, exploitation by the florists in the form of delayed payment and purchases of only quality flowers were the other constraints faced by the growers in marketing of anthuriums. At international level, the use of non-tariff barriers like sanitary and physto-sanitary measures (SPS) and technical barrier to trade (TBT) by importing countries have affected the mango export from India. The US banned import of Indian mango in 1989 on account of excessive usage of pesticides and fear of invasion of fruit flies and stone weevil and India had to offer reduced pesticide levels and Hot Water Treatment (HWT) as a viable measure of pest control (Rastogi 2011). In 2006, after prolonged negotiations, US permitted import of Indian mangoes with nuclear irradiation and strict inspection. The inspection norms were prohibitively strict as inspection in India by US inspectors increased the cost of mango manifold and rendered it uncompetitive (Sen 2007, Rabinowitz 2007). However, after further negotiations, US agreed for nuclear irradiation and routine inspection only. The EU also imposed ban on imports of Indian mangoes including the *Alphanso* along with four vegetables after observation of fruit flies in 207 consignments of produce. Indian system of exports controls failed to meet the international standard for years henceforth, Indian businesses and government need to address the concerns of EU by putting in place elaborate examination and certification procedure. Kavita et

al (2015) concluded that domestic supply of mango is mainly driven by expansion of area rather than productivity. High standards of SPS measures of importing countries raised cost of compliance of safe export norms for which Indian exporters faced problems to adjust to these standards. These challenges need to overcome through generation of research based scientific knowledge for structuring food safety norms and policy alignment according to the changing global regulations. Policy options for streamlining diversified export are to encourage food testing laboratories to get accreditation from international agencies setting up world class food testing and inception infrastructure particularly in clusters with significant presence of exporters to encourage importing countries to set up office for certification of export consignments, and to strengthen prerequisite physical resources for safe export of fresh mango. Suresh and Mathur (2016) opined that the comparative advantage improved in case of cotton, maize, and certain fruits and vegetables over time, but declined in case of some plantation crops, rice and wheat. In case of plantation-based spices and other commodities, India is gradually losing its comparative edge, mainly to Asian countries. Improving the comparative advantage in export warrants generation of exportable surplus and internationally competent prices. There was wide variation in the growth in productivity of various crops and crop groups. Productivity improvements would be a potential factor that would determine India's ability to generate exportable surplus, comparative advantage and export growth.

III. DATA COLLECTION AND METHODOLOGY

Based on the review of literature, it was noticed that though several studies dealt with trade performance of agricultural commodities, none of them tried to study the trade of agriculture commodities from India in general and with special reference to Telangana during pre-WTO and post-WTO regimes. Further, none of studies attempted to give pre-WTO and post-WTO agriculture production and trade related statistics. Therefore, the need to address various issues related to Indian Agricultural trade with special reference to Telangana during pre-WTO and post-WTO regimes arises. This study will definitely bridge the gap by addressing these issues.

As mentioned earlier, the present study is designed to analyze the growth dynamics and instability of area, production and productivity of selected crops in Telangana state; growth in MSPs, DMPs and IPs of selected commodities in Telangana during both pre and post-WTO regimes; domestic and export competitiveness of selected commodities in Telangana during both pre and post-WTO regimes; export performance of selected agricultural commodities from India during both pre and post-WTO regimes and trade direction of selected agricultural commodities from India. Thus, this study is conducted in Telangana state, as it holds significant share in total production of paddy (5.98%), bengal gram (2.74%), maize (10%), chillies (20%) and cotton (10.40%) at All-India level during 2016-17. For this study, top five districts viz., Adilabad, Karimnagar, Mahabubnagar, Nalgonda and Warangal in terms of area are selected after aggregating the total area under these selected crops. It is estimated that, these five selected districts contributed around 73 percent of total cropped area in Telangana (Table 1). After listing the mandals and villages across the selected districts, two mandals from each district and two villages from each mandal with highest aggregated area under these selected crops are selected. From each village, 10 farmers are selected for each crop.

Table 1: Sampling design of the study in Telangana

Crop	State	Districts	Mandals	Respondents
Rice	Telangana	Adilabad Karimnagar Mahabubnagar Nalgonda Warangal	2	200
Maize			2	200
Red Chilli			2	200
Bengal gram			2	200
Cotton			2	200
Total			**10**	**1000**

Note: i) 20 respondents in each mandal for each crop ii) 2 mandals in each district

Sources of Data: This study is based on both primary and secondary data. The secondary information on area, production, productivity, exports, imports, DMPs, IPs, exchange rates, export and import trade data, trade destinations, transportation and storage costs, port charges etc, of selected commodities are collected from different authentic sources such as Directorate of Economics and Statistics (DES), Statistical Year Book (2018), Director General of Foreign Trade (DGFT), Food and Agriculture Organization (FAO), State Agriculture Produce, Processing and Export Corporation Ltd, Container Corporation of India etc. Primary data are collected from sample farmers pertaining to the constraints in transacting the selected commodities with the help of a pre–tested schedule and the same data are subjected to relevant statistical analysis.

Data Collection: Primary and secondary data are collected on variables such area, production and productivity of the selected crops. In addition to that, data are also collected regarding quantities and value of exports and imports of selected commodities, MSPs, DMPs and IPs, internal transportation costs, port charges, storage costs, freight charges, exchange rates etc.

Statistical Techniques employed: The following techniques are employed to arrive at the realistic conclusions from the study:

i. Compound Growth Rates (CGRs): CGR analysis is employed through fitting the exponential function to the variables of interest viz., area, production, productivity, exports, imports, MSPs, DMPs, and IPs of the selected commodities at All-India level and in Telangana for the selected reference periods during both pre and Post-WTO regimes. The CGRs are calculated by fitting the following exponential function:

$$Y_t = Y_O (1 + r)t \quad (1)$$

Taking log on both sides, we will get

$LnY_t = LnY_O + t\ Ln(1 + r)$

$LnY_t = a + bt$ (2)

where,

$a = LnY_O$

$b = Ln(1 + r)$

Y_t = area/production/productivity/exports/imports/MSPs/DMPs/IPs

Y_O = Constant

t = time period in years and

b = regression coefficient

% compound growth rate = (Antilog b-1) × 100 (3)

ii. Revealed Comparative Advantage (RCA): Balassa Index (BI), its related indices and Lafay Index (LFI) are computed to determine the RCA of selected commodities being traded over the years during both pre-WTO (1971-1994) and post-WTO (1995-2017) regimes.

a. Balassa Index (BI): Balassa defined the method of calculating the revealed comparative advantage. It is a ratio of traded products of the industry by a particular country to the world and total trade of that country to the world. (Vollrath, 1991, Bojnec, 2001).

$$RCA_{ij} = RXA_{ij} = RCA_1 = \frac{X_{ij}/X_{it}}{X_{wj}/X_{wt}} \quad (4)$$

where,

RCA_{ij} = Revealed Comparative Advantage of the i^{th} country for the j^{th} product.

X_{ij} = j^{th} commodity exports by the i^{th} country,

X_{it} = Total commodity exports of the i^{th} country,

X_{wj} = World exports of j^{th} commodity,

X_{wt} = Total commodity world exports

. The calculated value of the above BI lies between 0 (zero) to infinity. If the value of the index is greater than one, then it shows that country ‘i’ have revealed comparative advantage in product ‘j’ and the value less than one indicates the country ‘i’ shows its comparative disadvantage capability in the product ‘j’. The calculated

RCA by BI was further re-defined by Dalum et al. (1998), Laursen (1998) and Widodo (2009) and this modified RCA became Revealed Symmetric Comparative Advantage ($RSCA_{ij}$). The value of RSCA lies between -1 to +1. A modified formula is as below:

$$RSCA_{ij} = \frac{RCA_{ij}-1}{RCA_{ij}+1}$$

$RSCA_{ij}$ represent the revealed symmetric comparative advantage the country 'i' enjoy for product 'j' when the value will be above 0 (zero) and *vice versa* if the value will be below 0 (zero).

The RCA_{ij} shows how a product is competitive in a country's exports compared to the product's share in another country or group of countries. A product with a high RCA_{ij} is competitive and can be exported to countries with a low RCA_{ij}. Countries with similar RCA_{ij} profile are likely to have high bilateral trade intensities unless intra-industry trade is involved (Chandran, 2010). Under the assumption that the commodity pattern of trade reflects inter-country differences in relative costs as well as non-price factors, the index is assumed to "reveal the comparative advantage of the trading countries (Shinoj & Mathur, 2008)". The advantage of using the RCA_{ij} index is that it considers the intrinsic advantage of a particular export commodity and is consistent with the changes in an economy's relative factor endowments and productivity. The disadvantage, however, is that it cannot distinguish between improvements in factor endowments and the pursuit of appropriate trade policies by a country (Batra & Khan, 2005).

However, RCA_{ij} (ie., BI) suffers from the problem of asymmetry as 'pure' RCA is basically not comparable on both sides of unity as the index ranges from zero to one if a country is not specialized in a given commodity while it ranges from one to infinity if a country is specialized. Some procedure has been proposed to alleviate the problem of asymmetry, such as the logarithmic transformation of the Balassa measure (Vollrath 1991). Vollrath (1991) proposed three alternative measures of RCA. These alternative measures have been given in the context of service sector in the studies of RCA of Service Sectors in Developing Countries (Belay Seyoum, 2007), which have been modified further in the context of commodity sectors under study.

- Second RCA index (RCA_2) considers exports and imports within a particular commodity sector which is derived by subtracting a country's Relative Import Advantage (RMA) from its relative export advantage (RCA_1) and it is referred as Relative Trade Advantage (RTA) index. The RMA is computed as follows:

  $RMA_{ij} = \frac{M_{ij}/M_{it}}{M_{wj}/M_{wt}}$

  where,

  RMA_{ij} = Import advantage of the i^{th} country for the j^{th} product.

  M_{ij} = jth commodity imports by the ith country,

  M_{it} = Total commodity imports of the ith country,

  M_{wj} = World imports of jth commodity,

  M_{wt} = Total commodity world imports

  So, $RCA_2 = RTA = RCA_1 - RMA_{ij}$

  $RCA_2 = RTA = (\frac{X_{ij}/X_{it}}{X_{wj}/X_{wt}}) - (\frac{M_{ij}/M_{it}}{M_{wj}/M_{wt}})$ (5)

  where, X = Exports and M = Imports

- The second alterative measure proposed by Vollrath is the logarithmic transformation of the RCA_1 and is expressed as follows:

  $RCA_3 = \ln(RCA_1)$ (6)

  where, RCA_3 = Third measure of revealed advantage

- The third alternative measure proposed by Vollrath is Revealed Competitiveness (RC), which is expressed as the difference between the logarithms of Relative Export Advantage ($RCA_{ij} = RCA_1$) and the RMA_{ij} and expressed as follows:

  $RCA_4 = RC = \ln(RCA_{ij}) - \ln(RMA_{ij})$ (7)

  RCA_4 = the fourth measure of RCA

  Positive values (>0) of above three alternative measures indicate the RCA, whereas a negative value (<0) indicates the revealed comparative

disadvantage. This report employed all the four RCA indices mentioned above (Equations 4 to 7) to estimate India's RCA in agricultural products. Further, to check the stability of the RCA indices, the Coefficient of Variation (CV) is computed.

Consistency Test of RCA: The study conducted consistency tests for RCA indices proposed by Ballance (1987). These are the cardinal measures and ordinal measures. He pointed out that the RCA indices can be interpreted in the following two ways:

- RCA can provide information regarding the degree of comparative advantage a commodity has compared to another commodity (cardinal interpretation). This cardinal measure is based on correlation coefficient between paired indices over the period.
- the commodities may be ranked on the basis of their RCA (ordinal interpretation). The ordinal measure is based on rank correlation coefficient between paired indices over the period.

b. Lafay index (LFI): To reduce the empirical weakness of the BI, LFI is used. It is an index that combines production and trade variables. The LFI is an index that measures the trade specialization concerning the specific product. The specialization of the country's trade is denoted by the higher positive value of the calculated index, whereas the negative value of index shows despecialization. The greater values of indices, the higher the degree of specialization/despecialization of country's trade in a particular production.

This index evaluates the normalized trade balance of the particular country 'i' for a specific product 'j'. The normalized trade balance is the ratio of the trade balance for the product and to the total traded value.

$$LFI_{ij} = \left[\frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}} - \frac{\sum_{j=1}^{N}(X_{ij} - M_{ij})}{\sum_{j=1}^{N}(X_{ij} + M_{ij})}\right] * \frac{X_{ij} + M_{ij}}{\sum_{j=1}^{N}(X_{ij} + M_{ij})} * 100$$

where, X denotes the export of i^{th} country for the product 'j', and 'M' is the import of that product. If the calculated index has a positive value for product 'j', it indicates the comparative advantage of the country and a high level of specialization on the product

'j'. If the calculated index has negative value, then it shows the reverse characteristics like comparative disadvantage and low degree of specialization of the particular product. 'N' is the number of items analyzed. If we break the LFI index into three categories, namely LFI_1, LFI_2, and LFI_3, following representations are as follow:

It is cleared that, $LFI = (LFI_1 - LFI_2) * LFI_3 * 100$.

The first element LFI_1 measures the net export for the given commodity by way of the turnover for such commodity; this is the well-known Balassa RCA index. The second element LFI_2 compares the total net export (the sum for all commodities) to the total turnover. The parenthesis consists of two elements of the index, namely LFI_1 and LFI_2. If the value of LFI_1 is higher than LFI_2, then RCA index of the particular commodity is higher than the RCA assessed as the sum for all commodities. The third element LFI_3 adjusts the value of the parenthesis; it expresses what share the given commodity has in the total turnover. A positive value of index shows the high comparative advantage, and degree of specialization and negative value signals that comparative advantage is lacking and despecialization (Zaghini, 2005).

By definition, LFI sustain symmetricity among all commodities of the country and the sum must be zero of for all sectors of a given country. The LFI calculates specialization for a commodity 'j' in the country 'i' also relates the contribution of the product in the trade balance of the country alongside the country's entire trade balance and its share of trade. Even though RCA indices reflect relative measures, so calculated results must be noted carefully and with information about their restrictions. The results should be appropriately analyzed with an understanding of limitations. A study of revealed comparative advantage of the commodities helps explain the change in export specialization and structural transformation.

iii. Nominal Protection Coefficient (NPC): The NPCs were estimated for selected agricultural commodities under exportable hypothesis during both pre and post-WTO regimes in order to measure the extent to which DMPs diverge from border equivalent prices (IP). The exportable hypothesis is followed in the context, when the domestic crop is an actual or potentially to be compete in foreign markets. That is, under exportable hypothesis, the domestic goods compete with a foreign product at the foreign port or in foreign market.

It was estimated as follows:

$NPC = P_d/P_b$

where, P_d = DMP; and

P_b = the border equivalent producer price.

The border equivalent prices or world prices adjusted for transport, marketing and processing costs, were estimated to serve as yardstick to indicate the extent to which domestic prices have been distorted by the various Government interventions. The border equivalent producer price at the farm gate was derived by deducting ocean freight and insurance charges from the world price to obtain f.o.b. border price. From the latter, transport, processing and marketing charges from the farm to the domestic market were deducted and the value of byproducts was added to arrive at the border equivalent producer price. Algebraically,

Pb = Pw - Tw - Td - Cd + Vb

where,

Pb = Border Price,

Pw = World Price,

Tw = Ocean freight and insurance charges,

Td = Handling, transport and marketing charges from port to domestic markets,

Cd = Transport, processing and marketing charges farm gate to domestic market

Vb = The value of by-products

An NPC greater than one would show that the domestic market price of the commodity exceeded the border price, which discouraged the export of that particular commodity.

iv. Markov Chain Analysis: The changes in the exports of selected commodities to different countries was analyzed by employing a first order finite Markov chain model which captured the net effect in changes in their exports over a period of time. There is a growing awareness of the usefulness of this technique for analysis and forecasting in many areas including exports, particularly when the process is constant but has a gradual change (Eswarprasad *et al*., 1997).

In this report, the structural change in the exports of selected commodities from India in terms of market retention and market switching was examined by using the Markov chain approach. The estimation of the Transitional Probability Matrix (TPM, (P)) was central to this analysis. The element P_{ij} of the matrix indicated the probability

that the exports would switch from the i^{th} country to j^{th} country over a period of time. The diagonal elements P_{ij} indicated the probability that the export share of a country would be retained in the successive time periods, which in other words, measured the loyalty of an importing country to a particular exporting country. In the context of the current application, eleven major importing countries (including all other countries grouped under 'others') are considered for each of the selected commodities. The average exports to a particular country was considered to be a random variable which depended only on its past exports to that country and which was denoted algebraically by the following equation:

$$E_{jt} = \sum_{i=1}^{r} E_{it-1} P_{ij} + e_{jt}$$

where, E_{jt} = Exports from India to the ith country during the year 't'

E_{it-1} = Exports to the i^{th} country during the year 't – 1'

P_{ij} = Probability that exports will shift from the i^{th} country to j^{th} country

e_{jt} = Error-term which is statistically independent of e_{jt-1}, and

r = Number of importing countries

The transitional probabilities P_{ij}, which can be arranged in a (c × r) matrix, had the following properties:

$0 \leq P_{ij} \leq 1$

$$\sum_{i=1}^{r} P_{ij} = 1 \text{ for all } i$$

The expected export-share of India during a particular period, 't' was obtained by multiplying the quantity of exports to the selected countries(eleven in the present study) during the previous period (t–1) with the estimated TPM (P). There are several approaches to estimate the transitional probabilities of the Markov chain model such as un weighted restricted least squares, weighted restricted least squares, Bayesian maximum likelihood, unrestricted least squares, *etc.* In the present study, Minimum Absolute Deviations (MAD) estimation procedure was employed to estimate the transitional probability, which minimizes the sum of absolute deviations. The conventional Linear Programming (LP) technique was used, as this satisfies the properties of transitional probabilities of non-negativity restrictions and row sum

constraints in estimation (Mandana *et al.*,1998 and Hugar, 2002). The LP formulation on analysis was stated as per expression given below:

Min O P* + I_e

subject to,

XP* + V = Y

GP* = 1

$P^* \geq \phi$

where, P* is a vector of the probabilities P_{ij}; O is a null vector; I is an appropriately dimensional vector of areas; e is the vector of absolute errors (|U|); Y is the vector of exports to each country; X is a block diagonal matrix of lagged values of Y; V is the vector of errors; and G is a grouping matrix to add the row elements of P arranged in P* to unity.

P* vectors were arranged to obtain the transitional probability matrix which indicated the overall structure of the transitions that had taken place in the system. Essentially, the transitional probability matrix captures the dynamics of the changes in raw cotton exports from India. The individual probabilities P_{ij} indicate the probability of the shift from the country i to country 'j'.

v. Garrett's Ranking Test (Constraint Analysis): Garrett scoring technique was being used to rank the constraints expressed by the sample farmers towards exports of selected commodities. Accordingly, ranks given by a sample farmers for constraints were converted to per cent position and per cent positions were transformed to scores for which mean values were calculated to identify the rank of constraints. The per cent position was calculated using the formula:

Per cent Position = [100 (R_{ij}-0.5)]/N

where, R_{ij} = Rank assigned to i^{th} constraint by the j^{th} respondent and N = No. of constraints

The per cent position of each rank was converted into scores referring to the table given by Garrett and Woodworth (1969). For each constraint, the scores of individual respondents was added together and divided by the total number of the respondents for whom scores was added. These mean scores for all the constraints will be arranged in descending order, ranks were given and most important constraints are prioritized accordingly.

IV. TRENDS IN AREA, PRODUCTION AND PRODUCTIVITY OF SELECTED CROPS IN TELNAGANA

i. Agricultural Scenario in Telangana

The erstwhile state of Andhra Pradesh has been bifurcated into two states viz., Telangana and residuary Andhra Pradesh (Seemandhra). Pre-separation, Andhra Pradesh was one of the relatively faster growing states in the country. In Post-bifurcation, the recent past trends of Telangana state economy is witnessing a structural and social transformation. The socio-economic progress of Telangana continues to firm-up in the last five and a half years of its journey. The State has made remarkable achievements in some of the key sectors by grounding path-breaking initiatives to reconstruct and revive the State economy and to achieve the goal of 'Bangaru Telangana' (Golden Telangana).

Telangana State, with its inception, inherited a lopsided and a precarious economy, growing at a dismal 3 – 5 per cent rate with some of the key sectors such as manufacturing reeling under negative growth. There were acute shortage of power to the agriculture, industry and domestic segments. Agriculture sector was utterly neglected in the combined State. With the absence of public-funded canal irrigation, farmers were heavily dependent on (bore) well irrigation, which resulted in mounting debt burden. Although the State started its journey with this background, it has been an eventful and progressive five and a half years so far. The key tenet of 'Bangaru Telangana' is to achieve a sustainable development path focusing on faster economic growth coupled with a strong focus on social inclusiveness. Towards this end, the State has undertaken pro-poor growth policies targeted towards rural communities, farmers, and weaker sections and put in concerted efforts to make the State business friendly in the country.

About 60 per cent of the State's population resides in rural areas. Their livelihood depends on farming, animal husbandry, dairy, fisheries, and other occupational trades. The recovery of the farm and non-farm sectors, therefore, becomes critical for revival of the rural economy. Agriculture provides livelihood to more than half of the state's workforce and is crucial for restoring rural economy. However, agriculture sector in the State is prone to frequent droughts, resulting in distress among farming community. Having understood that drought proofing of agriculture is critical to mitigate the natural curse on agriculture sector, the State adopted a strategy of large-

scale public investment along with direct support to farmers through various interventions. The State has unveiled a comprehensive irrigation development strategy to provide irrigation facilities to at least one crore acres. Several direct support initiatives to farmers like farm loan waiver, subsidization of farm mechanization and micro irrigation, uninterrupted free power supply to agricultural pumpsets, input subsidy and making them available at the doorstep of farmers, etc., have helped increase farm productivity. The state has given special focus on the "Doubling of Farmers' Income" initiative of the Government of India. In this regard, the Government has initiated measures to reduce COC and increase farm returns. The farmers are being encouraged to cultivate high-value and horticultural crops by providing subsidy on greenhouse/polyhouses. Extension services are being made available to all the agricultural clusters. Rythu Vedikas are being constructed in every cluster to facilitate interactions among farmers and to undertake regular training programmes to create awareness on new, modern scientific techniques of cultivation.

Telangana economy is classified into three sectors — Agriculture, Industry and Services. The magnitude and growth of Gross Value added (GVA) Gross State Domestic Product (GSDP)* clearly reflects the economic performance of the State and from the Tables 2 to 5, it can be witnessed that, the GSDP is rising sharply from Rs. 3.59 lakh crore to Rs. 7.33 lakh crore at current prices and from Rs. 3.59 lakh crore to Rs. 5.49 lakh crore at constant prices during 2011-12 to 2017-18 (AE) (Tables 2 & 3). The growth rate of GSDP of 12 per cent in 2014-15 at current prices has surpassed the national growth of 11.0 percent in the same year and in the year 2017-18 (AE), the growth rate is 14.1 per cent. The GSDP at constant (2011-12) prices had risen sharply between 2012-13 to 2017-18 from 3 per cent to 10.4 per cent and this impressive growth is due to significant performance from Services sector (Tables 4 & 5).

Note: * - The GSDP estimates at current prices are arrived by evaluating the value of all final goods and services produced in a particular year within the state with the current year prices. These current price estimates do not reveal the factual economic growth, due to the combined impact of the changes in prices of goods and services and the changes in volume of goods produced. In order to overcome this limitation, GSDP at constant prices or real GSDP is calculated. The GSDP evaluated with the base year prices is termed as estimates at constant (base year) prices or real State Domestic Product. This is said to be the anticipated real growth arrived at by adjusting the price inflation and scale of production.

Table 2: GVA and GSDP Estimates of Telangana at Current Prices from 2011-12 to 2017-18 in New Base 2011-12 (Rs. Crore)

Sector	2011-12	2012-13	2013-14 (TRE)	2014-15 (TRE)	2015-16 (SRE)	2016-17 (FRE)	2017-18 (AE)
1	2	3	4	5	6	7	8
Agriculture, Livestock, Forestry and Fishing	54,615	67,364	76,631	76,123	76,340	89,142	97,885
Crops	32,368	40,570	47,093	41,706	37,418	44,358	47,108
Livestock	18,848	22,858	24,878	29,282	33,753	39,843	45,260
Forestry and Logging	1,917	2,096	2,163	2,465	2,520	2,666	2,795
Fishing and Aquaculture	1,481	1,839	2,497	2,670	2,649	2,275	2,721
Mining and Quarrying	11,061	12,685	12,386	14,706	17,068	20,890	22,235
Primary	**65,676**	**80,049**	**89,016**	**90,828**	**93,408**	**1,10,032**	**1,20,120**
Secondary	**92,778**	**84,906**	**90,440**	**89,660**	**94,364**	**99,425**	**1,08,412**
Tertiary	**1,77,597**	**2,10,308**	**2,42,273**	**2,86,011**	**3,28,754**	**3,75,179**	**4,32,520**
Total GSVA at Basic Prices	3,36,050	3,75,263	4,21,729	4,66,499	5,16,526	5,84,636	6,61,052
Taxes on Products	32,811	37,164	40,929	48,642	56,993	69,514	86,250
Subsidies on Products	9,427	10,833	11,078	9,292	10,163	12,165	14,644
Gross State Domestic Product	**3,59,434**	**4,01,594**	**4,51,580**	**5,05,849**	**5,63,356**	**6,41,985**	**7,32,657**

Note: GSVA = Primary sector (Crops + Livestock + Forestry and Logging + Fishing and Aquaculture + Mining and Quarrying) + Secondary sector + Tertiary sector ; GSDP = GSVA + (Product taxes - Product Subsidies); FRE - First Revised Estimates, SRE - Second Revised Estimates, AE - Advance Estimates;

Figures in parentheses indicate percentage share in respective GSVA

Source: Socio-Economic Outlook – 2018 (P.209), Planning Department, Government of Telangana

Table 3: GVA and GSDP Estimates of Telangana at Constant Prices from 2011-12 to 2017-18 in New Base 2011-12 (Rs. Crore)

Sector	2011-12	2012-13	2013-14 (TRE)	2014-15 (TRE)	2015-16 (SRE)	2016-17 (FRE)	2017-18 (AE)
1	2	3	4	5	6	7	8
Agriculture, Livestock, Forestry and Fishing	54,615	59,434	61,792	55,811	52,348	58,076	62,086
Crops	32,368	35,541	37,235	29,546	24,921	29,431	30,532
Livestock	18,848	20,351	20,827	22,519	23,937	25,519	28,179
Forestry and Logging	1,917	1,906	1,858	1,715	1,683	1,635	1,636
Fishing and Aquaculture	1,481	1,636	1,872	2,031	1,808	1,491	1,738
Mining and Quarrying	11,061	11,921	10,824	12,604	14,055	16,441	16,936
Primary	**65,676**	**71,355**	**72,616**	**68,415**	**66,403**	**74,516**	**79,023**
Secondary	**92,778**	**81,925**	**82,240**	**78,231**	**83,114**	**86,143**	**91,427**
Tertiary	**1,77,597**	**1,92,596**	**2,09,440**	**2,36,427**	**2,62,529**	**2,89,280**	**3,21,309**

Total GSVA at Basic Prices	3,36,050	3,45,876	3,64,296	3,83,073	4,12,046	4,49,939	4,91,759
Taxes on Products	32,811	34,209	35,183	41,113	48,716	57,666	69,524
Subsidies on Products	9,427	9,972	9,522	7,854	8,687	10,092	11,804
Gross State Domestic Product	**3,59,434**	**3,70,113**	**3,89,957**	**4,16,332**	**4,52,075**	**4,97,513**	**5,49,479**

Source: Socio-Economic Outlook – 2018 (P.212), Planning Department, Government of Telangana

Table 4: Sector-wise Growth Rates (%) of GVA and GSDP Estimates in Telangana at Current Prices from 2012-13 to 2017-18 in New Base Year 2011-12

Sector	2012-13	2013-14 (TRE)	2014-15 (TRE)	2015-16 (SRE)	2016-17 (FRE)	2017-18 (AE)
1	2	3	4	5	6	7
Agriculture, Livestock, Forestry and Fishing	23.3	13.8	-0.7	0.3	16.8	9.8
Crops	25.3	16.1	-11.4	-10.3	18.5	6.2
Livestock	21.3	8.8	17.7	15.3	18	13.6
Forestry and Logging	9.3	3.2	14	2.2	5.8	4.9
Fishing and Aquaculture	24.1	35.8	6.9	-0.8	-14.1	19.6
Mining and Quarrying	14.7	-2.4	18.7	16.1	22.4	6.4
Primary	**21.9**	**11.2**	**2**	**2.8**	**17.8**	**9.2**
Secondary	**-8.5**	**6.5**	**-0.9**	**5.2**	**5.4**	**9**
Tertiary	**18.4**	**15.2**	**18.1**	**14.9**	**14.1**	**15.3**
Total GSVA at Basic Prices	11.7	12.4	10.6	10.7	13.2	13.1
Taxes on Products	13.3	10.1	18.8	17.2	22	24.1
Subsidies on Products	14.9	2.3	-16.1	9.4	19.7	20.4
GSDP	**11.7**	**12.4**	**12.0**	**11.4**	**14.0**	**14.1**

Source: Socio-Economic Outlook – 2018 (P.210), Planning Department, Government of Telangana

Table 5: Sector-wise Growth Rates (%) of GVA and GSDP Estimates in Telangana at Constant Prices from 2012-13 to 2017-18 in New Base Year 2011-12

Sector	2012-13	2013-14 (TRE)	2014-15 (TRE)	2015-16 (SRE)	2016-17 (FRE)	2017-18 (AE)
1	2	3	4	5	6	7
Agriculture, Livestock, Forestry and Fishing	8.8	4	-9.7	-6.2	10.9	6.9
Crops	9.8	4.8	-20.6	-15.7	18.1	3.7
Livestock	8	2.3	8.1	6.3	6.6	10.4
Forestry and Logging	-0.6	-2.5	-7.7	-1.9	-2.9	0.1
Fishing and Aquaculture	10.4	14.4	8.5	-11	-17.6	16.6
Mining and Quarrying	7.8	-9.2	16.4	11.5	17	3
Primary	**8.6**	**1.8**	**-5.8**	**-2.9**	**12.2**	**6**
Secondary	**-11.7**	**0.4**	**-4.9**	**6.2**	**3.6**	**6.1**
Tertiary	**8.4**	**8.7**	**12.9**	**11**	**10.2**	**11.1**

Total GSVA at Basic Prices	2.9	5.3	5.2	7.6	9.2	9.3
Taxes on Products	4.3	2.8	16.9	18.5	18.4	20.6
Subsidies on Products	5.8	-4.5	-17.5	10.6	16.2	17
GSDP	**3**	**5.4**	**6.8**	**8.6**	**10.1**	**10.4**

Source: Socio-Economic Outlook – 2018 (P.213), Planning Department, Government of Telangana

From the Tables 6 and 7, it can be clearly witnessed that, the sectoral composition of GVA both at current and constant (2011-12) prices has undergone considerable change during the past few years with the shift happening from both Agriculture and Industry sectors to Services sector. In 2011-12, the share of Industry in the GVA at current prices was 28 per cent, Agriculture 20 per cent and Services sector 53 per cent. In 2017-18 (AE), the shares of Agriculture and Industry sectors in the GVA are declined to 16 and 18 percents respectively and Services sector was the gainer whose contribution moved up to 65 per cent. Similar trends are observed across these sectors during the same reference period in terms of constant prices (2011-12). This analysis showed that the contributions from Service sector alone was increased in Telangana, unlike Agriculture and Industry sectors in terms of both current and constant (2011-12) prices during the reference period, 2011-12 to 2017-18 (AE).

Table 6: Telangana Sector-wise Contribution (%) of GVA at Current Prices

Sectors	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16 SRE.**	**2016-17 FRE**	**2017-18 AE**
1	2	3	4	5	6	7	8
Agriculture, Livestock, Forestry and Fishing	16.3	18	18.2	16.3	14.8	15.2	14.8
Crops	9.6	10.8	11.2	8.9	7.2	7.6	7.1
Livestock	5.6	6.1	5.9	6.3	6.5	6.8	6.8
Forestry and Logging	0.6	0.6	0.5	0.5	0.5	0.5	0.4
Fishing and Aquaculture	0.4	0.5	0.6	0.6	0.5	0.4	0.4
Mining and Quarrying	3.3	3.4	2.9	3.2	3.3	3.6	3.4
Primary (Agriculture) sector	**19.5**	**21.3**	**21.1**	**19.5**	**18.1**	**18.8**	**18.2**
Secondary (Industry) sector	27.6	22.6	21.4	19.2	18.3	17.0	16.4
Tertiary (Services) sector	52.8	56.0	57.4	61.3	63.6	64.2	65.4

Source: Socio-Economic Outlook – 2018 (P.211), Planning Department, Government of Telangana

Table 7: Telangana Sector-wise Contribution (%) of GVA at Constant Prices (2011-12)

Sectors	2011-12	2012-13	2013-14	2014-15	2015-16 SRE.	2016-17 FRE	2017-18 AE
1	2	3	4	5	6	7	8
Agriculture, Livestock, Forestry and Fishing	16.3	17.2	17	14.6	12.7	12.9	12.6
Crops	9.6	10.3	10.2	7.7	6	6.5	6.2
Livestock	5.6	5.9	5.7	5.9	5.8	5.7	5.7
Forestry and Logging	0.6	0.6	0.5	0.4	0.4	0.4	0.3
Fishing and Aquaculture	0.4	0.5	0.5	0.5	0.4	0.3	0.4
Mining and Quarrying	3.3	3.4	3	3.3	3.4	3.7	3.4
Primary (Agriculture) sector	**19.5**	**20.6**	**19.9**	**17.9**	**16.1**	**16.6**	**16.1**
Secondary (Industry) sector	**27.6**	**23.7**	**22.6**	**20.4**	**20.2**	**19.1**	**18.6**
Tertiary (Services) sector	**52.8**	**55.7**	**57.5**	**61.7**	**63.7**	**64.3**	**65.3**

Source: Socio-Economic Outlook – 2018 (P.214), Planning Department, Government of Telangana

Thus, the Agriculture sector in Telangana needs to be given more emphasis to realize impressive performances from crops, horticulture and livestock enterprises. Unfavourable/adverse seasonal conditions prevailing in most parts of the State was largely responsible for this downslide during 2011-12 to 2017-18. However, in the liberalized trade regime, it is high time to promote the (cost-effective) production of agricultural commodities and that too the crops that enjoy major share in the Gross Area Sown (GAS) in the country in general and in Telangana State in particular. In order to take advantage of the trade opportunities offered by the liberalized trade regime, it is essential to analyze the growth dynamics of major agricultural crops and domestic and export competitiveness of selected commodities in Telangana state. However, there are some evidences available in respect of trends in area, production, productivity and export trends of agricultural and horticultural commodities. But not much information is available with respect to domestic and export competitiveness of major agricultural commodities, direction of exports and constraints in the exports of the selected commodities and in this context, the present study is certainly a significant one.

ii. Performance of area, production and productivity of selected crops in Telangana:

a. Trends in area, production and productivity of selected crops: Over a period of time, the selected crops have registered an impressive performance in terms of area, production and productivity both in Telangana (Figure 1) and at All-India level (Table 8) during 1980-2015 on Triennium Ending (TE) basis.

Paddy: It is interesting that, the share of paddy area of Telangana in All-India has increased from 2.84 to 3.37 per cent during the reference period. Though paddy production increased by two folds from 2.22 m. tonnes to 4.72 m. tonnes in Telangana, its share in All-India is stagnated around four per cent. However, in Telangana, paddy productivity levels are increased impressively from 1955.33 kg/ha to 3141.26 kg/ha and they are comparatively higher than the national average productivity during the reference period. The increase in production of paddy in Telangana can be attributed to increase in the yield by adopting high yielding hybrids. That is, the general increasing productivity growth of paddy complemented by positive growth in its area resulted in overall increase in the rice production during the reference period.

Table 8: Trends in Area, Production and Productivity of Paddy in Telangana vis-à-vis All-India

Period (TE years)	Telangana			All-India		
	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)
1980-82	1.13	2.22	1955.33	39.72	51.33	1291.28
1990-92	1.26	2.90	2285.33	42.37	73.94	1745.22
2000-02	1.27	3.33	2561.00	43.59	83.37	1907.80
2010-12	1.71	5.44	3174.00	43.20	102.17	2364.44
2013-15	1.48	4.72	3141.26	43.91	105.51	2402.33

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana; Directorate of Economics and Statistics, Government of India

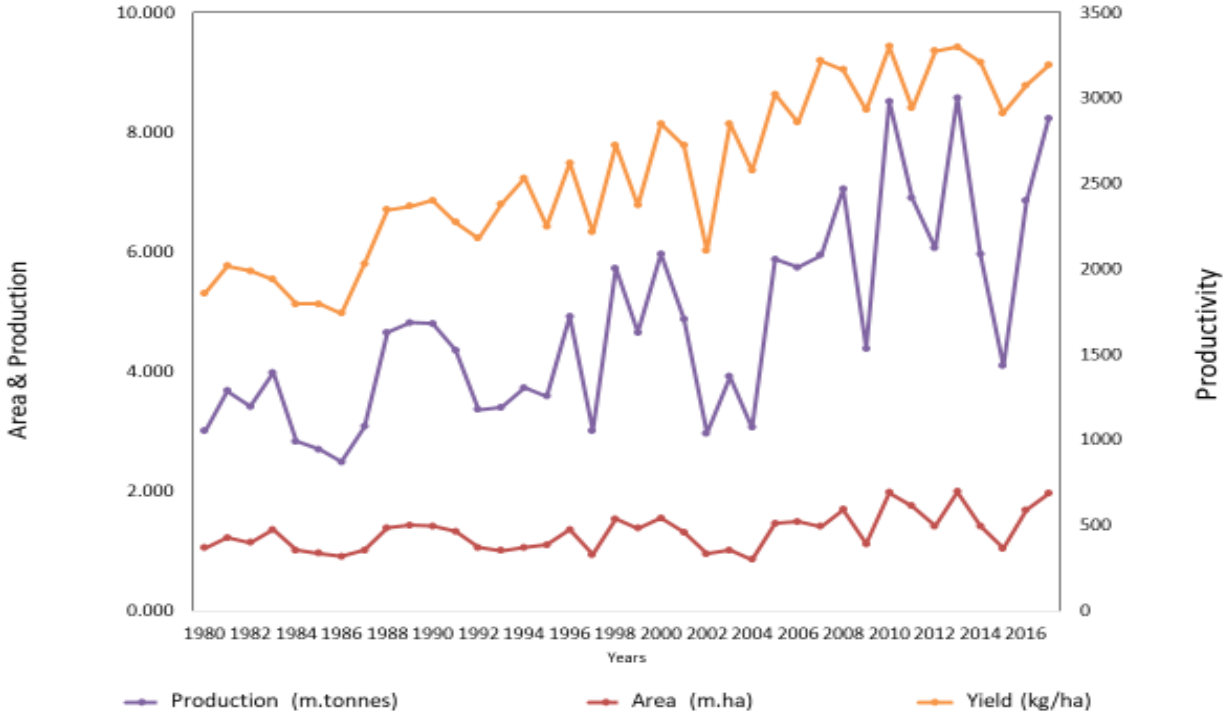

Figure 1: Trends in Area, Production and Productivity of Paddy in Telangana (1980-2015)

Maize: In cereals group, maize is second predominant crop cultivated after paddy in Telangana. In GAS, maize enjoy a share of 13.41 per cent during 2016-17. Area under maize crop was 0.32 m. ha during TE 1980-82 and it got doubled to 0.67 m. ha during TE 2013-15 (Table 9). Production also scaled up to 2.52 m. tonnes from 0.65 m. tonnes during the same period. Productivity spiraled from 2081 kg/ha to 3692 kg/ha. To the total national maize production, Telangana contributed around 10 per cent. The productivity of maize in Telangana is appreciably higher compared to national level. It is interesting that the districts (say, Khammam, Karimnagar, Nizamabad etc) having good irrigation and adopting crop in the Rabi season are harvesting very good maize yield, while in other districts where it is grown during Kharif season as rainfed crop, the yield is not encouraging even with the adoption of hybrids. A significant increase in the maize area and production during this period (1980-2015) has happened mainly due to the introduction of single crossed hybrids and implementation of Government of India sponsored 'Integrated Scheme of Oilseeds, Pulses, Oil palm and Maize' (ISOPOM), as well as shift in growing season from Kharif to Rabi in many States including Telangana [Dass et al. (2010) and DMR (2012)].

Table 9: Trends in Area, Production and Productivity of Maize in Telangana vis-à-vis All-India

Period (TE years)	Telangana			All-India		
	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)
1980-82	0.31	0.65	2081.00	5.89	6.80	1155.17
1990-92	0.28	0.64	2250.33	5.91	9.01	1523.43
2000-02	0.42	1.21	2877.00	6.61	12.12	1833.96
2010-12	0.59	2.30	3898.67	8.67	21.92	2527.94
2013-15	0.67	2.52	3692.00	9.02	23.67	2623.67

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana; Directorate of Economics and Statistics, Government of India

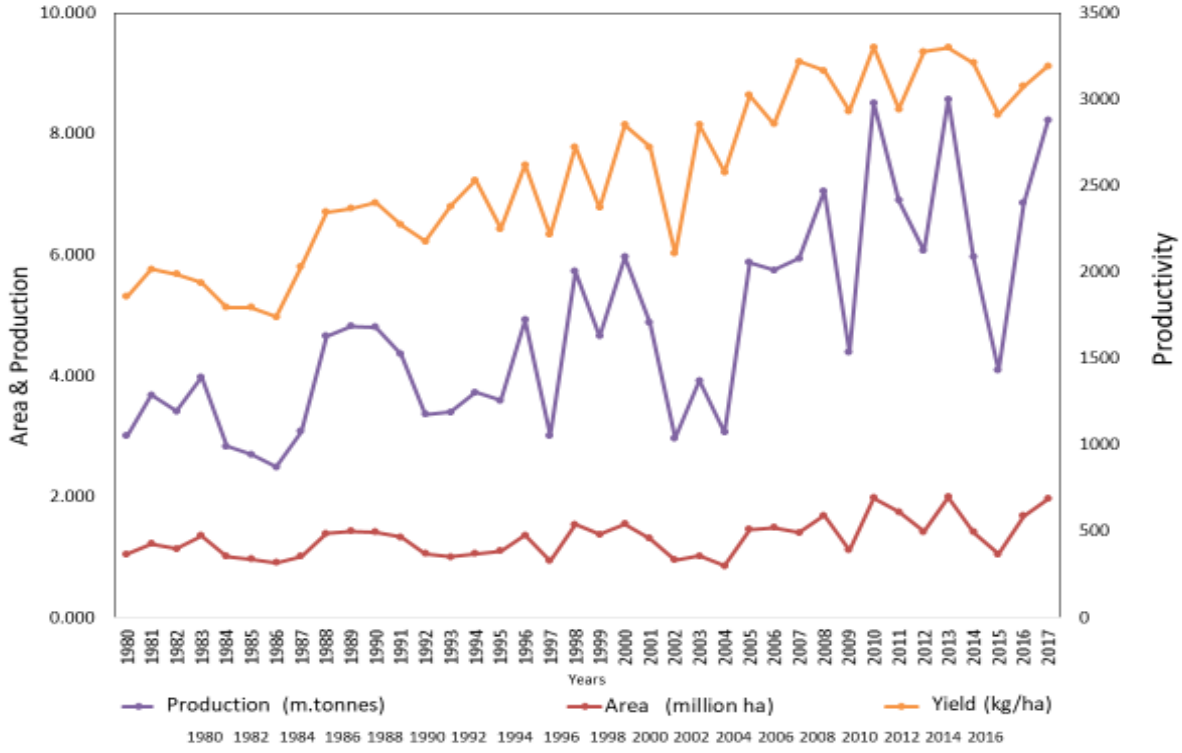

Figure 2: Trends in Area, Production and Productivity of Maize in Telangana (1980-2015)

Bengal gram: Among the pulses, bengal gram is the second largest pulse crop grown in Telangana next to red gram. State's bengal gram production contributes about 1.3 per cent in its total production at national level. During 1980's and 1990's, area under bengal gram cultivation was meager in Telangana. By development of niche specific improved varieties and due to technology spillover from Andhra Pradesh, bengal gram cultivation gained momentum in Telangana. This resulted in two folds increase in its area from 0.03 m. ha to 0.08 m. ha during TE 1980-82 to TE 2013-15 (Table 10). The

reasons for this slow growth in area may be due to replacing bengal gram by groundnut and cotton, as the farmers' choice towards cultivating remunerative crops in Telangana. Further, over-use of groundwater enhanced salinity and increased incidence of ascochyta blight aggravated with low temperature besides excessive use of fertilizers and pesticides deteriorated soil quality. Despite of marginal increase in area, production considerably increased during this period and this is mainly due to adoption and cultivation of HYVs. Productivity of bengal gram in Telangana increased by four times from 339.33 kg/ha to 1269 kg/ha during TE 1980-82 to TE 2013-15 and this State registered the highest productivity level in the country during TE 2013-15. This significant growth in productivity is due to effective implementation of schemes like ISOPOM, Accelerated Pulses Production Programme (A3P) and National Food Security Mission' (NFSM).

Table 10: Trends in Area, Production and Productivity of Bengal gram in Telangana vis-à-vis All-India

Period (TE years)	Telangana			All-India		
	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)
1980-82	0.03	0.01	339.33	7.28	4.75	654.00
1990-92	0.02	0.01	333.67	6.52	4.63	711.67
2000-02	0.04	0.05	1023.67	5.84	4.52	771.33
2010-12	0.10	0.13	1225.08	8.67	8.25	952.67
2013-15	0.08	0.11	1269.00	8.86	7.97	896.33

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana; Directorate of Economics and Statistics, Government of India

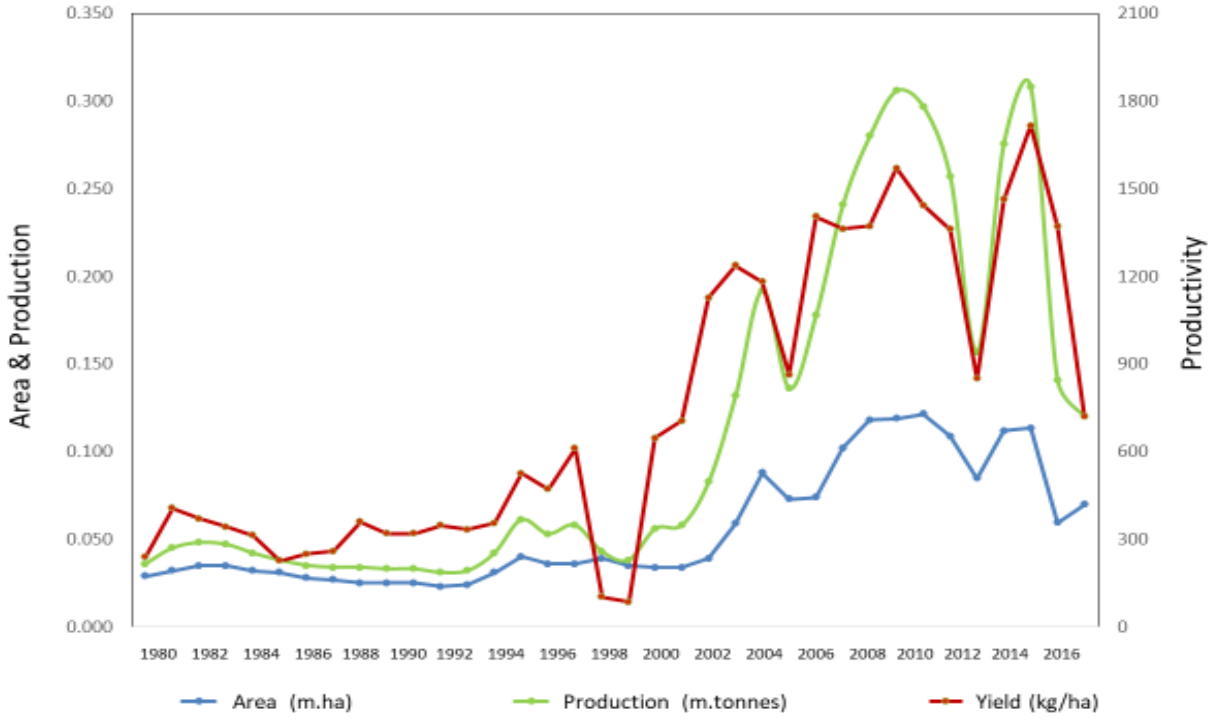

Figure 3: Trends in Area, Production and Productivity of Bengal gram in Telangana (1980-2015)

Chillies: In the spices and condiments group, (dry) chilli is the only crop cultivated in Telangana. Area under (dry) chillies cultivation was around 0.09 m. ha during TE 1980-82 and this remained more or less same with marginal upside and downside movement during the reference period (Table 11). Production showed positive trend and increased by three times from 0.08 m. tonnes to 0.25 m. tonnes during the selected period. Despite of downward trend in area under cultivation, the production of chillies was increased due to steep increase in productivity by more than three times (from 857 kg/ha to 3236 kg/ha during TE 1980-82 to TE 2013-15). Telangana holds a share of about 15 per cent in total chillies production at All-India level. It is interesting that, productivity levels are comparatively higher in Telangana (3236 kg/ha) compared to its national average (1969.67 kg/ha) during TE 2013-15. It is apparent that the area under chillies has marginally declined after 2000-2001 and at the same time there was increase in its productivity. Looking to the data, it is convincing that the increase in chillies production is due to increase in the productivity rather than the area. The cardinal factors driving this significant increase in production are the use of high yielding hybrids in place of traditional varieties, increase in average yield, favourable weather conditions and changing consumption pattern. Better crop management practices and higher yield levels led to bumper crop harvests during 2012-13 and 2013-14 resulted in a sharp fall

in prices during these periods. Due to unattractive prices, most of the farmers shifted their production to other cash crops like cotton, ground nut etc., and thus resulting in a decline in area and slow growth in production during subsequent years. Moreover, crop damage due to pests and diseases and droughts (severe drought in 2015-16) in major producing regions resulted in sharp decline in area and hence, in production. During that year, prices posted historic high of Rs. 15000/quintal in the domestic market compared to Rs. 3000/quintal in 2014-15. The increased productivity may be attributed to advent of HYVs and improved crop management practices.

Table 11: Trends in Area, Production and Productivity of Chillies in Telangana vis-à-vis All-India

Period (TE years)	Telangana			All-India		
	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)
1980-82	0.09	0.08	857.00	0.82	0.52	633.33
1990-92	0.11	0.12	1134.67	0.87	0.73	833.33
2000-02	0.10	0.21	2054.00	0.85	0.98	1157.33
2010-12	0.08	0.26	3174.01	0.80	1.27	1591.00
2013-15	0.08	0.25	3236.00	0.78	1.54	1969.67

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana; Directorate of Economics and Statistics, Government of India

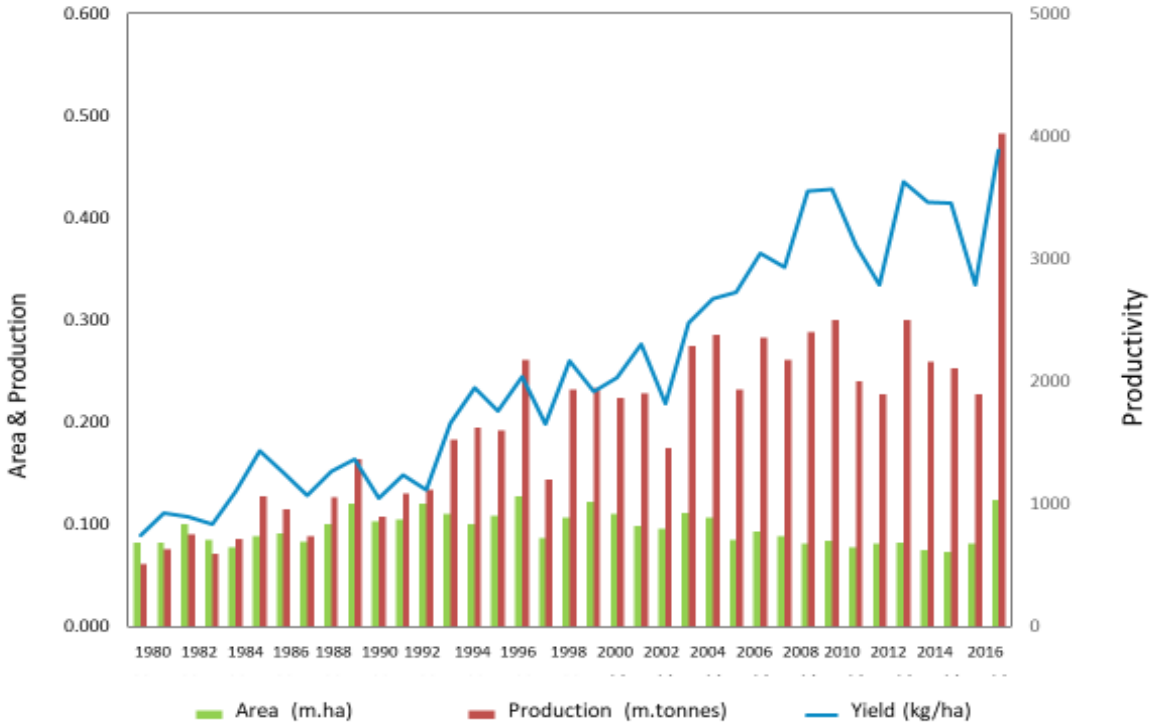

Figure 4: Trends in Area, Production and Productivity of Chillies in Telangana (1980-2015)

Cotton: Cotton is an important fiber crop cultivated in Telangana. It contributes significantly to both agriculture and industry sectors in terms of generating both farm income and employment. It plays a dominant role by meeting the rising domestic and export demands and earns foreign exchequer. Table 12 furnishes that area under cotton was meager during TE 1980-82 period (0.15 m. ha), but with the introduction of the 'Bt' cotton varieties, area under cotton has increased considerably to 1.72 million ha by TE 2013-15 in Telangana. Production and productivity also followed the same suit and increased many folds during the reference period. Productivity witnessed an impressive growth ie., 55.67 kg/ha to 380.30 kg/ ha during TE 1980-82 to TE 2013-15. There was a rise in yield during the early hybrid phase (1976-71 to 1991-92), stagnation or decline during the late hybrid phase (1992-93 to 2001-02), and a spurt during the Bt phase (2002-03 to 2014-15). The use of inputs and the gradual spread of hybrids were responsible for yield growth during the early hybrid phase, while the slump in growth during the late hybrid phase could be because of a reduced use of inputs in the post-liberalization period, as happened with wheat (Raghavan, 2008). Bt technology, which reduced bollworm-induced economic loss, also entailed a high level of input

application, causing an improvement in yield realization during the Bt phase. Thus, increase in cotton production can be attributed to both area expansion (Extensification) and increased productivity on adoption of HYVs (Intensification) and practicing Integrated Pest Management (IPM) by the cotton growers in the State. The share of Telangana's cotton production in national production has increased from 0.65 per cent during TE 1980-82 to 11 per cent during 2013-15. However, the state suffers from lower productivity levels of cotton compared to national average during the reference period.

Table 12: Trends in Area, Production and Productivity of Cotton in Telangana vis-à-vis All-India

Period (TE years)	Telangana			All-India		
	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)
1980-82	0.15	0.01	55.67	7.92	1.27	160.47
1990-92	0.38	0.07	183.00	7.55	1.75	232.43
2000-02	0.65	0.16	248.67	8.45	1.59	188.96
2010-12	1.60	0.53	332.26	11.80	5.80	492.24
2013-15	1.72	0.65	380.30	12.36	5.71	462.33

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana; Directorate of Economics and Statistics, Government of India

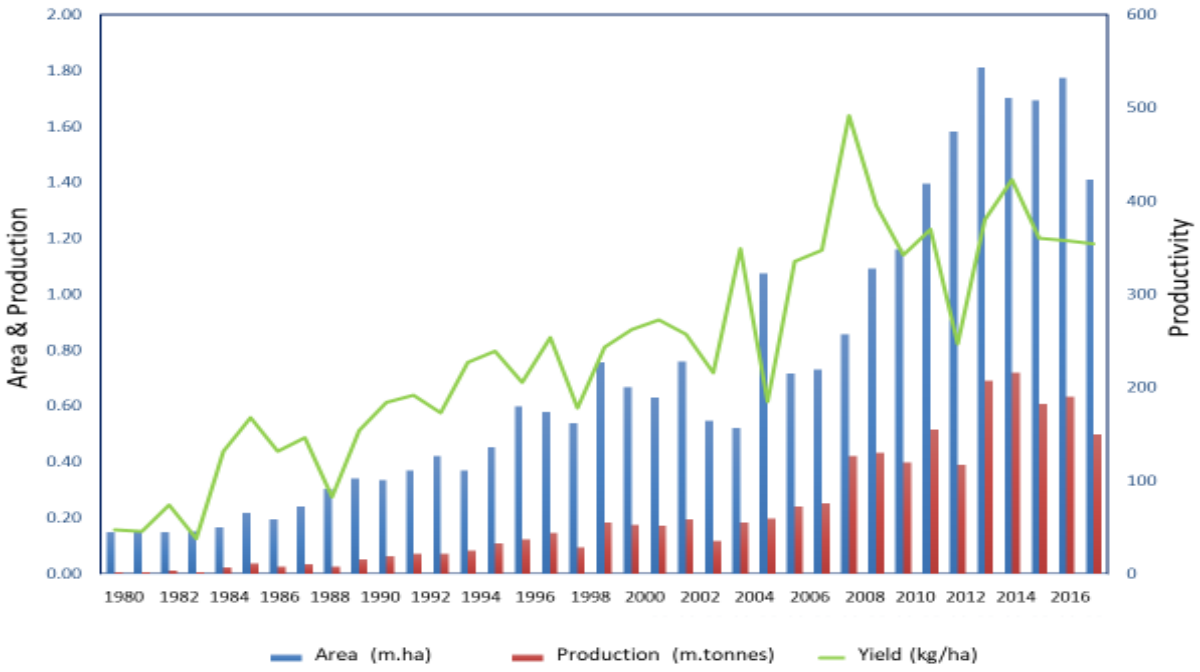

Figure 5: Trends in Area, Production and Productivity of Cotton in Telangana (1980-2015)

On the whole, the discussion revealed that the heartening performance of selected crops in terms of area, production and productivity can be attributed to wide variety of factors relating to favourable weather conditions, improved availability of inputs such as HYVs, pests and diseases resistant varieties, quality seed, fertilizers, adoption of IPM, subsidies and price support measures etc.

b. Growth in area, production and productivity of selected crops during both pre and post-WTO regimes: To understand the growth dynamics of the selected crops during both pre-WTO and Post-WTO regimes in Telangana, CGRs are computed by fitting exponential model (Table 13).

Paddy: In case of paddy, positive and significant growth rate is registered for production during post-WTO regime (6.69%, significant a 5% level), unlike pre-WTO regime. Though productivity of paddy recorded significant growth rates during both pre and post-WTO regimes (4.51 and 3.68 percents respectively), the rate of growth showed declining trend during the latter regime. The area under paddy has not registered any significant increase during both pre and post-WTO regimes. Declining contributions from canal and tank irrigations is one of the major reasons for this and as a result, the farmers are depending more on bore well irrigation to irrigate paddy, especially during rabi season. As bore well irrigation is not cost-effective for the farmers, there is no significant increase in area under paddy in Telangana. However, considering the overall reference period (1980-2015), production of paddy showed significant increasing trend (6.09%) due to significant positive contributions from both area and productivity of paddy (2.10 and 3.19 percents respectively). This is due to cultivation of location specific HYVs of paddy over a period of time and especially during the past one decade period.

Maize: In pre–WTO regime, the production of maize has not registered a significant positive growth rate. Though productivity of maize registered a significant positive growth rate (7.05%), the significant decline in area (-2.00%) could not boost its production to a significant level (4.91% NS). However, during post-WTO regime, as the area under maize showed significant increasing trend (8.95%), it scaled up the production at a significant level (12.20%) though the crop registered non-significant positive growth rate in terms of productivity (2.96% NS). A close examination of the table revealed that the growth rates for area and production of maize are higher and

significant during post-WTO regime compared to pre-WTO regime and this signifies the increasing demand for this commodity both in domestic and export markets. However, the growth rate of productivity is much higher and significant during pre-WTO regime (7.05%) and this period marks the transition from cultivation of local varieties to HYVs of maize since late eighties. During overall reference period, the production of maize recorded significant positive growth (13.51%, at 1% level) and this is due to significant positive contributions both from area (6.92%, at 1% level) and productivity (6.16%, at 1% level). With the greater expansion of area under maize under HYVs since late eighties, its contribution to production is higher relative to productivity. This also highlights the potential demand for maize both in domestic and export markets with the advent of trade liberalization phase since 1991.

Table13: CGRs of Area, Production and Productivity of selected crops in Telangana

Particulars		Paddy	Maize	Bengal Gram	Chilli	Cotton
Pre- WTO period (1980-1994)	Area	0.25NS	-2.00*	-0.81NS	5.15**	24.17**
	Production	4.76NS	4.91NS	-4.57NS	17.02**	58.88**
	Productivity	4.51**	7.05*	5.65*	11.30**	27.84**
Post WTO- period (1995-2015)	Area	2.90NS	8.95**	14.95**	-5.12**	16.81**
	Production	6.69*	12.20**	28.14**	2.90NS	25.31**
	Productivity	3.68**	2.96NS	21.03**	8.44**	7.29**
Total Period (1980-2015)	Area	2.10*	6.92**	1.03**	0.88NS	18.10**
	Production	6.09**	13.51**	20.70**	9.41**	33.19**
	Productivity	3.19**	6.16**	13.75**	10.36**	12.75**

Note: ** significant at 1% level; * significant at 5% level; NS – Not significant
Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana

Bengal gram: During pre-WTO regime, in Telangana, bengal gram is cultivated mainly under rainfed conditions that too at subsistence level. Hence, during this regime, this crop has registered negative growth rates both in terms of area (-0.81%) and production (-4.57%), though non-significant. Though productivity of bengal gram is significant during this period (5.65%, at 5% level), the decline in area could not escalate the production. However, during post-WTO regime, with drastic increase in area and productivity, the production of bengal gram showed significant positive growth rate (28.14%, at 1% level). That is, the productivity of bengal gram registered positive and significant growth rates during both pre and post-WTO regimes and this was due to adoption of improved niche specific cultivars. Even during the overall reference period,

production of bengal gram showed positive and significant growth rate (20.70%, at 1% level) and this was mainly due to increased productivity (13.75%, significant at 1% level) followed by significant increase in area (1.03%, at 1% level).

Chillies*:* Among the spices, (dry) chilli enjoy a major share in production terms. This is an important well known commercial crop used as a condiment, culinary supplement or as a vegetable. The cultivation scenario is positive for chillies cultivation in Telangana, as the production and productivity levels showed positive trends during both pre and post-WTO regimes. The positive contributions of productivity during both the above regimes is due to adoption of improved varieties and good agricultural practices by the farming community. Though area under chillies showed positive and significant growth rate during pre-WTO regime, it has registered negative growth rate of -5.12 per cent in post-WTO regime. This fall in area can be attributed to high instability and volatility in the DMPs of the chillies. During the overall reference period, chillies production showed positive and significant growth rate (9.41%, at 1% level) due to significant contribution from productivity (10.36%, at 1% level).

Cotton: The growth dynamics of cotton in Telangana has revealed an heartening picture. Area, production and productivity of cotton has registered positive and significant growth rates (at 1% level) during pre-WTO, post-WTO and overall periods. This signifies the potentiality of cotton in Telangana state in view of suitability of soil and climate, advent of Bt cotton varieties, prevailing ginning facilities, marketing opportunities, rising both domestic and export demands etc.

From the above analysis it can be concluded that during the overall reference period (1980-2015), all the selected crops have shown positive and significant growth rates in terms of area, production and productivity, except chillies area in Telangana. Among these selected crops, higher growth rates were registered for cotton followed by bengal gram and chillies. In other crops such as paddy and maize, growth rates are moderate. Factors responsible for area expansion under cotton, chillies and gram can be attributed to increased output prices, availability of the improved varieties and rising export demand.

c. District-wise Growth dynamics of selected crops in Telangana: Performance of selected crops in terms of growth dynamics of area, production and productivity is also studied across districts in Telangana (Tables 14 to 19). In addition, the districts are also categorized into high, medium and low growth categories based on respective growth rates in terms of area under selected crops during the two reference periods viz., Pre-WTO regime and Post-WTO regime.

Paddy: During pre-WTO regime, paddy area recorded highest (positive) growth rate (15.63%) in Khammam district, while Karimnagar, Medak, Mahabubnagar and Warangal are in the medium growth category (Tables 14 & 15). Adilabad, Nizamabad, Hyderabad, Ranga Reddy and Nalgonda districts registered low growth rates. However, during post-WTO regime, Adilabad, Nalgonda, and Warangal registered higher growth rates in terms of paddy area. Karimnagar, Ranga Reddy and Khammam showed medium growth rates and Nizamabad, Medak, Hyderabad and Mahabubnagar registered low growth rates for paddy area in Telangana state. During overall reference period, all the districts in Telangana registered in the medium growth category for paddy area.

Maize: During pre-WTO regime, Khammam, Mahabubnagar and Nalgonda registered higher growth rates, while Adilabad, Karimnagar and Ranga Reddy are found in the medium growth category (Tables 14 & 16). Nizamabad, Hyderabad, Medak and Warangal districts registered lower growth rates. During post-WTO regime, along with Nalgonda and Mahbubnagar, Adilabad and Ranga Reddy districts moved to higher growth rate category. Medak, Hyderabad and Warangal moved to medium growth rate category from lower growth rate category. Only, Nizamabad registered negative growth rate for maize area.

Bengal gram: During pre-WTO regime, Adilabad and Mahabubnagar registered higher growth rates for area under bengal gram whereas, Karimnagar, Medak, Nizamabad, Ranga Reddy, Warangal, Nalgonda, Khammam and Hyderabad registered lower growth rates (Tables 14 & 17). During post-WTO regime, Karimnagar and Nizamabad shifted from low performer to high performer districts, Adilabad maintained its higher growth rate. Nalgonda, Medak, Mahabubnagar and Warangal registered medium growth rates and Hyderabad, Medak, Ranga Reddy and Khammam districts registered lower growth rate.

Chillies: During pre-WTO regime, Nalgonda alone remained in the high performer category whereas Nizamabad, Hyderabad, Ranga Reddy, Khammam, Mahabubnagar and Warangal registered medium growth rates (Tables 14 & 18). Adilabad, Karimnagar and Medak registered lower growth rates. During post-WTO regime, Mahabubnagar and Hyderabad shifted from medium growth performing category to higher growth category with reference to area expansion under chillies in Telangana. Ranga Reddy and Warangal districts are maintained in the medium growth rate category. Nalgonda from higher growth rate category, Nizamabad and Khammam from medium growth rate category shifted to lower growth rate category during this regime. Adilabad, Karimnagar and Medak continued to remain in the lower growth rate category.

Cotton: During pre-WTO regime, Ranga Reddy registered in high growth rate category whereas Karimnagar, Mahabubnagar, Warangal, Nalgonda and Khammam are with medium growth rate (Tables 14 & 19). Adilabad, Medak, Nizamabad and Hyderabad are the four districts remained in low performing districts with reference to cotton cultivation in Telangana. During post-WTO regime, Ranga Reddy is replaced by Mahabubnagar as a high performing district followed by Nalgonda and Medak with medium growth rate. Adilabad, Nizamabad and Hyderabad continued to perform as low growth rate districts along with Karimnagar, Khammam, Ranga Reddy and Warangal.

Table 14: Categorization of the districts based on their growth rate in area under selected crop in Telangana during pre and post-WTO regimes

Crops	Period	Pre-WTO regime (1980-1994)	Post-WTO regime (1995-2015)
Paddy	High growth	Khammam	Adilabad, Nalgonda, Warangal
	Medium growth	Karimnagar, Medak, Mahabubnagar, Warangal	Karimnagar, Ranga Reddy, Khammam
	Low Growth	Adilabad, Nizamabad, Hyderabad, Ranga Reddy, Nalgonda	Nizamabad, Medak, Hyderabad, Mahabubnagar
Maize	High growth	Khammam, Mahabubnagar, Nalgonda	Adilabad, Ranga reddy, Nalgonda, Mahabubnagar
	Medium growth	Adilabad, Karimnagar, Ranga Reddy	Karimnagar, Medak, Khammam, Warangal,
	Low Growth	Nizamabad, Hyderabad, Medak, Warangal	Nizamabad, Hyderabad
Bengal gram	High growth	Adilabad, Mahabubnagar	Adilabad, Nizamabad, Karimnagar

	Medium growth	-	Nalgonda, Medak, Mahabubnagar, Warangal,
	Low growth	Karimnagar, Medak, Nizamabad, Ranga Reddy, Warangal, Nalgonda, Khammam, Hyderabad	Hyderabad, Medak, Ranga Reddy, Khammam
Chillies	High growth	Nalgonda	Mahabubnagar, Hyderabad
	Medium growth	Nizamabad, Hyderabad, Ranga Reddy, Khammam, Mahabubnagar, Warangal	Ranga Reddy, Warangal
	Low growth	Adilabad, Karimnagar, Medak	Adilabad, Nalgonda, Karimnagar, Medak, Khammam, Nizamabad
Cotton	High growth	Ranga Reddy	Mahabubnagar
	Medium growth	Karimnagar, Warangal, Nalgonda, Khammam	Nalgonda, Medak
	Low growth	Adilabad, Mahabubnagar, Medak, Nizamabad, Hyderabad	Adilabad, Karimnagar, Khammam, Nizamabad, Ranga Reddy, Warangal, Hyderabad

Note: High growth: CGR computed > Mean + SD; Low growth: CGR computed < Mean - SD;
Medium growth: CGR between Mean ± SD
Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana

Table 15: District wise CGRs of Area, Production and Productivity of Paddy in Telangana during pre and post-WTO regimes

Districts	**1980-94**	**1995-2015**	**1980-2015**	**1980-94**	**1995-2015**	**1980-2015**	**1980-94**	**1995-2015**	**1980-2015**
	Area			**Production**			**Productivity**		
Adilabad	0.18	15.23	8.51	8.20	29.96	20.19	6.69	6.65	6.37
Nizamabad	-0.36	4.41	2.42	2.30	8.42	5.87	2.25	-3.91	-4.12
Karimnagar	1.55	6.65	3.83	4.44	14.58	9.74	4.41	2.98	3.67
Medak	2.03	4.28	3.01	8.70	11.45	9.81	4.57	3.09	3.52
Hyderabad	0.00	-6.26	-4.18	-3.33	-4.23	-4.32	2.80	-3.92	-1.01
Ranga reddy	0.58	4.39	2.30	4.31	5.26	4.20	2.62	1.53	1.77
Mahabubnagar	1.42	4.51	2.87	9.09	12.10	10.30	1.34	3.88	2.59
Nalgonda	1.28	15.97	9.85	4.62	28.32	18.56	2.78	2.70	2.86
Warangal	5.93	16.10	11.58	16.16	28.38	22.90	6.11	2.25	3.73
Khammam	15.63	3.74	8.145	27.08	9.67	16.35	6.99	**2.37**	**4.28**
Telangana	1.475	3.77	2.38	4.85	8.57	6.490	2.58	1.74	1.97

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana

Table 16: District wise CGRs of Area, Production and Productivity of Maize in Telangana during pre and post-WTO regimes

Districts	1980-94	1995-2015	1980-2015	1980-94	1995-2015	1980-2015	1980-94	1995-2015	1980-2015
	Area			Production			Productivity		
Adilabad	1.16	60.69	34.96	9.28	54.55	35.68	3.94	8.97	7.32
Nizamabad	-0.04	-1.03	-0.62	7.19	0.91	3.53	3.06	9.16	6.62
Karimnagar	0.02	18.72	10.26	8.72	32.29	21.76	7.80	8.96	8.42
Medak	0.59	3.74	2.15	13.79	18.46	16.74	13.65	15.57	15.36
Hyderabad	0.00	2.78	0.93	0.00	10.02	5.38	5.58	-1.68	1.46
Ranga reddy	0.11	33.05	18.87	35.15	41.91	39.27	28.55	13.92	20.71
Mahabubnagar	11.67	30.82	22.69	24.41	37.20	31.76	6.63	9.82	8.52
Nalgonda	3.33	69.18	41.39	16.56	66.19	45.88	10.92	-0.10	5.21
Warangal	-1.07	9.92	4.78	3.56	19.23	12.23	5.26	5.49	5.55
Khammam	14.20	9.30	10.33	25.93	11.87	17.26	9.41	4.45	7.36
Telangana	0.24	4.29	2.11	7.55	9.82	8.67	7.04	7.70	7.77

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana

Table 17: District wise CGRs of Area, Production and Productivity of Bengal gram in Telangana during pre and post-WTO regimes

Districts	1980-94	1995-2015	1980-2015	1980-94	1995-2015	1980-2015	1980-94	1995-2015	1980-2015
	Area			Production			Productivity		
Adilabad	8.89	20.35	15.57	13.33	33.11	30.42	35.31	25.16	32.73
Nizamabad	0.21	18.53	12.29	10.00	32.75	24.66	18.86	78.10	54.91
Karimnagar	-3.33	16.68	8.34	0.00	19.26	11.23	14.16	28.49	24.02
Medak	2.37	0.55	1.46	10.49	28.94	22.84	9.73	22.04	18.24
Hyderabad	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ranga reddy	1.44	0.46	0.87	-2.22	20.54	13.84	-3.97	30.01	17.35
Mahabubnagar	19.44	9.24	14.60	13.33	53.39	39.48	11.82	61.00	42.01
Nalgonda	0.00	1.05	0.61	0.00	5.47	3.19	12.58	22.25	19.72
Warangal	0.00	4.71	2.74	0.00	16.81	9.81	11.56	25.42	21.14
Khammam	0.00	-7.48	-4.36	0.00	-7.31	-4.26	7.63	22.25	17.66
Telangana	**1.35**	**5.33**	**4.08**	**9.39**	**38.37**	**28.61**	**6.53**	**29.15**	**21.39**

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana

Table 18: District wise CGRs of Area, Production and Productivity of Chillies in Telangana during pre and post-WTO regimes

Districts	1980-94	1995-2015	1980-2015	1980-94	1995-2015	1980-2015	1980-94	1995-2015	1980-2015
	Area			Production			Productivity		
Adilabad	1.40	-2.27	-1.05	23.13	18.81	23.64	28.52	20.66	27.49
Nizamabad	8.66	-6.55	-0.21	9.83	-4.34	1.56	9.97	1.03	4.75
Karimnagar	1.43	1.08	1.10	13.31	14.38	14.60	10.19	6.73	9.10
Medak	3.65	-11.04	-5.23	50.28	-10.11	15.05	42.03	-0.78	17.25
Hyderabad	7.00	25.00	18.08	0.00	-1.60	-0.93	-5.98	2.41	-0.70
Ranga reddy	1.44	5.65	3.67	7.00	19.35	13.83	12.91	10.39	11.18
Mahabubnagar	0.31	18.99	11.20	32.06	17.08	23.32	27.45	5.50	15.02
Nalgonda	11.54	4.84	6.80	35.20	21.33	25.87	18.28	8.85	12.46
Warangal	8.07	8.03	7.35	24.71	20.51	21.54	13.15	5.33	8.44
Khammam	2.78	3.85	3.31	12.15	5.02	7.50	8.91	2.51	4.76
Telangana	**2.09**	**-0.01**	**0.59**	**9.95**	3.64	6.32	7.52	8.24	8.31

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana

Table 19: District wise CGRs of Area, Production and Productivity of Cotton in Telangana during pre and post-WTO regimes

Districts	1980-94	1995-2015	1980-2015	1980-94	1995-2015	1980-2015	1980-94	1995-2015	1980-2015
	Area			Production			Productivity		
Adilabad	2.21	9.55	6.98	28.34	20.78	24.44	26.26	20.20	22.76
Nizamabad	10.67	4.66	7.17	21.70	5.37	12.17	172.44	6.87	75.85
Karimnagar	37.52	11.66	22.97	49.76	13.30	28.74	31.38	14.05	21.01
Medak	25.17	18.62	22.61	20.36	28.56	26.45	21.85	15.36	17.89
Hyderabad	0.00	-1.28	0.25	0.00	-2.27	0.06	0.00	-2.34	-1.01
Ranga reddy	49.80	12.36	29.45	49.59	13.20	29.09	22.72	15.86	18.19
Mahabubnagar	23.09	46.56	37.82	21.58	115.50	77.22	16.64	18.86	17.76
Nalgonda	34.48	19.54	25.88	28.01	26.46	31.50	21.87	16.70	23.00
Warangal	38.38	10.54	22.68	76.59	14.02	39.04	34.01	15.85	22.08
Khammam	43.60	9.75	24.66	67.41	12.60	35.12	36.24	17.54	24.46
Telangana	**9.09**	**9.74**	**10.04**	**32.11**	11.45	20.43	21.30	14.74	17.31

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana

d. Instability of Area, Production and Productivity of selected crops in Telangana:

Instability in the cultivation of selected crops in terms of area, production and productivity is studied through computing CV. This is essential for the selected crops in Telangana, as the agriculture is mainly dependent on weather conditions and accordingly, the area, production and productivity of the crops are subjected to significant variations over time. In Telangana, paddy has registered a higher instability both in terms of area and production during post-WTO regime compared to pre-WTO regime (Table 20). Maize and cotton followed the same suit. Regarding bengal gram and chillies, the instability with respect to area is higher during post-WTO regime compared to pre-WTO regime and reverse is the case for production of these crops. It is interesting that instability in terms of productivity is higher with respect to maize and bengal gram during pre-WTO regime compared to post-WTO regime and even chillies showed marginally higher instability during pre-WTO regime. In view of boll worm menace and frequent droughts in the State, the productivity of cotton showed higher level of instability during post WTO regime as against pre–WTO regime. However, in case of paddy and chillies, there is no significant change in the instability levels during the two regimes under consideration.

During the overall reference period (1980-2015), among all the selected crops, bengal gram registered highest instability rate in terms of area, production and productivity viz., 71.29 per cent, 97.24 per cent and 47.32 per cent respectively. This high instability especially in terms of area and production can be attributed to fluctuating marketing prices, weather conditions, incidence of pest and diseases. As mentioned earlier, higher instability in terms of production of cotton can be mainly attributed for fluctuations in area under the crop due to boll worm menace and fluctuating productivity levels due to declining contributions from canal and tank irrigation sources. Paddy registered lower instability rate compared to other selected crops in Telangana, as this crop is mainly cultivated under bore well irrigation, which is more assured compared to canals and tanks. Overall it is observed that production of crops exhibited higher instability compared to the area and productivity.

Table 20: Instability in Area, Production and Productivity of selected crops in Telangana

Period/Item		Paddy	Maize	Bengal gram	Chillies	Cotton
Pre-WTO period (1980-1994)	Area	15.18	6.01	39.05	13.64	15.91
	Production	23.35	20.96	73.76	33.30	36.48
	Productivity	11.89	22.11	46.41	25.85	21.78
Post-WTO period (1995-2015)	Area	22.75	26.54	43.72	17.07	43.28
	Production	31.82	40.37	58.74	24.67	71.75
	Productivity	12.45	19.93	26.06	24.77	43.41
Overall Period (1980-2015)	Area	22.43	36.97	71.29	15.76	58.97
	Production	38.30	63.44	97.24	43.62	109.81
	Productivity	18.80	31.60	47.32	44.31	65.55

Raw Data Source: Directorate of Economics & Statistics, Hyderabad, Government of Telangana

The spread of new technology say HYVs, Bt cotton varieties, IPM technology, SRI production technology, micro irrigation etc., of selected crops has contributed for low area instability, while the adverse climatic conditions, pests and diseases incidences, price fluctuations in commodities contributed for higher area instability. Access to irrigation facilities like bore wells, relatively stable market prices, adoption of SRI technology etc., has contributed for low productivity and production instabilities for paddy.

V. REVEALED COMPARATIVE ADVANTAGE (RCA) OF SELECTED COMMODITIES

i. India's RCA_1 in Exports (Balassa Index): This section analyzes the RCA_1 and RMA in terms of exports and imports respectively for the selected commodities. The RCA_1 of India was derived with the help of exports of India to the world for all the selected commodities during both Pre-WTO and Post-WTO regimes. As discussed earlier, if $RCA_1>1$, it implies the commodity is more competitive in the world market. That is, the commodities which are enjoying higher RCA_1 are more competitive as compared with the rest of the commodities.

As indicated in Table 20.1 and Figure 6, chillies and rice enjoy more comparative advantage for exports during both Pre-WTO and Post-WTO regimes and this showed increasing trend during post-WTO regime compared to pre-WTO regime. Hence India can increase the trade in particular for these commodities in the international market. Similar is the case for cotton, as the RCA has improved during post-WTO regime compared to pre-WTO regime. It is interesting that, though Bengal gram is not competitive during pre-WTO regime, but gained RCA during post-WTO regime. With IPs of bengal gram are slightly higher than the DMPs during 2005-06, exporters across the country felt that the seven per cent export incentive announced by the Central Government is playing crucial role for gaining comparative advantage in the international market. However, in the recent past (since 2015-16), with increasing COP of bengal gram due to spurt in prices of both resources and resource services and the IPs falling way below the DMP, the All India Dal Mills Association has written to the Government seeking a hike in export incentive to 15 per cent. Initially, the Government's decision to grant seven per cent export incentive to bengal gram, under the Merchandise Export from India Scheme (MEIS) for a period of three months till June 20, 2018 has immensely helped to gain comparative advantage in the international market. Pressured by the domestic market conditions — large harvests, low prices over the last few years — the Centre recently lifted the prohibition on export of all varieties of pulses. A blanket ban on pulses export was imposed over ten years ago in 2007 as a knee-jerk reaction to rising domestic prices then. In response to trade representation, one variety, Kabuli of bengal gram, was exempted from the ban. In recent years, this variety shipments are averaged around two lakh tonnes. Prior to total ban, India used to

export respectable quantities of pulses — mainly masur (lentil) and to a less extent tur/arhar (pigeon pea), urad (black gram) and moong (green gram). Indian pulses were quite popular in overseas markets, especially in countries with large expatriate Indian population. However, maize do not enjoy RCA during both pre-WTO and post-WTO regimes. That is, it has the least RCA over the years that shows the less comparative advantage as compared to other exported commodities.

Table 20.1: India's RCA_1 in Exports (BI)

Period	Rice	Maize	Bengal gram	Cotton	Chillies
Pre-WTO					
TE 1973	0.230	0.003	2.046	0.660	2.743
TE 1976	0.473	0.001	1.661	0.598	2.340
TE 1979	1.474	0.000	0.079	0.394	10.124
TE 1982	5.226	0.000	0.097	1.513	6.803
TE 1985	3.807	0.019	0.610	1.283	7.791
TE 1988	6.694	0.000	1.266	1.151	6.748
TE 1991	6.872	0.000	1.221	2.760	11.221
TE 1994	7.949	0.025	0.420	1.734	10.181
Average (1971-1994)	4.091	0.006	0.925	1.262	7.244
CV (%)	0.741	2.278	0.835	0.967	0.636
Post-WTO					
TE 1997	11.314	0.031	0.027	1.906	12.231
TE 2000	9.953	0.024	0.247	0.248	12.386
TE 2003	10.867	0.282	0.185	0.582	12.006
TE 2006	11.413	0.714	4.277	4.252	13.948
TE 2009	8.672	1.630	9.740	8.943	16.207
TE 2012	7.559	1.262	8.930	8.295	16.592
TE 2015	11.824	0.844	7.140	7.622	15.220
Average of 2016-17	13.226	0.232	2.997	5.867	19.216
Average (1995-2017)	10.490	0.645	4.245	4.664	14.530
CV (%)	0.243	0.920	0.993	0.828	0.207

Raw Data Source: <www.fao.org>

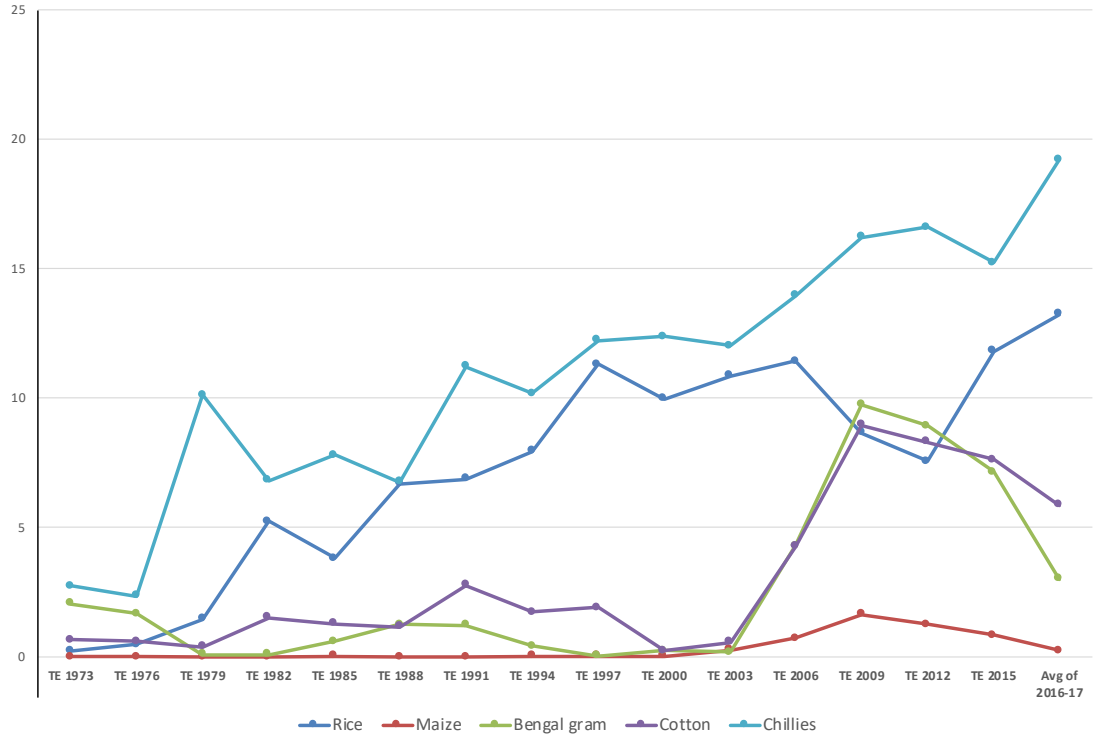

Figure 6: Trends in RCA_1 of selected commodities during Pre-WTO (1971-94) and Post-WTO (1995-2017) Regimes

A close perusal of the Table 1 revealed interesting results. The RCA_1 values for some commodities are found stable whereas, some others showed decreasing trends. The RCA_1 values for commodities like rice and chillies are stable around average values of 10.6 and 14.7 respectively during post-WTO regime. For commodities like bengal gram and cotton, the values of RCAs showed decreasing trend since TE 2012, but still the values are higher than one implying that India still enjoy comparative advantage in their exports. Similarly, for maize, the values of RCAs showed declining trend, but lie below one implying that India is losing its comparative advantage in its exports.

The calculated RCA_1 above was further re-defined as RSCA, as proposed by Dalum et al. (1998), Laursen (1998) and Widodo (2009) and the findings (Table 20.2) again revealed that chillies and rice enjoyed more RSCA for exports during both Pre-WTO and Post-WTO regimes. For cotton and bengal gram, the picture turned favourable during post-WTO regime ie., TE 2006. However, maize do not enjoy RSCA during both pre-WTO and post-WTO regimes. That is, it has the least RSCA (negative) over the years that shows the less comparative advantage as compared to other exported commodities.

Table 20.2: India's RSCA in Exports

Period	Rice	Maize	Bengal gram	Cotton	Chillies
Pre-WTO					
TE 1973	-0.626	-0.994	0.309	-0.208	0.247
TE 1976	-0.372	-0.998	0.245	-0.269	0.152
TE 1979	-0.018	-1.000	-0.856	-0.606	0.779
TE 1982	0.658	-1.000	-0.826	0.191	0.717
TE 1985	0.566	-0.963	-0.245	0.051	0.610
TE 1988	0.726	-0.999	0.070	-0.121	0.690
TE 1991	0.742	-1.000	0.082	0.281	0.813
TE 1994	0.776	-0.953	-0.523	0.104	0.821
Average (1971-1994)	0.307	-0.988	-0.218	-0.072	0.603
CV (%)	1.827	-0.027	-2.173	-5.823	0.554
Post-WTO					
TE 1997	0.830	-0.941	-0.949	0.139	0.844
TE 2000	0.810	-0.953	-0.635	-0.613	0.845
TE 2003	0.823	-0.593	-0.694	-0.474	0.846
TE 2006	0.835	-0.201	0.565	0.378	0.861
TE 2009	0.788	0.238	0.805	0.758	0.884
TE 2012	0.762	0.113	0.762	0.774	0.885
TE 2015	0.844	-0.135	0.738	0.768	0.874
Avg of 2016-17	0.859	-0.624	0.491	0.709	0.901
Average (1995-2017)	0.817	-0.377	0.120	0.287	0.866
CV (%)	0.050	-1.214	6.068	2.136	0.032

Raw Data Source: <www.fao.org>

ii. India's RMA in Imports (Balassa Index): As indicated in Table 20.3, India's RMA is calculated with the help of import figures of selected commodities with the rest of the world RCA to find out the competitiveness in the world market. Bengal gram and cotton are more competitive in the perspective of imports from the international market compared to other commodities, as their respective average indices are higher compared to other commodities and further increased during post-WTO regime when compared to pre-WTO regime.

Table 20.3: India's RMA in Imports of selected commodities (Balassa Index)

Period	Rice	Maize	Bengal gram	Cotton	Chillies
Pre-WTO					
TE 1973	6.1405	0.0158	0.3944	4.8646	0.0035
TE 1976	2.2144	0.0153	0.1542	0.8112	0.0295
TE 1979	0.5963	0.0394	1.0476	2.1025	0.1635

TE 1982	0.2460	0.0592	2.4780	0.1004	0.0691
TE 1985	1.9248	0.0042	6.2927	0.0613	0.0162
TE 1988	2.1606	0.1736	50.7634	0.4989	0.0096
TE 1991	3.3052	0.1291	68.9343	0.1132	0.0176
TE 1994	0.8220	0.0000	42.5689	2.1737	0.0007
Average (1971-1994)	2.176	0.055	21.579	1.341	0.039
CV (%)	1.134	2.165	1.388	1.432	1.842
Post-WTO					
TE 1997	0.0003	0.0000	34.5284	1.1375	0.0688
TE 2000	0.0603	0.1154	9.2058	3.6150	0.0723
TE 2003	0.0016	0.0037	30.2312	5.5380	0.4261
TE 2006	0.0006	0.0054	22.1808	1.9919	0.2574
TE 2009	0.0006	0.0234	16.7983	2.7393	0.2361
TE 2012	0.0020	0.0103	10.4713	0.8818	0.2191
TE 2015	0.0036	0.0213	17.7148	1.8396	0.0994
Average of 2016-17	0.0030	0.0554	20.7474	4.0006	0.1273
Average (1995-2017)	0.009	0.028	20.212	2.662	0.191
CV (%)	2.454	2.117	0.641	0.663	0.708

Raw Data Source: <www.fao.org>

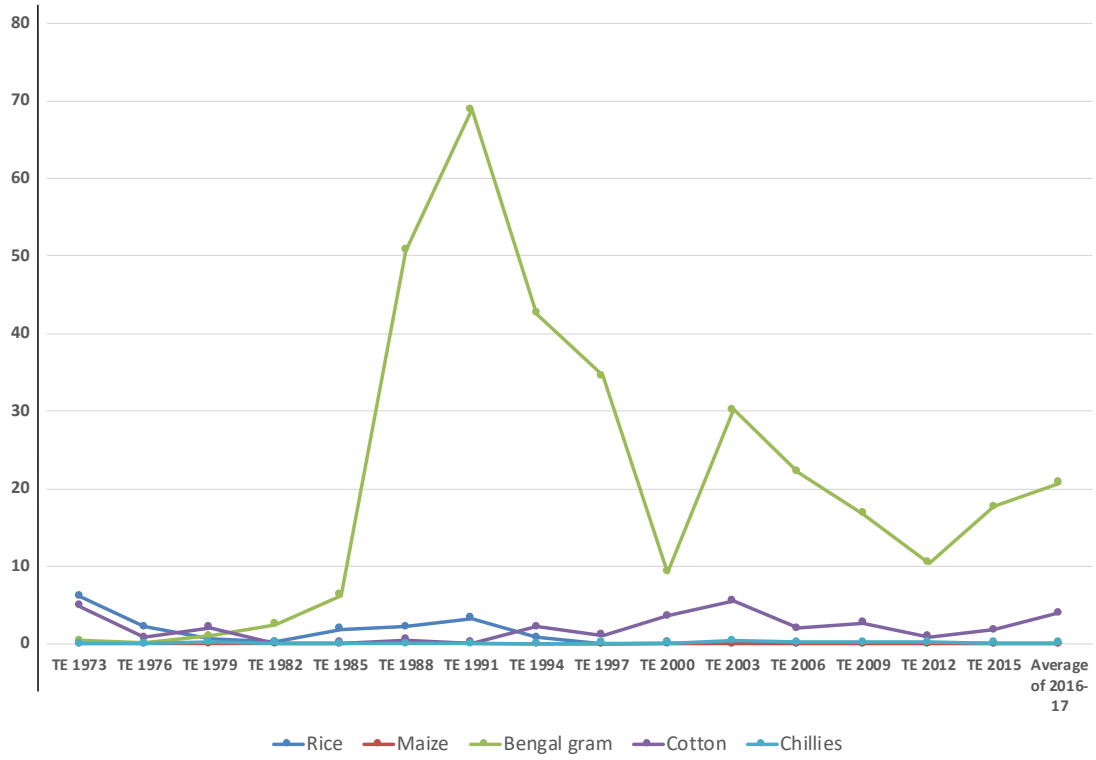

Figure 7: Trends in RMA of selected commodities during Pre-WTO (1971-94) and Post-WTO (1995-2017) Regimes

Along with RCA_1, other three RCA indices viz., RCA_2, RCA_3 and RCA_4, are also estimated for the selected commodities during both pre-WTO and post-WTO regimes (Table 20.4 and Figures 8 to 12) along with the average value and CVs. The estimated results of the RCAs for rice and chillies showed that India enjoy RCA in the exports of these commodities. The picture of comparative advantage for these two commodities was greatly improved during post-WTO regime compared to pre-WTO regime, as the average values of RCAs have increased over the study period. Average RCA_1 is more than unity and other three average values of RCAs are more than zero during both pre-WTO and post-WTO regimes implying that. India enjoy comparative advantage in their exports in the international market. The values of RCAs were greatly improved since TE 1973 for these two commodities. Similarly, cotton enjoyed RCA during post-WTO regime. Though it enjoyed relative trade disadvantage (RCA_2) and negative RCA_3 during pre-WTO regime, the scenario improved during post-WTO regime. This is so because, in view of dismantling of Quantitative Restrictions (QRs) on textile exports, India stands to gain substantially. The higher comparative advantage for cotton from India is due to cost-effective and quality production of short staple cotton. However, to further boost the trade advantage, it is high time to focus on upon the production of high quality long staple cotton. So, efforts should be intensified further to gain competitive edge for cotton exports into the global market. The RCA of maize was improved ($RCA_1>1$ and $RCA_2>0$) during post-WTO regime compared to pre-WTO regime. Maize exports from India have started picking up during post-WTO regime due to higher production. However, continuous MSP hike and over-supply in world market made India's maize exports non-export competitive. So, the way forward for the Indian maize sector depends on producing good quality maize, having a clear plan to increase the maize area under the dry season, focusing on post-harvest management, and establishing linkages between indsutry and farms. Role of transgenic crops for food security, improving India’s competitiveness in global maize trade, reducing the COP of maize, leveraging public-private partnerships (PPP) for maize farmers’ skill development and promoting alternative uses of maize as vital towards keeping up with international demand. However, regarding Bengal gram, though RCA_1 was improved during post-WTO regime, but RCA_2 was still negative implying that there is comparative disadvantage in its exports over the study period. A close perusal of the table further reveals that since TE 2012, the values of RCAs were improved for

rice and chillies, unlike other three commodities implying India should focus on these two commodities to boost their exports into the international market. As the estimated results show an increase in the average RCA values for all the commodities (except RCA_4 for bengal gram, cotton and chillies) during post-WTO regime compared to pre-WTO regime, it implies two important aspects viz., India's competitiveness in the export of these commodities has been increasing in the international market and India's position has been changing from comparative disadvantage (maize and bengal gram) during pre-WTO regime to comparative advantage during post-WTO regime. Further, the results of CVs showed that for rice and chillies, the RCA indices were fairly stable over the study period compared other commodities.

Table 20.4: RCA indices of selected commodities during both pre-WTO and post-WTO regimes

Period	Rice				Maize				Bengal Gram				Cotton				Chillies			
	RCA_1 (>1)	RCA_2 (>0)	RCA_3 (>0)	RCA_4 (>0)	RCA_1 (>1)	RCA_2 (>0)	RCA_3 (>0)	RCA_4 (>0)	RCA_1 (>1)	RCA_2 (>0)	RCA_3 (>0)	RCA_4 (>0)	RCA_1 (>1)	RCA_2 (>0)	RCA_3 (>0)	RCA_4 (>0)	RCA_1 (>1)	RCA_2 (>0)	RCA_3 (>0)	RCA_4 (>0)
Pre-WTO																				
TE 1973	0.23	-5.910	-1.471	-3.263	0.003	-0.013	-7.440	-3.263	2.046	1.652	0.657	1.990	0.660	-4.205	-0.422	-1.907	2.743	2.740	0.621	0.000
TE 1976	0.473	-1.741	-0.801	-1.510	0.001	-0.014	-8.027	-1.510	1.661	1.507	0.502	2.565	0.598	-0.213	-0.566	-0.294	2.340	2.310	0.398	4.425
TE 1979	1.474	0.877	-0.131	1.700	0.000	-0.039	0.000	1.700	0.079	-0.968	-2.703	-2.43	0.394	-1.708	-2.464	-2.064	10.124	9.960	2.188	4.548
TE 1982	5.226	4.98	1.611	3.462	0.000	-0.059	0.000	3.462	0.097	-2.381	-2.493	-3.146	1.513	1.413	0.391	4.248	6.803	6.734	1.854	5.605
TE 1985	3.807	1.882	1.302	0.918	0.019	0.015	-4.840	0.918	0.610	-5.683	-0.501	-1.598	1.283	1.222	0.114	0.000	7.791	7.774	1.705	0.000
TE 1988	6.694	4.533	1.868	2.506	0.000	-0.173	-9.226	2.506	1.266	-49.498	0.141	-3.459	1.151	0.652	-0.475	1.639	6.748	6.739	1.792	6.694
TE 1991	6.872	3.567	1.918	1.378	0.000	-0.129	0.000	1.378	1.221	-67.713	0.166	-4.026	2.760	2.647	0.679	3.431	11.221	11.204	2.332	6.625
TE 1994	7.949	7.127	2.072	2.793	0.025	0.025	-4.488	2.793	0.420	-42.149	-1.593	-5.230	1.734	-0.440	0.251	-0.086	10.181	10.180	2.319	0.000
Average (1971-1994)	**4.091**	**1.914**	**0.796**	**0.998**	**0.006**	**-0.049**	**-4.583**	**0.998**	**0.925**	**-20.654**	**-0.728**	**-1.917**	**1.262**	**-0.079**	**-0.311**	**0.993**	**7.244**	**7.205**	**1.651**	**4.865**
CV (%)	0.741	2.328	1.739	2.598	2.278	-2.506	-0.833	2.598	0.835	-1.446	-1.926	-1.480	0.967	-33.386	-4.276	3.474	0.636	0.637	0.579	0.548
Post-WTO																				
TE 1997	11.314	11.314	2.398	10.633	0.031	0.031	-4.025	10.633	0.027	-34.501	0.000	0.000	1.906	0.768	0.313	0.885	12.231	12.162	2.486	6.072
TE 2000	9.953	9.893	2.273	5.303	0.024	-0.091	-4.271	5.303	0.247	-8.959	-1.832	-3.793	0.248	-3.367	-1.475	-2.58	12.386	12.314	2.496	5.123
TE 2003	10.867	10.866	2.355	9.350	0.282	0.278	-1.494	9.350	0.185	-30.046	-1.768	-5.140	0.582	-4.956	-1.416	-3.114	12.006	11.580	2.484	3.396
TE 2006	11.413	11.413	2.419	0.000	0.714	0.708	-0.421	0.000	4.277	-17.904	1.347	-1.698	4.252	2.260	0.995	0.357	13.948	13.690	2.614	4.032
TE 2009	8.672	8.671	2.145	9.656	1.630	1.607	0.486	9.656	9.740	-7.059	2.249	-0.566	8.943	6.204	2.08	1.112	16.207	15.971	2.785	4.244
TE 2012	7.559	7.557	2.010	8.534	1.262	1.251	0.228	8.534	8.930	-1.542	2.090	-0.098	8.295	7.413	2.084	2.304	16.592	16.373	2.801	4.375
TE 2015	11.824	11.821	2.469	8.099	0.844	0.822	-0.301	8.099	7.140	-10.575	1.923	-0.940	7.622	5.782	2.03	1.430	15.22	15.120	2.710	5.221
Avg of 2016-17	13.226	13.223	2.580	8.411	0.232	0.176	-1.464	8.411	2.997	-17.751	1.082	-1.950	5.867	1.867	1.769	0.389	19.216	19.089	2.956	5.037
Average (1995-2017)	**10.490**	**10.480**	**2.320**	**8.268**	**0.645**	**0.616**	**-1.405**	**8.268**	**4.245**	**-15.968**	**0.217**	**-2.452**	**4.664**	**2.002**	**0.755**	**0.085**	**14.530**	**14.339**	**2.654**	**4.672**
CV (%)	0.243	0.244	0.106	0.289	0.920	0.987	-1.338	0.289	0.993	-0.938	10.64	-1.083	0.828	2.485	2.143	25.632	0.207	0.211	0.081	0.24

Raw Data Source: <www.fao.org>

Figure 8: Trends in RCA indices of Rice during Pre-WTO (1971-94) and Post-WTO (1995-2017) Regimes

Figure 9: Trends in RCA indices of Maize during Pre-WTO (1971-94) and Post-WTO (1995-2017) Regimes

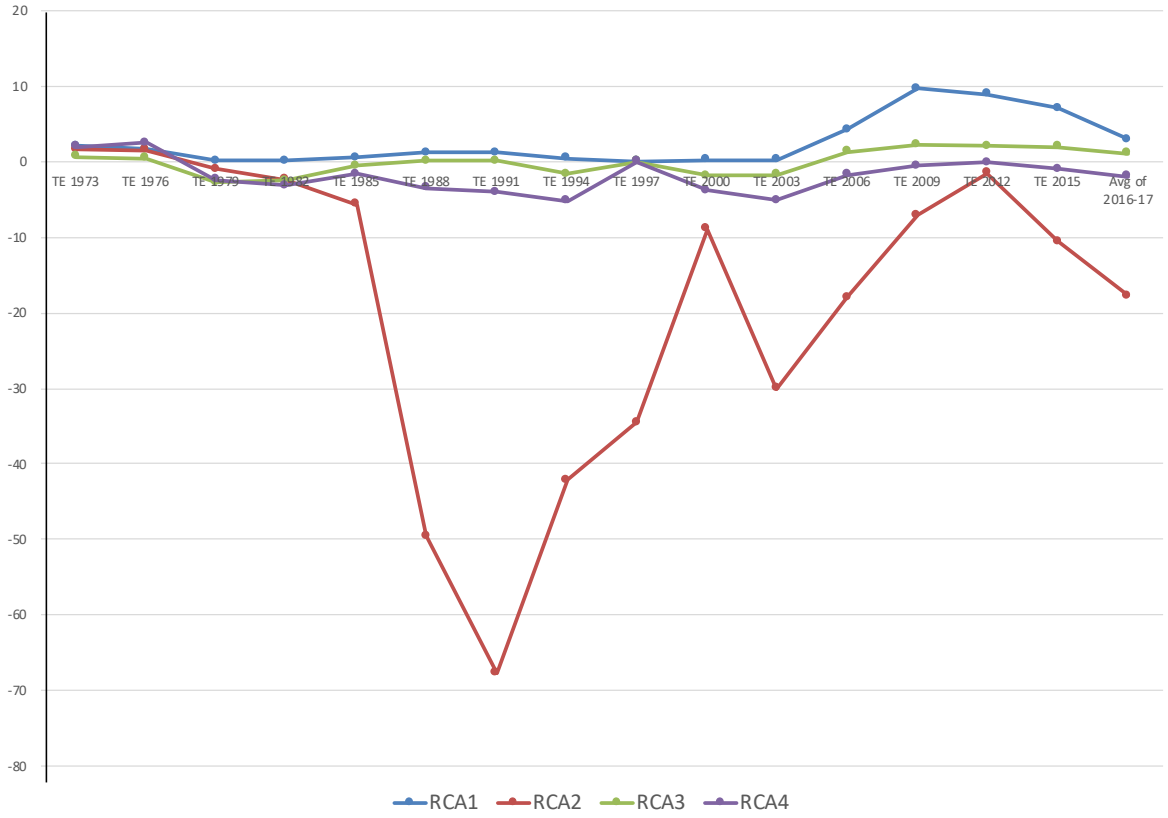

Figure 10: Trends in RCA indices of Bengal Gram during Pre-WTO (1971-94) and Post-WTO (1995-2017) Regimes

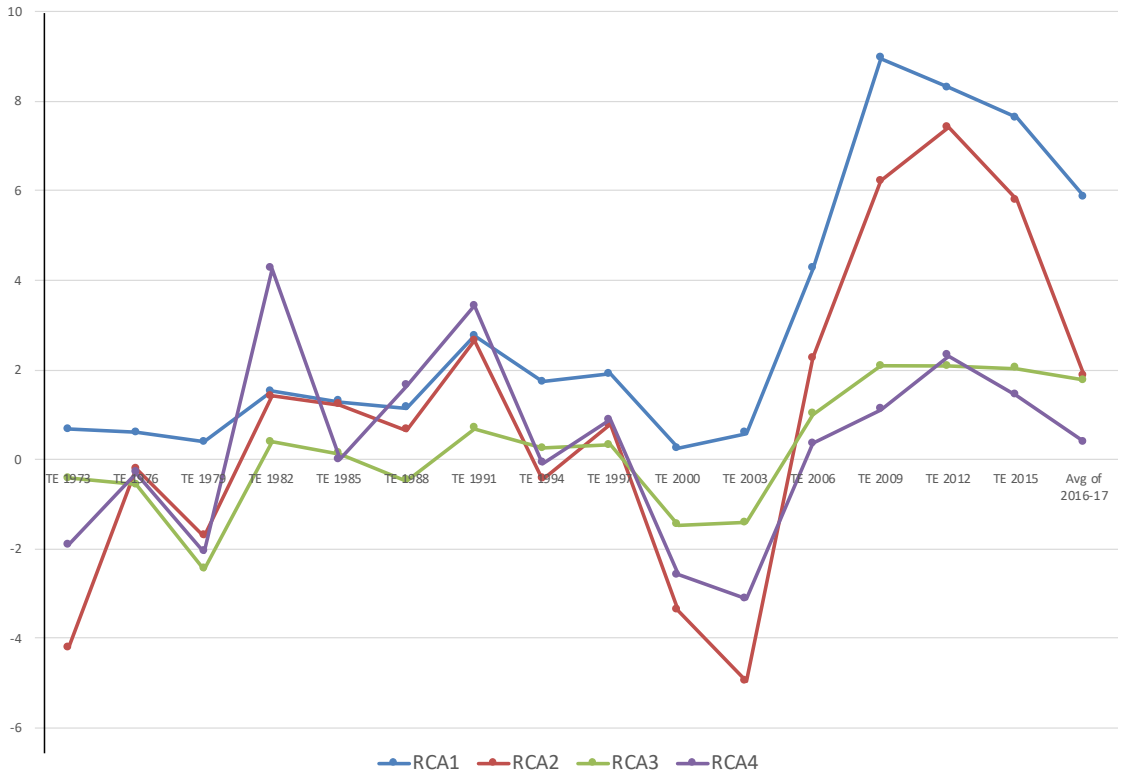

Figure 11: Trends in RCA indices of Cotton during Pre-WTO (1971-94) and Post-WTO (1995-2017) Regimes

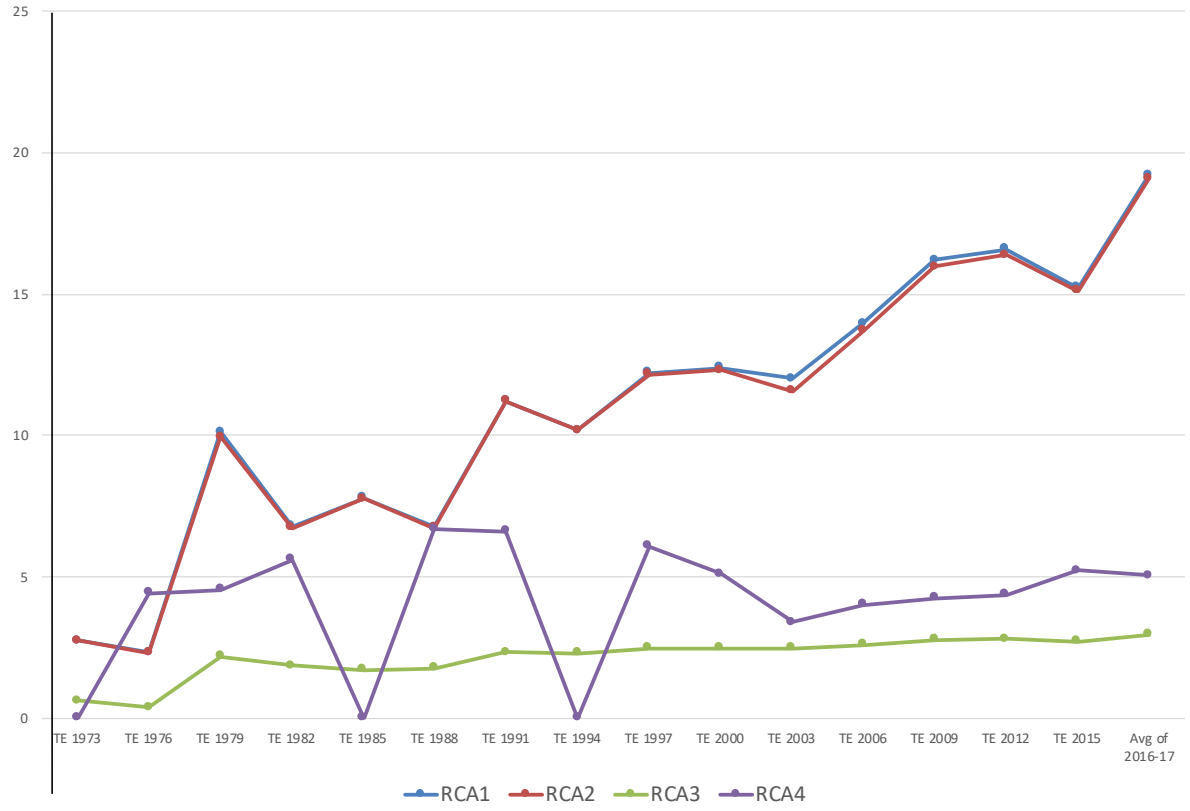

Figure 12: Trends in RCA indices of Chillies during Pre-WTO (1971-94) and Post-WTO (1995-2017) Regimes

iii. Consistency Tests of RCA

a. Cardinality test: The cardinality test of RCAs will show the degree of comparative advantage a product will have compared to other products. For this test, the correlation coefficient was used to examine the consistency of cardinal measure. The estimated results of the consistency test of cardinality of the four indices during post-WTO regime are presented through Table 20.5. The critical cut-off point to indicate consistency is > 0.70.

For rice, the test for consistency found that of the six possible pairings for each of the four sub-periods (ie., 1995-00, 2001-06, 2007-12 and 2013-17), 12 (RCA_1, RCA_2 and RCA_3 pairs across four sub-periods) out of total 24 pairs showed a high level of significant positive correlation (>0.70), or 50 per cent, out of the total pairs (24). However, the paired correlations between RCA_4 with RCA_1, RCA_2 and RCA_3 during 2001-06 are found negative, but non-significant. In case of maize, 13 (RCA_1 and RCA_3 during 1995-00, RCA_1, RCA_2 and RCA_3 during 2001-06 and 2007-12 and RCA_1, RCA_2, RCA_3 and RCA_4 during 2013-17) out of 24 pairs showed a high level of significant positive correlation (>0.70), or 54 per cent, out of the total pairs (24). However, the paired

correlations between RCA_4 with RCA_1, RCA_2 and RCA_3 are found negative during 2007-12, but non-significant. For bengal gram, 15 (RCA_4 and RCA_3 during 1995-00; RCA_3 with RCA_1 and RCA_4 with RCA_1 and RCA_3 during 2001-06; and among RCA_1, RCA_2, RCA_3 and RCA_4 during 2007-12; and RCA_3 with RCA_1 and RCA_2, and RCA_4 with RCA_1, RCA_2 and RCA_3 during 2013-17) out of 24 pairs showed a high level of significant positive correlation (>0.70), or 62.5 per cent, out of the total pairings (24). For cotton, 21 (among RCA_1, RCA_2, RCA_3 and RCA_4 during 1995-00, 2001-06 and 2013-17; and among RCA_1, RCA_2, RCA_3 during 2007-12) out of 24 pairs showed a high level of significant positive correlation (>0.70), or 87.5 per cent, out of the total pairings (24). Regarding chillies, 15 (among RCA_1, RCA_2 and RCA_3 during 1995-00, 2001-06 and 2013-17; and among RCA_1, RCA_2, RCA_3 and RCA_4 during 2007-12) out of 24 pairs showed a high level of significant positive correlation (>0.70), or 62.5 per cent, out of the total pairings (24).

These results showed that only one of the six possible parings (RCA_1 and RCA_2) across each sub-period was found to have a high level of correlation especially for rice and chillies. Since 2007-12, for other commodities like maize and cotton (except for bengal gram), the correlation between RCA_1 and RCA_2 showed significant positive correlation. However, the results obtained for all the four indices of RCA are not considered consistent, as a cardinal measure of comparative advantage (Andhale and Kannan, 2015).

Table 20.5: Consistency (Correlation) Test of RCA - Cardinal Approach

Rice												
	1995-00			**2001-06**			**2007-12**			**2013-17**		
	RCA_1	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**
RCA_2	1**			1**			1**			1**		
RCA_3	0.998**	0.998**		0.997**	0.997**		0.996**	0.996**		0.999**	0.999**	
RCA_4	0.385	0.395	0.406	-0.691	-0.691	-0.682	0.033	0.033	0.005	0.514	0.515	0.532
Maize												
	RCA_1	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**
RCA_2	0.412			1**			0.999**			1**		
RCA_3	0.947**	0.242		0.935**	0.934**		0.997**	0.996**		0.992**	0.995**	
RCA_4	0.078	0.644	0.17	0.509	0.515	0.369	-0.667	-0.64	-0.693	0.937*	0.946*	0.97**
Bengal gram												
	RCA_1	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**
RCA_2	0.624			0.465			0.851*			0.866		
RCA_3	0.451	0.78		0.942**	0.659		0.99**	0.818*		0.978**	0.899*	
RCA_4	0.415	0.713	0.991**	0.894*	0.77	0.987**	0.875*	0.992**	0.849*	0.937*	0.969**	0.976**
Cotton												
	RCA_1	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**
RCA_2	0.901*			0.966**			0.958**			0.97**		
RCA_3	0.947**	0.973**		0.881*	0.92**		0.985**	0.984**		0.999**	0.968**	

RCA_4	0.94**	0.988**	0.994**	0.908*	0.959**	0.992**	0.62	0.813	0.709	0.96*	0.997**	0.957*
Chillies												
	RCA_1	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**	**RCA_1**	**RCA_2**	**RCA_3**
RCA_2	1**			0.998**			1**			1**		
RCA_3	0.998**	0.998**		0.997**	0.994**		0.998**	0.997**		0.998**	0.998**	
RCA_4	0.178	0.19	0.222	0.243	0.301	0.238	0.857*	0.87*	0.834*	0.517	0.53	0.543

Note: ** - Significant at 1% level, * - Significant at 5% level
Raw Data Source: <www.fao.org>

b. Ordinality test: The ordinal test is based on rank correlation coefficient between each paring of four indices. Table 20.6 presents the results of ordinality test for the selected commodities during post-WTO regime. The findings infer that for rice and chillies, 12 out of 24 parings of RCA1 and RCA2 found a perfect positive rank correlation (1.00), which works out to 50 per cent. As the Spearman's rho is 1.00, it implies, the imports for these two commodities are negligible in total commodities imported into the country during post-WTO regime. However, no significant correlation exists across different RCA indices for these two commodities. For bengal gram, there exists higher and significant rank correlation (>0.70) between RCA1 and RCA2 during the recent two sub-periods. Ten out of 24 parings, or 42 per cent, showed a high level of rank correlation for bengal gram across the four sub-periods. However, maize and cotton, no significant rank correlation (>0.70) was found between RCA1 and RCA2 during the recent two sub-periods. For cotton, only seven out of 24 parings or 29 per cent, showed a high level of rank correlation across the two sub-periods, 199-00 and 2001-06. These results support the ordinal interpretation of RCA, and shows that these commodities may be ranked on the basis of comparative advantage. This result also supports the study done by Andhale and Kannan (2015).

Table 20.6: Consistency (Rank Correlation) Test of RCA - Ordinal Approach

	1995-00			2001-06			2007-12			2013-17		
Rice												
	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3
RCA_2	1			1			1			1		
RCA_3	1	1		1	1		1	1		1	1	
RCA_4	0.6	0.6	0.6	-0.886	-0.886	-0.886	-0.143	-0.143	-0.143	0.6	0.6	0.6
Maize												
	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3
RCA_2	0.714			1			1			1		
RCA_3	1	0.714		1	1		1	1		1	1	
RCA_4	0.058	0.348	0.058	0.429	0.429	0.429	-0.714	-0.714	-0.714	0.9*	0.9*	0.9*
Bengal gram												
	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3
RCA_2	0.943**			0.371			0.829*			0.9*		
RCA_3	0.143	0.429		1	0.371		1	0.829*		1	0.9*	
RCA_4	0.143	0.429	1	0.943**	0.6	0.943**	0.829*	1	0.829*	1	0.9*	1
Cotton												
	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3
RCA_2	0.886*			0.943**			1			0.8		
RCA_3	1	0.886*		1	0.943**		1	1		1	0.8	
RCA_4	0.886*	1	0.886*	1	0.943**	1	0.714	0.714	0.714	0.8	1	0.8
Chillies												
	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3	RCA_1	RCA_2	RCA_3
RCA_2	1			1			1			1		
RCA_3	1	1		1	1		1	1		1	1	
RCA_4	0.714	0.714	0.714	0.486	0.486	0.486	0.714	0.714	0.714	0.3	0.3	0.3

Note: ** - Significant at 1% level, * - Significant at 5% level
Raw Data Source: <www.fao.org>

The results discussed above with reference to consistency tests showed that the four indices are less consistent as cardinal measures, but relatively consistent as ordinal measures. Therefore, the RCA measure is also a useful indicator in determining whether a commodity has more comparative advantage or disadvantage than another commodity. Overall, the ordinal measure is relatively more consistent than the cardinal test, at around 77 per cent, with the indices at greater than cut-off point (>0.70). This shows that it is fairly stable over the years.

The results also showed that the four RCA indices are fairly stable for all the selected commodities (except bengal gram) especially during post-WTO regime, as indicated by the lower CV values. This will guide India should prepare long-term policy initiatives for promoting their

(importers' need based) exports at the global level considering the RCA. The study also suggests that improving infrastructure facilities in labelling and packaging, raising the quality of exportable products, providing greater storage facilities and marketing agricultural products better in the world market will provide an advantage for the Indian agricultural sector. It is disheartening to observe that India's comparative advantage in the world market for transacting maize and bengal gram is not on desired lines during the study period. The main reason for this trend in comparative advantage indices is that the denominator is increasing more than the numerator. It implies that the export share of these two commodities in total agricultural trade of the country, has been declining. Multiple factors are contributing to the declining export of these two commodities viz., poor quality in terms of international norms, no cost-effective production, and lack of infrastructure in labelling, packaging, marketing, storage facility etc.

iv. Lafay Index (LFI): The LFI analysis the trade situation of a particular commodity within the structure of foreign trade boundaries for every country or group of countries (Zaghini, 2003). As mentioned earlier, this index that measures the trade specialization concerning the specific commodity/product. Higher the value of LFI of a commodity implies the specialization of the country's trade, whereas the negative value of index shows despecialization. That is, the greater values of indices, the higher the degree of specialization (+ve value) / despecialization (-ve value) of country's trade in a particular commodity. Analyzing the obtained results (Table 20.7), and inferred that rice have a comparative advantage and country has a high level of specialization. Other commodities like maize, cotton and chillies have lower positive LFI indices and this implies lesser degree of specialization of the country's trade in view of frequent market price (both domestic and international) fluctuations. Further, the LFI values for maize and cotton started declining during post-WTO regime ie., since TE 2009 and TE 2012 respectively. On the contrary, the LFI values for chillies showed increasing trend during post-WTO regime ie., since TE 1997 and this is an heartening picture that the country showed relative advantage and gradual improvement in its specialization in the country's trade. Bengal gram exhibited negative LFI values and this shows relative disadvantage and low degree of its specialization in the country's trade.

Table 20.7: Trade Balance of selected commodities (LFI)

Period	Rice	Maize	Bengal gram	Cotton	Chillies
Pre-WTO					
TE 1973	-5.529	-0.025	0.036	-9.183	0.083
TE 1976	-1.887	-0.040	0.023	-0.423	0.060
TE 1979	0.715	-0.080	-0.022	-3.390	0.281
TE 1982	5.124	-0.142	-0.040	2.105	0.148

TE 1985	1.465	0.031	-0.111	1.860	0.230
TE 1988	3.082	-0.259	-1.275	0.692	0.181
TE 1991	1.489	0.000	-1.505	2.547	0.288
TE 1994	4.681	0.025	-1.066	-0.865	0.285
Average (1971-1994)	1.143	-0.084	-0.495	-0.832	0.195
CV (%)	3.151	-2.145	-1.461	-5.335	0.664
Post-WTO					
TE 1997	7.845	0.033	-1.025	0.394	0.369
TE 2000	9.282	-0.104	-0.271	-2.800	0.436
TE 2003	8.023	0.291	-1.366	-3.567	0.481
TE 2006	8.020	0.631	-0.547	1.607	0.617
TE 2009	7.199	1.728	-0.256	3.114	0.706
TE 2012	6.236	1.393	-0.080	4.787	0.717
TE 2015	9.810	0.886	-0.409	2.855	0.715
Avg of 2016-17	10.801	0.188	-1.654	0.857	1.236
Average (1995-2017)	8.298	0.650	-0.660	0.908	0.635
CV (%)	0.267	1.022	-1.039	3.603	0.397

Raw Data Source: <www.fao.org>

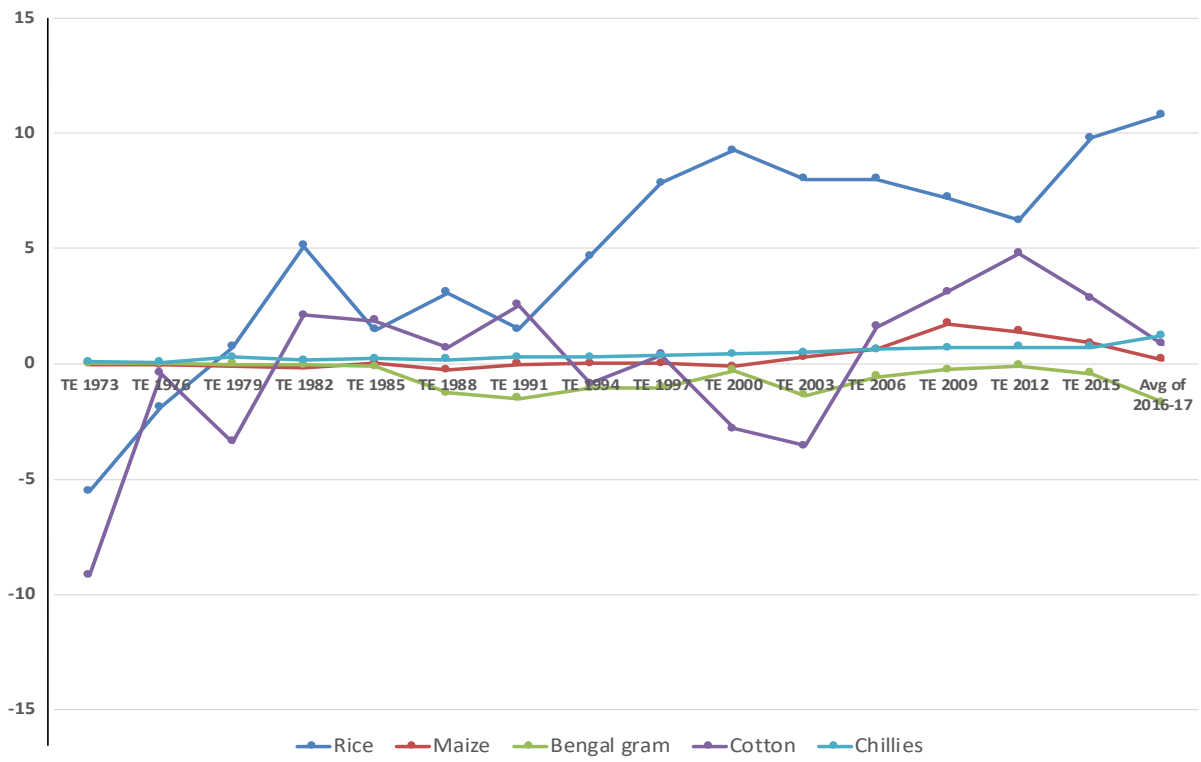

Figure 13: Trends in LFI of selected commodities during Pre-WTO (1971-94) and Post-WTO (1995-2017) Regimes

VI. PRICE ANALYSIS OF SELECTED AGRICULTURAL COMMODITIES IN TELANGANA

For comprehensive understanding of the crop dynamics, price analysis was also carried out along with the crops growth performance in terms of area, production and productivity in the study area. CGRs and CVs are calculated for MSP, DMP and IP for three periods viz., pre-WTO (1990-94), post–WTO (1995-2017) period and for overall reference period (1990-2017). For this analysis, secondary data on MSPs and DMPs are collected from different sources viz., Directorate of Economics and Statistics, Government of India; Commission for Agricultural Costs and Prices Reports and IPs are obtained from Food and Agriculture Organization (FAO).

i. Growth in MSPs, DMPs and IPs: In all the three reference periods, MSPs, DMPs and IPs recorded positive and significant growth rates (at 1% level), except for IPs of rice, maize, bengal gram and chillies during pre-WTO regime, as they recorded negative growth rates, though non-significant (Table 21). It is interesting that, the growth rates of MSPs and DMPs are much higher than IPs of selected commodities during the three reference periods. Further, the growth rate of MSPs is higher than growth rate of DMPs during the three reference periods, except for rice during post-WTO regime. This highlights three important aspects: Firstly, the rise in MSPs of selected commodities by the Government of India has escalated the COP of these crops and hence their DMPs. Secondly, there is slow pace of increase in MSPs of paddy during post-WTO regime compared to pre-WTO regime (with a view to reduce the cultivation of paddy as a second crop in rabi season and also considering mounting buffer stocks in Food Corporation of India (FCI) godowns), but this is sufficient enough to escalate the DMPs at a faster pace over and above its IPs. Thirdly, the higher growth rates of MSPs of the selected commodities above their respective IPs is a warning signal for losing their export competitiveness in the international market. Further, the growth rates of MSPs of the selected commodities are higher than their respective DMPs during overall reference period (except paddy) and also during the sub-periods imply that, the farmers are encouraged to escalate the COC and COP of these crops. These higher growth rates of MSPs are sufficient enough to escalate the DMPs of the selected commodities and hence, the growth of the DMPs is higher compared to their respective IPs during the overall reference period and even during the sub-periods. This price movement from MSP to COP and to DMP for each crop will have a direct relation with the export competitiveness of the commodities. That is, rise in MSPs of commodities have an indirect influence on their export performance from the country.

Table 21: CGR (%) in MSPs, DMPs and IPs of selected commodities in Telangana

Period	Prices	Rice	Maize	Bengal gram	Chilli	Cotton
Pre-WTO - regime (1990-1994)	DMP#	4.07**	6.60**	4.56 NS	7.84NS	17.18NS
	MSP#	14.00**	13.43**	10.99**	--	12.34**
	IP	-1.97NS	1.71 NS	-0.33 NS	4.35 NS	1.70**
Post-WTO - regime (1995-2017)	DMP	8.61**	7.37**	6.71**	6.18**	5.39**
	MSP	7.24**	7.70**	8.53**	--	5.71**
	IP	5.60**	4.68**	2.96**	3.11**	3.11**
Overall reference period (1990-2017)	DMP	7.90**	6.83**	6.78**	6.18**	5.52**
	MSP	7.43**	7.86**	8.34**	--	6.28**
	IP	3.99**	4.10**	2.73**	2.05**	2.05**

Note 1: ** - Significant at 1% level; NS – Non-significant;
Note 2: # - DMPs correspond to Telangana, IP is an average price of major exporting countries in respective periods
Raw Data Source: Directorate of Economics and Statistics, Government of India;
Commission for Agricultural Costs and Prices Reports
Food and Agriculture Organization (FAO)

ii. Instability in Prices: The price instability analysis (Table 22) revealed that IPs are more instable compared to DMPs for rice, maize and cotton during post-WTO regime, as indicated by higher CVs. Similar is the case for rice even during pre-WTO regime. However, for maize and cotton, DMPs showed more instability compared to IPs during pre-WTO regime. In case of bengal gram and chillies, higher instability was noticed in DMPs compared to IPs during both pre-WTO and post-WTO regimes. This high volatility of DMPs can be attributed to pests and diseases incidences, fluctuating productions and consequently fluctuations in domestic market demand. Lack of adequate cold storage facilities (for chillies) is also one of the major reasons for the fluctuations in DMPs. A close perusal of the table also revealed that IPs are more volatile than DMPs during post-WTO regime (2005-08 and 2014-17) for cereals and cotton and reverse is the case for commercial crops like bengal gram and chillies.

Table 22: Price instability (CV (%)) of selected agricultural commodities

Commodity	Period	DMP	International price
Rice	1990-94	5.67	14.93
	2005-08	17.03	44.22
	2014-17	6.61	16.92
Maize	1990-94	9.01	6.09
	2005-08	19.12	21.17
	2014-17	1.26	8.32
Bengal gram	1990-94	37.71	17.39
	2005-08	13.36	8.40
	2014-17	28.06	15.40
Chilli	1990-94	40.45	10.57
	2005-08	22.00	14.40

	2014-17	5.12	15.72
Cotton	1990-94	25.42	7.69
	2005-08	13.80	15.30
	2014-17	2.02	13.23

Note: Pre -WTO period (1990-94); Post- WTO period (2005-08) and (2014-17).
Raw Data Source: Directorate of Economics and Statistics, Government of India;
Commission for Agricultural Costs and Prices Reports
Food and Agriculture Organization (FAO)

Particularly in developing countries like India that enjoy significant trade in exports with reference to all the selected commodities (Table 23), extreme price fluctuations in the international market can put market supplies at risk during times of high supply and low demand. During post-WTO regime, the selected commodities suffered from considerable volatilities both in terms of DMPs and IPs and this often caused severe supply problems. The main reasons for this were changes in fundamental supply and demand factors. These include the population growth rate, and changed dietary habits (especially in neighbouring countries) along with the resulting increases in the consumption of feed grain and food. Weather-induced harvest losses in important producing countries viz., China, Indonesia, Bangladesh, Vietnam, Thailand etc., for paddy; USA, China, Brazil, Argentina, Mexico etc., for maize; Pakistan, Ethiopia, Burma, Turkey etc., for bengal gram; China, Pakistan, Morocco, Mexico, Spain, Turkey for chillies and USA, China, Brazil, Pakistan etc., for cotton have a major impact on price development. These supply-demand sources led to the instability of prices (especially in case of bengal gram and chillies) during post-WTO regime and thereby, dissuades farmers from undertaking long term investments in agriculture, compromising long-term sustainability.

iii. Export Competitiveness of selected commodities from Telangana: In the era of globalization, foreign trade policies have given high importance in boosting agricultural exports. This has resulted in cut throat competition among member nations in the trade scenario of various commodities and in this connection a country's exports will be decided by efficiency promotion and its price competitiveness. Under the WTO regime, the bilateral agreements between the countries as per which the trade of different items have taken place, is of not much importance. Hence, examining the export competitiveness of the commodities of interest for a country is utmost importance. India has to gear up its production and marketing strategies to gain higher access to global market and the selected commodities in this study enjoyed significant growth in the exports during post-WTO regime. It is in this context, the export competitiveness of selected commodities in Telangana was examined by using NPC. This is a measure of actual divergence or distortion DMP and IP or border price. The underlying rationale is that such divergence represents the presence of market

interventions such as taxes, subsidies and other policy instruments (Appleyard, 1987). The NPCs were calculated under exportable hypothesis (implying the domestic good competes at a foreign port) for three years viz., pre-WTO regime (1992-93) and post-WTO regime (2005-06 and 2017-18). These NPCs are estimated for three major exporting counties under each commodity and this highlights the comparative advantage the commodity that enjoys in the international market. If NPC is less than 0.5, the commodity is highly competitive, if it is between 0.5 to 0.1, it can be judged as moderately competitive and if the NPC is more than, then the commodity is not competitive for export into the international market.

Rice: For rice, the NPCs are estimated to the three major export destinations viz., Saudi Arabia, Iran, UAE for the above said three years. It is evident that, rice is moderately competitive in Saudi Arabia (0.619) and UAE (0.800) from Telangana and not export competitive in Iran (1.813) during pre-WTO period, 1992-93. However, during the recent post-WTO period (2017-18), this commodity gained export competitiveness across all the above three countries.

Table 23: NPCs of selected commodities from Telangana to major importing countries during pre and post-WTO regimes

Commodity	Countries	Pre-WTO period	Post - WTO period	
		1992-93	2005-06	2017-18
Rice	Saudi Arabia	0.619	0.973	0.841
	Iran	1.813	1.065	0.841
	UAE	0.800	1.000	0.842
Maize	Indonesia	2.470	2.036	1.175
	Nepal	2.877	1.999	1.377
	Malaysia	2.525	1.714	1.327
Bengal gram	Pakistan	1.776	0.800	0.892
	Algeria	0.585	0.919	1.503
	Sri Lanka	1.488	1.141	1.641
Chilli	Saudi Arabia	2.008	1.522	0.824
	Iran	2.499	1.956	0.911
	UAE	1.698	1.927	1.584
Cotton	China, mainland	0.732	0.629	0.618
	Bangladesh	0.607	0.595	0.584
	Pakistan	1.132	0.567	0.512

Note: DMPs correspond to Telangana, IP is an average price of major exporting countries in respective periods
Raw Data Source: Commission for Agricultural Costs and Prices Reports,
Food and Agriculture Organization (FAO),
Container Corporation of India, Hyderabad

Maize: Maize is majorly imported by traditional countries like Indonesia, Nepal and Malaysia from India. It is disheartening that in all the selected countries during both pre and post-WTO regimes,

maize was found to be non-export competitive, as the NPCs are above unity. This implies, the DMPs of maize in Telangana are significantly higher than the IPs during the selected periods.

Bengal gram: Pakistan, Algeria and Sri Lanka are the top three major importing countries of bengal gram from India. During pre–WTO regime (1992-93), Algeria is the only country, where gram is found moderately competitive, as the NPC value is 0.585. However, during post-WTO regime (2005-06), this commodity gained comparative advantage in Pakistan and Algeria, as the NPC values are 0.800 and 0.919 respectively. However, in the recent period, 2017-18 this commodity is found (moderately) export competitive only in Pakistan from Telangana with NPC value, 0.892.

The interesting aspect is that the MSPs of Bengal gram in India is very high. Though the actual realized prices are sometimes lower than the MSP, they are still uncompetitive when compared them to prices in the global market. The gram offered by Algeria, Sri Lanka, Australia, Canada etc., are way cheaper than those from India. So, the Indian bengal gram is out-priced in the global market. As gram is found non-export competitive. increasing domestic production and low per capita consumption in the last two years (2016 & 2017), it resulted in severe price cash due to over-supply into the market. So, the Government responded positively by opening up its exports. However, the countries like Myanmar, Australia, Canada, UAE etc., have fully operational processing facilities and long running exports and processing contracts, which Indian exporters do not have. So, due to lack of proper trading agreements with the imports need-based member nations, the Indian Bengal gram is not export competitive in the international market.

(Dry) Chillies: Saudi Arabia, Iran and UAE are the three major (dry) chillies importing counties from India. The estimated NPCs infer that, these three markets are found to be non-export competitive for this commodity during both pre and post-WTO periods viz., 1992-93 and 2005-06 respectively. However, this commodity became export competitive in Saudi Arabia and Iran with NPCs 0.824 and 0.911 respectively in the recent period, 2017-18.

Cotton: The selected three major markets namely China, mainland; Bangladesh and Pakistan are moderately competitive for exporting cotton from Telangana, as the NPC values are ranged between 0.500 to 1.000 during post-WTO periods viz., 2005-06 and 2017-18. Though this commodity remained non-export competitive only in Pakistan during pre-WTO regime (1992-93), it gained export competitiveness during post-WTO regime.

A close perusal of the findings infers that commodities like maize and bengal gram are not export-competitiveness during the recent post-WTO period (2017-18). Of course, the NPC values are often influenced by the individual countries' internal and external trade policies like Government's interventions, import restrictions, subsidies and high tariffs, etc. Even the quality of

produce also affects the trade prospects of a commodity in the international market. Thus, a disadvantage may not be a true picture of the comparative status, but it may indicate that the trade policies are not in favour of the exports of the produce.

The trends in the NPCs of the above commodities during post-WTO regime indicated that Telangana's comparative advantage improved in case of all the selected commodities viz., rice, maize (though still not export competitive), cotton (Bangladesh) and chillies. On the other hand, weakening of comparative advantage was noted in case of bengal gram and cotton (China, mainland & Pakistan). This trend clearly indicates a pattern in exports. While rice, cotton and chillies, which are major commodities produced in Telangana gained comparative advantage during 2017-18 compared to the earlier period, 2005-06 during post-WTO regime and erosion of comparative advantage is noted in case of bengal gram.

As the NPCs for rice, chillies and cotton are less than one, it indicates they are export competitive and enjoy a considerable degree of comparative advantage in the international market. With these results, it implies, Telangana enjoy a great advantage to specialize in the production and export of these commodities so as to earn the valuable foreign exchange. The country also needs to capitalize this advantageous position thereby, ensuring its position in the international market as a stable and dependable source of low-price good-quality produce in the world. As maize and bengal gram are found non-export competitive during post-WTO regime, it is high time now to focus on economies of large-scale production and quality production. It is also recommended that, in order to improve the competitiveness of these two commodities, attention needs to be given to domestic market thereby, rationalizing subsidies on certain inputs and improvement of domestic market performance. That is, production is to be made as per the requirements of international market by increasing the investment in Research and Development coupled with export friendly trade policies.

VII. EXPORT PERFORMANCE OF SELECTED AGRICULTURAL COMMODITIES FROM INDIA

The focus of the analysis in this core chapter of the report relates to the export performance of selected agricultural commodities from India during both pre-WTO and post-WTO regimes. The recent developments in the international trade scenario and corresponding alterations in India's foreign trade policies have depicted far-reaching implications for India's agricultural sector in general and agricultural exports in particular. Indian agricultural exports have occupied an important place in the world agricultural exports especially during the post-WTO regime. Today, India is a major supplier of several agricultural commodities like rice, coffee, tea, spices, cashew, oil meals, fresh fruits, fresh vegetables, meat and its preparations and marine products to the international market. However, the country faces cut throat competition from other major players in the field, both the existing and new entrants in the field. Ironically, the major challenge is from within Asia itself where countries like China, Malaysia, Philippines, Thailand, Singapore and Indonesia among others pose a big threat to Indian agricultural products. The demand and supply situations in the Asian continent have undergone a rapid transformation due to the growth of the world economy and lowering of trade barriers An economic revolution which took place in most of the South-East Asian countries has resulted in the creation of a huge supply potential of agriculture product in these economies along with an increase in their per capita income and a simultaneous increase in their trade potential. Moreover, some recent developments in the international trade scenario, followed by the establishment of World Trade Organization (WTO) and, The formation of regional trading blocks like ASEAN Free Trade Area (AFTA), Bangkok Agreement, South Asia Free Trade Agreement (SAFTA), etc. has given rise to powerful associations with strong bargaining power and these can significantly influence the demand and supply factors in the global markets. Above all, the Indian economy in itself has undergone a rapid transformation after the inception of economic reforms in 1991. India's ratification of the Agreement on Agriculture (AoA) with WTO also had a major impact leading to redefining of its agricultural trade. During this time period, various agricultural commodities exported from India have responded differently and their levels of contribution in India's total exports have shown a significantly an increasing trend. Indian agriculture has greatly contributed to foreign trade even in its traditional form. The performance of agriculture sector after its integration with the world markets is linked to the success of exports. In its bid to increase overall exports, the Government of India has decided to achieve this objective by giving a push to production and export of

agricultural commodities. Most of the export earnings of agriculture came from the conventional items such as rice, chillies, cotton, pulses, tea, cashew and spices, cereals etc.

i. Trends in Agricultural Exports and Imports from India since LPG phase: In this context, it is felt appropriate to study the export performance of Indian agricultural sector with special reference to the selected agricultural commodities. In this chapter, it is focused to analyze the destination-wise trends in exports, growth in exports and imports and changes in the trade direction of selected commodities across major importing countries. To begin with, a comparison of trends in agricultural exports and agricultural imports since the LPG phase was studied to serve as a backdrop for analyzing the trade performance of selected commodities from India.

Table 24: Trends in Agricultural Exports and Imports from India since LPG phase

(Rs. Crore)

Year	Agriculture Exports	Total National Exports	% Agriculture Exports to Total National Exports	Agriculture Imports	Total National Imports	% Agriculture Imports to Total National Imports	Ratio of Agricultural Exports to Agricultural Imports
1991-1992	7838.13	44041.81	17.80	1478.27	47850.84	3.09	5.30
1992-1993	9040.30	53688.26	16.84	2876.25	63374.52	4.54	3.14
1993-1994	12586.55	69748.85	18.05	2327.33	73101.01	3.18	5.41
1994-1995	13222.76	82673.40	15.99	5937.21	89970.70	6.60	2.23
1995-1996	20397.74	106353.35	19.18	5890.10	122678.14	4.80	3.46
1996-1997	24161.29	118817.32	20.33	6612.60	138919.88	4.76	3.65
1997-1998	24843.45	130100.64	19.09	8784.19	154176.29	5.70	2.83
1998-1999	25510.64	139751.77	18.25	14566.48	178331.69	8.17	1.75
1999-2000	25313.66	159095.20	15.91	16066.73	215528.53	7.45	1.58
2000-2001	28657.37	201356.45	14.23	12086.23	228306.64	5.29	2.37
2001-2002	29728.61	209017.97	14.22	16256.61	245199.72	6.63	1.83
2002-2003	34653.94	255137.28	13.58	17608.83	297205.87	5.92	1.97
2003-2004	37266.52	293366.75	12.70	21972.68	359107.66	6.12	1.70
2004-2005	41602.65	375339.53	11.08	22811.84	501064.54	4.55	1.82
2005-2006	49216.96	456417.86	10.78	21499.22	660408.90	3.26	2.29
2006-2007	62411.42	571779.28	10.92	29637.86	840506.31	3.53	2.11
2007-2008	79039.72	655863.52	12.05	29906.24	1012311.70	2.95	2.64
2008-2009	85951.67	840755.06	10.22	37183.03	1374435.55	2.71	2.31
2009-2010	89341.33	845533.64	10.57	59528.00	1363736.00	4.37	1.50
2010-2011	113046.58	1136964.22	9.94	51073.97	1683466.96	3.03	2.21
2011-2012	182801.00	1465959.31	12.47	70164.51	2345463.24	2.99	2.61
2012-2013	227192.61	1634318.29	13.90	95718.89	2669161.96	3.59	2.37
2013-2014	262778.54	1905011.00	13.79	85727.30	2715433.91	3.16	3.07
2014-2015	239681.04	1896445.47	12.64	121319.02	2737086.58	4.43	1.98
2015-2016	215396.55	1716378.05	12.55	140289.22	2490298.08	5.63	1.54

2016-2017	226651.91	1849433.55	12.26	164726.83	2577675.37	6.39	1.38
2017-2018 (Provisional)	251563.94	1956514.53	12.86	152095.20	3001033.43	5.07	1.65
CGR	**1.15****	**1.17****		**1.18****	**1.19****		

Note: ** - Significant at 1% level
Raw Data Source: www.indiastat.com

A trend of fluctuations in India's agricultural exports and imports during the past three decades from 1991-92 to 2017-18 corresponding to LPG phase is observed (Table 24). It was also noticed that the share of agricultural exports in the total exports was 17.8 per cent in 1991-92, which has increased by 2.5 per cent by the year 1996-97, there after the share was continuously declining and it reduced to 9.94 per cent in 2010-11. Between the years 2010-11 and 2012-13 there was an increase of around 4 per cent. However, the share of agricultural exports in India's overall exports has been declining from 17.8 percent in 1991-92 to 12.26 percent in 2016-17. There is an increase in the value of agricultural exports from Rs. 7838.13 crore in 1991-92 to Rs. 251563.94 crore in 2016-17.

The last six years of the first decade in the new millennium ie., between 2005-06 to 2010-11 have witnessed a continuous and substantial increase in India's agricultural exports and the total national exports. Agricultural exports from India rose from Rs. 49216.96 crore in 2005-06 to Rs. 113046.58 crore in 2010-11, which is more than 100 per cent increase during the six year period. Total national exports during the corresponding period rose from Rs. 456417.86 crore in 2005-06 to Rs. 1136964.22 crore in 2010-11, which is again an increase of more than 100 percent. However, during the subsequent period of next six years ie., 2011-12 to 2016-17, agricultural exports increased by only 24 per cent and total national exports by only 26 per cent. This highlight that both agricultural and national exports showed slow pace of increase during the second phase ie., 2011-12 to 2016-17 compared to the earlier phase of six years. On the contrary, both agricultural imports and national imports rose by 138 per cent and 135 per cent during 2005-06 to 2010-11 and 2011-12 to 2016-17 respectively. This implies agricultural imports are increasing at a greater pace compared to agricultural exports from the country and this is quite alarming during the recent period.

The slow rise in agricultural exports calls for the change in strategic approach of Indian agriculture in a big way to achieve higher levels of production in crops in which India has comparative advantage and generate surpluses for exports. The Government's commitment towards agriculture is seen from the ambitious 4 per cent growth target set under the Twelfth Five Year Plan. However, the agricultural imports in terms of absolute value also increased from Rs. 1478.27 crore to Rs. 164726.83 crore during 1991-92 to 2016-17. Similarly, the share of agricultural imports

in total national imports also increased from 3.09 per cent to 6.39 per cent (unlike agricultural exports) during the same reference period. It is quite alarming that the ratio of agricultural exports to agricultural imports is on the decline from 5.30 to 1.65 indicating that the imports are increasing at a faster pace compared to exports in agricultural sector.

The LPG reforms since 1991 has eliminated the bias against agriculture by lowering industrial tariffs and correcting for the overvalued exchange rates which lead to an improvement in the terms of trade in favour of agriculture. As a result, Indian agriculture has increasingly been opened to global agriculture with the ratio of agricultural exports and imports as a percent of Agricultural GDP rising from 4.9 percent in 1990-91 to 5.79 percent in 2016-17 (at current prices). The table further revealed that, India is a net exporter of agricultural commodities and net exports showed increasing trend in absolute value from Rs.6359.86 crore to Rs. 61925.08 crore during the above reference period. However, the growth in agricultural imports (1.18%, significant at 1% level) is slightly higher compared to growth in agricultural exports (1.15%, significant at 1% level) during the reference period.

ii. Destination-wise exports: From the earlier discussion it is evident that, in last three decades regime selected commodities have registered impressive growth rates in terms of production and DMPs and also export competitive even in the post-WTO regime (especially rice, chillies and cotton). In addition to this, here an attempt has been made in the following pages to study the major importers of the selected commodities from India during both pre and post-WTO regimes.

The total agricultural exports from India has increased considerably by multiple folds from Rs. 78.38 billion to Rs.2266 billion during 1991-92 to 2016-17. However, the share of agricultural exports' value in total national exports' value was found decreased from 17.80 per cent to 12.26 per cent during the same regime. Out of total agricultural exports value of Rs.2266 billion in 2016-17, the selected commodities exports viz., rice, pulses, cotton, and spices hold the prominent position with the shares of 16.92 percent, 0.5 percent, 0.48 percent and 8.42 percent respectively.

Rice: Rice is exported from India to many countries in the world. In fact, India is facing stiff competition in the international market for the export of (non-basmati) rice. India is the world's largest rice exporting country. Thailand is another large exporter of rice, but currently the demand for Thailand rice has steeply declined in the international market due to which India is likely to the world's largest exporter of rice. However, rice exports have been facing stiff competition from some of the neighboring Asian countries like Thailand and Vietnam majorly. Total India's exports of rice registered at 8.68 lakh tonnes during 1992-94 (pre-WTO regime) which increased by multiple folds to 106 lakh tonnes during 2014-2016. While in post-WTO regime, major rice

importing countries from India include Saudi Arabia (10.03%), Iran (7.87%), UAE (6.73%), Senegal (6.69%), Benin (5.74%), Nepal (4.76%), Bangladesh (4.53%), Iraq (4.37%), Guinea (3.82%) etc (Table 25). In pre-WTO regime, about 94 countries imported rice from India and out of this, around 55 per cent of rice exports from India are concentrated in Saudi Arabia, United Kingdom and UAE, whereas in post -WTO regime, the rice exports from India spread to around 143 countries in the world. India emerged as the largest exporter of rice during last decade in the global market over Thailand and Vietnam. Lifting the ban on exports of rice by the Government of India, increased international demand after declined supply from the major exporting countries viz., Thailand and Vietnam and depreciating currency are the major factors contributed India for being the largest exporter of rice in the global market in recent times.

The recent developments in the Indian rice (non-Basmati rice) segment in the domestic as well as the international markets are not encouraging for the Indian rice millers, since the MSP hike has been significant during 2018-19, as against a range bound hike in the past. The increase in the MSP could result in an increase in the acreage for sowing, thus ensuring higher availability of rice for exports, on the other hand this sharp increase of MSP would increase the DMP, thereby making Indian rice costlier in the global markets, which could impact adversely on rice exports. Moreover, with the imposition of the higher import duties by the member nations (say, Bangladesh imposed a duty of 28%), the exports to member nations are likely to decline. India is facing stiff competition in the international market from Thailand, Vietnam, USA and Pakistan. There was a considerable growth in the export of rice from India during the post-WTO regime (Table 30).

In the recent period, as cheaper rice from countries such as China and Thailand begins to enter into India's traditional markets in Africa, the concerned rice exporters in India are looking to the Government for incentives to sustain their markets. This is because, an increase in MSP for paddy, coupled with strengthening rupee against the dollar, has turned the Indian rice expensive in the world market and consequently the rice shipments got affected. The rice shipments fell to 7.11 lakh tonnes during April-May, 2019 from 15.25 lakh tonnes in the corresponding period last year, 2018. In value terms, the shipments slumped to $294 million from last year's $652 million during this reference period. In July, 2019, the Indian rice is expensive by 5-10 per cent compared with other traditional competitors such as Thailand, Vietnam, Pakistan and Myanmar. However, the entry of Chinese rice into the markets in 2019 has compounded the problem for Indian exporters. Chinese State agency, China Oil and Foodstuffs Corporation (COFCO) is out in the market to liquidate old stocks of 3-4 m. tonnes and is targeting markets in Africa, including Egypt. India has around 50 per cent share in African rice market, estimated at around 15 m. tonnes annually. So,

India's rice shipments slowed down during October-December, 2018 due to the impact of the higher paddy MSP, which saw an increase of 13 per cent for the kharif 2018 season. The announcement of five per cent Merchandise Exports from India Scheme (MEIS)* helped offset the impact of higher MSP. A further increase of 3.7 per cent in MSP for kharif 2019 has added to the exporters' challenge. The Government should look at a scheme such as Bhavantar Bhugtan Yojana (which sought to provide relief to farmers by providing the differential between MSPs and DMPs) ie., direct cash transfer instead of increasing MSP.

* - MEIS was introduced in the Foreign Trade Policy (FTP) for the period 2015-2020. The MEIS was launched as an incentive scheme for the export of goods. The rewards are given by way of duty credit scrips to exporters. The MEIS is notified by the DGFT (Directorate General of Foreign Trade) and implemented by the Ministry of Commerce and Industry. Under the FTP 2015-20, MEIS intends to incentivize exports of goods manufactured in India or produced in India. The incentives are for goods widely exported from India, industries producing or manufacturing such goods with a view to making Indian exports competitive. The MEIS covers goods notified for the purpose of the scheme.

Table 25: Country wise rice exports from India during Pre and Post-WTO regimes

Pre-WTO regime TE (1992-94)			Post-WTO regime TE (2014-16)		
Countries	**Export Quantity (lakh tonnes)**	**% share in total rice exports from India**	**Countries**	**Export Quantity (lakh tonnes)**	**% share in total rice exports from India**
Saudi Arabia	3.19	36.80	Saudi Arabia	10.74	10.03
United Kingdom	0.90	10.42	Iran (Islamic Republic of)	8.42	7.87
United Arab Emirates	0.63	7.27	United Arab Emirates	7.20	6.73
Netherlands	0.51	5.88	Senegal	7.16	6.69
Kuwait	0.45	5.21	Benin	6.14	5.74
Bangladesh	0.42	4.83	Nepal	5.09	4.76
Sri Lanka	0.24	2.74	Bangladesh	4.85	4.53
Iran (Islamic Republic of)	0.22	2.56	Iraq	4.68	4.37
Kenya	0.20	2.35	Guinea	4.09	3.82
Malaysia	0.17	1.94	Côte d'Ivoire	3.26	3.05
Germany	0.16	1.87	South Africa	3.03	2.83
USA	0.14	1.60	Turkey	2.68	2.51
Togo	0.14	1.57	Somalia	2.54	2.38
Singapore	0.13	1.51	Sri Lanka	2.42	2.26
Oman	0.12	1.32	Liberia	2.37	2.22
Bahrain	0.11	1.30	Yemen	2.25	2.10
Others	0.93	10.75	Others	30.07	28.10
Total	8.68	100.00	Total	106.99	100.00

Raw Data Source: www.fao.org

Maize: India exported 17.36 lakh tonnes of maize (Table 26) to major destinations such as Indonesia with 23.76 per cent of the total quantum of exports followed by Nepal (15.88%), Malaysia (14.41%), Vietnam (13.73%), Bangladesh (13.36%) etc., during TE 2014-16 (post-WTO regime). The maize exports escalated from meager quantity of 0.16 lakh tonnes in pre-WTO regime to 17.36 lakh tonnes in post-WTO regime. Malaysia, Bangladesh and Sri Lanka remained as the traditional importing countries for Indian maize and this shows the export demand is majorly from Asian countries.

Table 26: Country wise maize exports from India during Pre and Post-WTO regimes

Pre-WTO regime TE (1992-94)			Post-WTO regime TE (2014-16)		
Countries	**Export Quantity (lakh tonnes)**	**% share in total maize exports from India**	**Countries**	**Export Quantity (lakh tonnes)**	**% share in total maize exports from India**
Malaysia	0.0649	38.440	Indonesia	4.13	23.76
Iran	0.0491	29.103	Nepal	2.76	15.88
Sri Lanka	0.0175	10.392	Malaysia	2.50	14.41
South Africa	0.0096	5.672	Vietnam	2.38	13.73
Bangladesh	0.0082	4.866	Bangladesh	2.32	13.36
Seychelles	0.0049	2.921	Sri Lanka	0.52	2.98
Indonesia	0.0049	2.917	UAE	0.30	1.73
Thailand	0.0029	1.720	China, Taiwan Province of	0.29	1.67
Kuwait	0.0025	1.485	Oman	0.29	1.67
Saudi Arabia	0.0012	0.695	Singapore	0.25	1.42
Kenya	0.0010	0.589	Philippines	0.24	1.37
Mozambique	0.0007	0.395	Yemen	0.24	1.36
Others	0.0014	0.806	Others	1.15	6.65
Total	0.1688	100.000	Total	17.36	100.00

Raw Data Source: www.fao.org

India has been a major maize supplier in recent years, capturing 45 per cent of the Southeast Asian maize import market. The country's ability to supply these imports reflects a long-term increase in yields due to increased use of hybrid seed and improved agricultural practices. For India to remain both able to supply its own people's maize demand – ever-rising due to population growth and increased demand for animal feed – and remain a prominent exporter in the region, production will have to continue to increase. In order to increase production from 25 m. tonnes to 45 m. tonnes by 2025 and to meet domestic and export demand, maize breeding will have to shift towards developing improved maize cultivars for smaller areas due to the interactions between genetics and growing environments. One of the key problems the maize sector in India in general and Telangana in particular faces is inefficient supply chain infrastructure resulting in unpredictable supply for consumers. In an effort to improve infrastructure, the Government should modernize the infrastructure and electronic auctioning systems in Agricultural Produce Market Committees (APMCs) helping to reduce inefficiencies in the maize supply chain. The two major barriers for the maize sector include climate change and low competitiveness of Indian maize in the international market. Hence, it is high time to improve efficiency along the maize value chain and provide crop and weather insurance products specially designed to address challenges faced by maize farmers.

Further, bringing down cultivation costs by increasing hybridization, subsidizing maize drying infrastructure, promoting alternate usage of maize as potential drivers for maize industry growth, quality production, focusing on post-harvest management and establishing linkages between industry and farms deserve special attention.

Bengal gram: This commodity is a primary source of protein for the poor and the vegetarians. They are also excellent source of essential amino acids and fatty acids, fibers, minerals and vitamins. So, this is playing a leading role in food safety through covering the deficit in proteins of daily food ration. India being the largest bengal gram producing country, it exports to some extent and also imports considerable quantity to meet the rising domestic demand. Among the pulses, bengal gram is majorly exported from India, on the other hand, it also imports significantly and consequently India is a net importer of this commodity. Increased demand for livestock feed and rising domestic demand from mounting population in the developing countries (especially India) has changed the demand structure for bengal gram in recent past. The exports from India swollen considerably from 1530.67 tonnes in TE 1992-94 regime to TE 1.73 lakh tonnes in 2014-16 (Table 27). The imports also increased considerably from 0.95 lakh tonnes to 6.47 lakh tonnes during the same period. In post-WTO regime, Pakistan had a major share of 32.91 per cent in total quantum of bengal gram exports from India followed by Algeria (13.44%), Sri Lanka (8.99%), Turkey (7.58%), UAE (6%), Saudi Arabia (4.82%) etc. More than 90 per cent of the export demand for Indian bengal gram is from neighboring countries.

Table 27: Country wise Bengal gram exports from India during Pre and Post-WTO regimes

Pre-WTO regime TE (1992-94)			**Post-WTO regime TE (2014-16)**		
Countries	**Export Quantity (lakh tonnes)**	**% share in total bengal gram exports from India**	**Countries**	**Export Quantity (lakh tonnes)**	**% share in total bengal gram exports from India**
UAE	0.0065	42.66	Pakistan	0.5698	32.91
USA	0.002	12.74	Algeria	0.2327	13.44
Saudi Arabia	0.0016	10.5	Sri Lanka	0.1557	8.99
United Kingdom	0.0016	10.32	Turkey	0.1312	7.58
Kuwait	0.001	6.49	UAE	0.1039	6
Canada	0.0007	4.64	Saudi Arabia	0.0834	4.82
Israel	0.0004	2.77	Tunisia	0.0627	3.62
Bangladesh	0.0004	2.64	Iraq	0.0469	2.71

Bahrain	0.0004	2.48	Libya	0.0432	2.49
Singapore	0.0003	1.66	Spain	0.0393	2.27
Oman	0.0001	0.7	Egypt	0.0275	1.59
Sweden	0.0001	0.7	Vietnam	0.0235	1.36
Mauritius	0.0001	0.46	Kuwait	0.02296	1.33
Others	0.0002	1.26	Others	0.1886	10.9
Total	0.0153	100	Total	1.7313	100

Raw Data Source: www.fao.org

Pressured by the domestic market conditions — large harvests, low prices over the last one year ie., 2017-18 — the Centre recently lifted the prohibition on export of all varieties of pulses. A blanket ban on pulses export was imposed over ten years ago in 2007 to check rising DMPs then. In response to trade representation, one variety, Kabuli bengal gram, was exempted from the ban. In recent years, Kabuli bengal gram shipments averaged around 0.2 m. tonnes. Prior to total ban, India used to export respectable quantities of pulses — mainly masur (lentil) and to a less extent tur/arhar (pigeon pea), urad (black gram) and moong (green gram). Indian pulses were quite popular in overseas markets, especially in countries with large expatriate Indian population.

With India imposing ban on pulses export for ten long years, new origins have entered the world market with aggressive export plans. Myanmar and East African nations are relatively new entrants to the pulses export market and their volumes started to increase with expansion of India's import needs. So, it is not easy for India to promote exports of pulses in the international market. There is already fierce competition among various supplying countries: Canada, Australia, Russia, Ukraine, USA and others, especially after India imposed import restrictions. This further lead to fall in IPs of pulses. So, India will find it tough to re-enter the international market to gain export competitiveness, as the fluctuating domestic production and increasing MSPs are contributing for rise in DMPs. Especially, the bengal gram considered in this study proved non-export competitive in the top three destination markets (Table 23). It is known fact that, India has no genuine export surplus and even not self-sufficient yet in the production of pulses. Yet, opening up pulse exports makes the farmers to be prepared for competitiveness from the global players and at the same time allowing imports is a consumer-friendly step. So, any restriction on exports would be anti-farmer. Though pulses can make a small contribution in total export earnings, it will make popular the Indian cuisine across the countries, help improve capacity utilization of dal mills and lend stability to domestic prices. Given the present supplies, price and market conditions, India can hope to export about five lakh tonnes of various varieties of pulses. This calls for a strategic approach to export promotion. Accordingly, Government of India announced 7 per cent export incentives for bengal

gram (chana) under the MEIS in 2018. This follows increase in import duty on Kabuli Chana to 60 per cent.

Chillies: India is the largest producer and exporter of the spices in the world. In total spices exports, chillies exports in terms of quantity hold a major share of 40 per cent. During pre-WTO regime (TE 1992-94), total chillies exports from India recorded at 0.22 lakh tonnes and this scaled up significantly by 154 per cent ie., to 3.62 lakh tonnes during TE 2014-16. Major chillies importing countries from India include: Vietnam holding a major share of 16.7 per cent in total quantum of Indian exports followed by Thailand with 15.71 per cent, Sri Lanka (13.5%), UAE (9.49%), Malaysia (8.58%), USA (6.52%), Indonesia (5.75%) etc (Table 28). USA, Sri Lanka and UAE remained the stable importing counties of the chillies from India in last three decades period. The list of importing countries has increased from 71 to 128 during TE 1992-94 to TE 2014-16.

Table 28: Country wise Chillies exports from India during Pre and Post-WTO regimes

Pre-WTO regime TE (1992-94)			**Post-WTO regime TE (2014-16)**		
Countries	**Export Quantity (lakh tonnes)**	**% share in total chillies exports from India**	**Countries**	**Export Quantity (lakh tonnes)**	**% share in total chillies exports from India**
USA	0.0565	25.635	Vietnam	0.6044	16.70
Sri Lanka	0.0478	21.679	Thailand	0.5684	15.71
Bangladesh	0.0269	12.188	Sri Lanka	0.4887	13.50
UAE	0.0221	10.03	UAE	0.3433	9.49
UK	0.0105	4.768	Malaysia	0.3106	8.58
Singapore	0.0096	4.358	USA	0.2359	6.52
Italy	0.0041	1.847	Indonesia	0.2079	5.75
Saudi Arabia	0.0037	1.684	Bangladesh	0.1662	4.59
Mexico	0.0032	1.449	Mexico	0.1138	3.14
Canada	0.0029	1.313	Pakistan	0.0789	2.18
Netherlands	0.0026	1.167	UK	0.0745	2.06
Indonesia	0.0025	1.155	Nepal	0.0592	1.63
Oman	0.0025	1.146	Singapore	0.0352	0.97
France	0.0024	1.068	Saudi Arabia	0.0328	0.91
Mauritius	0.0023	1.056	Qatar	0.0311	0.86
Others	0.0208	9.450	Others	0.2683	7.41
Total	0.2205	100.000	Total	3.6193	100.00

Raw Data Source: www.fao.org

India is the leading producer of chillies contributing close to 43 per cent of world production followed by China (8.6%) and Peru (5.6%). World trade of chillies stands at approximately 0.5 m.

tonnes with an approximate value of $990 million. The USA is the leading chilli importer accounting for nearly 20 per cent of the world imports followed by Malaysia (10%) and Mexico (9%). Top chilli exporting countries of the world are India (37%), China (25%) and Peru (11.5%). Chilli contributes to about 40 per cent of total spice exports from the country. In the recent period, the DMPs of chillies have almost doubled since 2018 and the global prices are reaching new highs. However, the hopes of chilli farmers, who had just begun to celebrate high prices of Rs.15,000/qtl during January, 2020 have been dashed as prices began to slide in the range of Rs.9,000-14,000 in the key markets of Guntur (Andhra Pradesh), Khammam and Warangal (Telangana). Further, demand from China, one of the major buyers, has dried up following the outbreak of novel Coronavirus there. Teja variety of chillies has great demand in the export market, particularly Chinese, who use the produce for extracting oil. Telangana grows chillies on about 0.84 lakh ha. The State expects a production of 3.28 lakh tonnes, showing a growth of about 8 per cent over the 2017-18. Telangana produced a record 4.83 lakh tonnes of chillies in 2016-17. While chilli contributes significantly to the rural economy of the country, there is still immense potential to be tapped by plugging certain supply chain gaps. Measures need to be taken to increase chilli production to meet the growing global and domestic demands. There is an urgent need to reduce the post-harvest wastages by adapting scientific storage, efficient transport, grading and effective packaging.

Cotton: Though India being the third largest producer of cotton in the world, it exports only small proportion of the total production after meeting the domestic demand. Still, Indian cotton exports significantly increased from 1.13 lakh tonnes in TE 1992-94 to TE 13.95 lakh tonnes in TE 2014-16 (Table 29). Though India imports significant quantum of cotton (3.15 lakh tonnes during TE 2014-16), it enjoys net exporter status in the international trade. Major trade destinations for Indian cotton exports are China, main land with 30.91 per cent share, Bangladesh (27.14%), Pakistan (15.94%), Vietnam (9.62%), Indonesia (3.15%) and Turkey (1.91%).

Table 29: Country wise Cotton exports from India during Pre and Post-WTO regimes

Pre-WTO regime TE (1992-94)			Post-WTO regime TE (2014-16)		
Countries	**Export Qty in lakh tonnes**	**% share in total cotton exports from India**	**Countries**	**Export Qty in lakh tonnes**	**% share in total cotton exports from India**
China, Hong Kong SAR	0.22	19.205	China, mainland	4.31	30.91
Thailand	0.18	16.299	Bangladesh	3.79	27.14
Japan	0.17	14.849	Pakistan	2.22	15.94
Indonesia	0.13	11.844	Vietnam	1.34	9.62
Libya	0.11	9.934	Indonesia	0.44	3.15
Brazil	0.04	3.844	Turkey	0.27	1.91
Bangladesh	0.03	2.952	Republic of Korea	0.22	1.59
China, Taiwan Province of	0.03	2.746	China, Taiwan Province of	0.20	1.43
UK	0.03	2.525	Thailand	0.20	1.43
Belgium-Luxembourg	0.02	1.781	Japan	0.12	0.87
Others	0.16	14.021	Others	0.83	5.97
Total	1.13	100.000	Total	13.95	100.00

Raw Data Source: www.fao.org

Amid slowing raw cotton exports in recent months, India has seen sharp jump in cotton demand from an unexpected buyer, Iran. Iran's cotton purchases from India have gone up multiple times in recent months. Going by the Directorate General of Foreign Trade (DGFT) data, India exported 15,877 kg raw cotton (HS Code 52010015 of staple length 28.5 mm and above but below 34.5 mm) during the year 2017-18. Cotton exports to Iran reported a phenomenal jump of 1070 per cent to 1.85 million kg during 2018-19. Besides Iran, Oman is the only country where a growth in export is reported during the period. India exported 1.98 million kg of raw cotton to Oman during the first quarter of 2018-19, up from a nominal 0.02 million kg in the same period last year. The reason was favourable payment terms in rupee denomination and higher demand. The total cotton exports are estimated around 46 lakh bales by the end of 2019. New buyers are expected from countries such as Iran, Vietnam and Bangladesh. The recent outbreak of coronavirus, which spread from China to over a dozen countries, is unlikely to pose a major threat to India's cotton exports, as India's export prices are competitive in the international market and the exports can be diverted from China to other markets. Considering the comparative price advantage, Indian cotton is export

competitive in China, Bangladesh, Pakistan, Vietnam, Indonesia and Taiwan and this hints that India's cotton will have no difficulty finding a market elsewhere. However, increased production led to drastic fall in DMPs of cotton and even lower than MSP, though the Cotton Corporation of India (CCI) has already bought about 45-50 per cent of the overall arrivals across the markets in India during 2018-19. So, considering the current price trend, CCI procurement and the stocks available with the farmers, raw cotton prices have remained under pressure during the peak marketing season. However, the demand outlook remains strong and being export competitive, there will be a revival in the domestic market.

iii. Growth rates of exports and imports: CGRs of exports and imports both in terms of quantity and value (Table 30) are worked out for selected commodities during pre and post-WTO regimes, so as to ascertain their trends and prospects in international trade. It is heartening to note that for all the selected commodities, the exports both in terms of quantity and value had shown positive and significant growth rates during post-WTO regime (except for quantum of exports of cotton). Further, the growth in exports both in terms of quantity and value are higher during post-WTO regime compared to pre-WTO regime. The findings are much encouraging for maize, bengal gram and cotton, as the exports turned significant during post-WTO regime and especially in case of cotton, the exports that showed negative growth rate during pre-WTO regime turned positive and significant (exports value) during post-WTO regime. In case of bengal gram, the Government of India had lifted a decade-old ban on export of pulses in 2018 (ie., removed restrictions), but this has not led to a surge in shipments because, this led to a loss of overseas markets. At least the Government should export 2.5 m. tonnes of pulses in 2018 to support DMPs and create domestic demand for the pulses. It is also necessary to announce incentives for export of pulses. To support DMPs, the Government of India also announced seven per cent export incentive for bengal gram (chana) during March, 2018 under the Merchandise Export from India Scheme (MEIS) for a period of three months till June, 2019. So, with these interventions, it is expected that the exports may still rise in the future. As mentioned earlier, India is significantly importing bengal gram and cotton however, the rate of growth declined during post-WTO regime compared to pre-WTO regime. This is due to increased domestic production of these commodities (Table 13) that led to declined imports into India. The opportunity to grow more pulses especially bengal gram in India boomeranged as imports flooded the country along with the DMPs went below the MSPs during pre-WTO regime. However, the increased production during post-WTO regime has led to declined imports growth rate. This is set to provide a major relief for Indian farmers who faced a subdued price trend during pre-WTO regime. The decline in growth rate of imports is expected to improve

prices in domestic market, which will be aided by the expected uneven distributions of the monsoon rainfall and consequently fluctuating output levels. Recently, the Government has increased the import duty on the pulses to 60 per cent from the earlier 40 per cent and this move helped to restrict cheaper imports from Australia and Canada, among other countries, and stabilize the prices of Bengal gram, which are currently ruling below the MSPs of Rs.4,400 per quintal (including a bonus of ₹150) in various APMCs. Even during the overall reference period, the exports both in terms of quantity and value had shown positive and significant growth rates and this growth is higher compared to imports. However, in case of cotton, during overall reference period 1980-2016, though the exports showed positive and significant growth rates both in terms of quantity and value, still the growth of imports is much higher than exports. Fluctuating crop production due to frequent droughts, higher volatility of DMPs, decline in global prices for cotton due to higher production than mill-use etc., has prompted the Indian industry to look for cotton from global suppliers such as the US, Brazil and African counries. It is interesting to note that the imports of cotton provide an economical proposition to Indian traders and millers, as it is more economical to import rather than purchasing cotton at higher DMPs. That is, the huge price gap between Indian and foreign cotton, making it cheaper to import. On the quality issues, the international cotton comes with little trash and higher realization, resulting in additional 2-3 per cent cost benefit. It is disheartening that though India is one of the leading producers of (dry) chillies in the world, its imports both in terms of quantity and value showed positive and significant growth rates during post-WTO regime, though it recorded non-significant growth for imports during pre-WTO regime. This is due to fluctuating production of chillies due to various factors like frequent droughts, pests and diseases incidences, high price volatility etc. Similarly, maize imports though showed significant declining trend during pre-WTO regime, but exhibited significant positive growth rate (in terms of value) during post-WTO regime. This is because, India's growing population, rising disposable incomes and changing food habits are boosting the consumption of non-vegetarian food. With increasing per capita incomes over a period of time, the demand for chicken is likely to rise and hence, the imports of maize (feed for poultry industry) has increased. Another reason for the increased imports is maize production in some of the leading states in India got affected due to frequent droughts since past five years. Slowly, the country could become a net importer, if the growth rate of domestic maize output stays lower than the pace of consumption. The significant shortfall in domestic production is also being reflected in the sharp rise of maize prices. Rising local prices are also prompting some Indian feed manufacturers to buy wheat as a substitute, which is generally costlier than maize. Hence, the imports of maize showed positive

growth rate during post-WTO regime. As expected, rice being the staple food crop in India, the imports both in terms of quantity and value showed declining trend.

Table 30: CGR (%) of Exports and Imports of the selected commodities in India

Particulars/Crops		Rice	Maize	Bengal gram	Chilli	Cotton
Pre-WTO regime (1980-1994)	Export quantity	10.22NS	73.18NS	22.62NS	8.62NS	-16.64NS
	Export value	17.13**	68.88NS	24.11NS	31.48**	-7.45NS
	Import quantity	-6.48NS	-81.95**	70.76**	-9.62NS	76.73*
	Import value	-2.03NS	-75.19**	88.04**	-9.14NS	113.20**
Post-WTO regime (1995-2016)	Export quantity	18.16**	101.83**	125.22**	33.39**	66.96NS
	Export value	32.74**	110.43**	154.21**	46.69**	77.02**
	Import quantity	-18.35NS	34.26NS	24.64**	39.87**	11.72NS
	Import value	-1.79NS	39.77**	38.09**	73.18**	22.37**
Overall period (1980-2016)	Export quantity	18.16**	101.83**	52.63**	30.63**	18.34**
	Export value	26.87**	121.87**	61.39**	38.37**	26.46**
	Import quantity	-36.76**	16.97NS	30.54**	50.26**	51.46**
	Import value	-30.23**	28.25**	38.99**	65.39**	59.99**

Note: ** - Significant at 1% level; * - Significant at 5% level; NS – Non-significant;
Raw Data Source: www.fao.org

On the whole, during overall reference period 1980-2016, the growth rates of exports outweigh the growth rates of imports for rice, maize and bengal gram. On the contrary, for chillies and cotton, the growth rates of imports are higher compared to exports owing to raw material requirements, superior quality produce and price factors.

iv. Instability in exports and imports: CVs are worked to measure the extent of instability in exports and imports (in terms of quantity and value) of selected commodities (Table 31) during both pre and post-WTO regimes. The instability in terms of quantity and value of exports of rice was around 93 and 123 per cents respectively during the overall reference period. The instability rates for exports both in terms of quantity and value are higher during post-WTO regime compared to pre-WTO regime. Similarly, instability rates for rice imports both in terms of quantity and value are higher during post-WTO regime compared to pre-WTO regime and these rates are much higher compared to exports. This implies India is not the frequent importer of rice from the international market. That is, India being one of the major producers of rice and net exporter, the rice imports to India are gradually declining year by year and this contributed to higher instability rates. In case of maize, higher instability rates are registered for exports and imports during pre and post-WTO regimes and even during overall reference period. The maize export quantity and value found significant growth during post- WTO regime, but instability indices remained in higher category.

The high instability carries a risk of varying export prices and is a concern for assuring income to exporters and for linking them with international markets. The reasons for high instability may be inconsistent domestic production, consumption and international demand. Thus, the export policies should be in line with consistent growth of maize exports with low instability. The significant increase in domestic production of maize is the major option for improvement of its export trade. Also the export price of maize must compete with the global prices.

Table 30: Instability in Export and Imports of selected commodities in India

Particulars/Crops		Rice	Maize	Bengal gram	Chilli	Cotton
Pre-WTO regime (1980-1994)	Exports quantity	25.67	180.60	76.49	63.41	61.25
	Exports value	33.53	178.83	79.66	61.09	78.94
	Imports quantity	134.78	189.40	103.04	151.19	159.55
	Imports value	126.88	175.16	97.26	130.84	181.72
Post-WTO regime (1995-2016)	Exports quantity	62.23	109.76	114.23	66.56	95.36
	Exports value	84.59	119.23	114.46	88.73	106.84
	Imports quantity	208.35	207.39	80.62	76.75	62.58
	Imports value	135.66	135.10	106.37	79.63	65.17
Overall period (1980-2016)	Exports quantity	93.31	164.00	166.15	109.56	123.28
	Exports value	123.46	174.90	167.83	133.73	147.25
	Imports quantity	234.63	202.12	104.93	125.23	105.93
	Imports value	221.15	151.90	139.08	130.76	108.33

Raw Data Source: www.fao.org

It is interesting that for bengal gram, during pre-WTO regime, the instability rates are higher for imports compared to exports. However, reverse is the case during post-WTO regime and also during the overall reference period. This indicates that with increase in production of bengal gram in the country from 4.33 m.tonnes to 9.33 m. tonnes during 1980-81 to 2016-17, the dependency on imports gradually declining and this is really an heartening picture. Though exports are on the rise due to increasing production during post-WTO regime, the instability rates are also higher because of declining export competitiveness, fluctuating demand and prices, trade policies between the member countries etc. Regarding chillies and cotton, similar trends in instability rates are followed during pre-WTO, post-WTO and overall reference period as in case of bengal gram. The higher instability rates noticed for imports of these three commodities during pre-WTO regime are due to inconsistent domestic production (especially chillies and cotton) due to vagaries of monsoons, pests and diseases, domestic requirements etc. It is further interesting to note that, whenever the average quantity and the average value of exports were higher, the variability co-efficient were low indicating stability in exports.

v. Trade Direction of the selected agricultural commodities from India: The dynamics of changes in the export trade of selected commodities from India were studied through the estimation of a Markov probability matrix. The probability of retaining the previous period market share (gain or loss) is interpreted by studying the diagonal and off diagonal elements of TPM and the findings are presented commodity-wise in the ensuing pages.

Rice: The major importing countries taken for the analysis of trade in rice exports during the post-WTO regime (2006-07 to 2016-17) were Benin, Côte d'Ivoire, Iran, Nepal, Saudi Arabia, Senegal, South Africa, UAE, Iraq, Guinea, Somalia and along with the remaining importing countries grouped under 'others'. That is, there are eleven major countries importing Indian rice in large quantity and rest of countries are pooled under 'others' category. The diagonal elements in the TPM (Table 32) for rice exports provide the information on the probability of retention of the trade, while row elements indicate the probability of loss in trade on account of competing countries. The column elements indicate the probability of gain in trade from the competing countries. TPM revealed that Saudi Arabia was found to be the most stable importer of Indian rice, as it retained its original share of around 30.40 per cent which was the highest among the importing countries. It lost its remaining share of 69.60 per cent to UAE, Iran and Nepal. That is, Saudi Arabia was the largest buyer of Indian rice followed by other traditional buyers like UAE, Iran, Nepal, Benin, Senegal and South Africa. UAE was also found to be stable with 5.60 per cent retention of its shares, while losing major share of 94.40 per cent to Saudi Arabia, Iran, Benin, Côte d'Ivoire and other countries. Côte d'Ivoire was also found to be stable with 7.20 per cent of retention of its shares, while losing major share of 92.80 per cent to Saudi Arabia, South Africa, Somalia, UAE and other countries. Other countries were also found to be stable with 35.70 per cent of retention of their shares, while losing a share of 64.30 per cent to Saudi Arabia, UAE and Benin. Superior quality of grain has made Indian rice more acceptable across the countries in the international market. The launch of paddy pledging scheme (under which 50% more price was offered than the open market price for boosting the farmers' income) by other major producers like Thailand has helped India to achieve record performance in rice exports in recent times. The higher exports to Saudi Arabia, UAE, Nepal etc., and retentions by major countries could be due to high export competitiveness of Indian rice across these countries.

It is also revealed from Table 32 that 'other' countries and Saudi Arabia were the stable markets for Indian rice among the importing countries, as reflected by high retention probability of 35.70 and 30.40 percents respectively. This was reflected in fact that India's share in total import of rice by Saudi Arabia would be on increasing trend in the future years. Next to 'other' countries

and Saudi Arabia, Côte d'Ivoire is also a major importer of rice, as its retention probability is 7.2 per cent. India could not retain the previous export shares to Senegal and hence, this is an unstable market for rice, as it is having probability of retention of zero.

Table 32: TPM of rice exports from India (2006-07 to 2016-17)

Countries	Benin	Côte d'Ivoire	Iran	Nepal	Saudi Arabia	Senegal	South Africa	UAE	Iraq	Guinea	Somalia	Others
Benin	0.022	0.054	0.002	0.055	0.193	0.027	0.066	0.056	0.000	0.008	0.032	0.484
Côte d'Ivoire	0.023	0.072	0.004	0.034	0.133	0.028	0.083	0.049	0.002	0.021	0.034	0.516
Iran	0.019	0.097	0.002	0.036	0.118	0.020	0.043	0.078	0.003	0.032	0.016	0.535
Nepal	0.004	0.002	0.069	0.010	0.211	0.001	0.003	0.192	0.002	0.002	0.000	0.503
Saudi Arabia	0.002	0.002	0.170	0.010	0.304	0.000	0.001	0.291	0.005	0.000	0.000	0.214
Senegal	0.000	0.000	0.168	0.014	0.279	0.000	0.011	0.297	0.009	0.000	0.000	0.221
South Africa	0.017	0.025	0.116	0.013	0.146	0.018	0.037	0.171	0.026	0.001	0.010	0.422
UAE	0.045	0.065	0.083	0.027	0.081	0.083	0.037	0.056	0.025	0.024	0.008	0.465
Iraq	0.121	0.027	0.161	0.037	0.086	0.070	0.041	0.039	0.022	0.020	0.010	0.367
Guinea	0.054	0.019	0.092	0.048	0.098	0.062	0.030	0.042	0.021	0.030	0.017	0.487
Somalia	0.050	0.037	0.076	0.047	0.109	0.082	0.026	0.070	0.043	0.035	0.023	0.401
Others	0.069	0.036	0.067	0.047	0.093	0.055	0.029	0.092	0.07	0.052	0.032	0.357

Raw Data Source: www.fao.org

Maize: The major importing countries taken for the analysis of trade in maize exports during the post-WTO regime (2006-07 to 2016-17) were Bangladesh, Indonesia, Malaysia, Nepal, Oman, Republic of Korea, Singapore, UAE, Vietnam, Yemen and along with the remaining importing countries grouped under ‘others’. That is, there are ten major countries importing maize from India in large quantity and rest of countries are pooled under ‘others’ category. TPM of maize exports (Table 33) revealed that Bangladesh is the most stable importer of Indian maize, as it retained its original share of around 46.60 per cent, which was the highest among the importing countries. It lost its remaining share of 53.40 per cent to Indonesia, Malaysia, UAE, Nepal and other countries. This implies, Bangladesh is the largest buyer of Indian maize followed by other traditional buyers like Malaysia, Nepal and Indonesia. Malaysia was also found to be stable with 35.90 per cent of retention of its shares, while losing a major share of 64.10 per cent to Bangladesh, UAE, Yemen and other countries. Vietnam was also found to be stable with 17.70 per cent of retention of its shares, while losing major share of 82.30 per cent to Indonesia, Malaysia, Bangladesh, Nepal and other countries. Other countries were also found to be stable with 20.80 per cent of retention of their shares, while losing a share of 79.20 per cent to Nepal, Bangladesh, Yemen, and Malaysia. The higher exports to Bangladesh and Malaysia and retentions by major countries could be due to higher domestic demand in their respective countries.

It is also revealed from Table 33 that Bangladesh and Malaysia were the stable markets for maize among the importing countries, as reflected by high retention probability of 46.60 and 35.90

percents respectively. This was reflected in fact that India's share in total import of maize by these two countries would be on increasing trend in the future years. Next to Bangladesh and Malaysia, 'other' countries is major importer of maize, as its retention probability is 20.80 per cent.

Table 33: TPM of maize exports from India (2006-07 to 2016-17)

Countries	Bangladesh	Indonesia	Malaysia	Nepal	Oman	Republic of Korea	Singapore	UAE	Vietnam	Yemen	Others
Bangladesh	0.466	0.171	0.076	0.022	0.004	0.000	0.015	0.038	0.019	0.000	0.188
Indonesia	0.073	0.014	0.451	0.021	0.007	0.103	0.006	0.034	0.081	0.030	0.179
Malaysia	0.035	0.012	0.359	0.005	0.015	0.003	0.010	0.056	0.012	0.047	0.335
Nepal	0.231	0.04	0.209	0.014	0.015	0.000	0.013	0.027	0.022	0.007	0.215
Oman	0.304	0.067	0.259	0.042	0.008	0.001	0.019	0.017	0.234	0.003	0.046
Republic of Korea	0.135	0.294	0.197	0.019	0.016	0.014	0.011	0.037	0.154	0.009	0.113
Singapore	0.044	0.302	0.208	0.019	0.009	0.018	0.011	0.02	0.277	0.008	0.086
UAE	0.094	0.265	0.214	0.041	0.008	0.000	0.011	0.018	0.022	0.01	0.118
Vietnam	0.117	0.309	0.178	0.07	0.017	0.001	0.012	0.015	0.177	0.008	0.098
Yemen	0.239	0.108	0.088	0.229	0.019	0.008	0.032	0.021	0.069	0.024	0.164
Others	0.054	0.001	0.027	0.622	0.014	0.014	0.001	0.028	0.003	0.029	0.208

Raw Data Source: www.fao.org

Bengal gram: The major importing countries taken for the analysis of trade in rice exports during the post-WTO regime (2006-07 to 2016-17) were Algeria, Egypt, Jordan, Kuwait, Pakistan, Saudi Arabia, Sri Lanka, Tunisia, Turkey, UAE and along with the remaining importing countries grouped under 'others'. That is, there are ten major countries importing bengal gram in large quantity and rest of countries are pooled under 'others' category. TPM of bengal gram (Table 34) revealed that Pakistan is the most stable and loyal importer of Indian bengal gram, as it retained its share of around 34.00 per cent, which was the highest among the importing countries. It lost its remaining share of 66.00 per cent to Algeria, Turkey, Sri Lanka, UAE and other countries. Algeria was also found to be stable with 13.00 per cent of retention of its shares, while losing major share of 77.00 per cent to Pakistan, Saudi Arabia, UAE, and other countries. Sri Lanka was also found to be stable with 9.00 per cent of retention of its shares, while losing 91per cent of its shares to Pakistan, Algeria, Turkey, and UAE. Turkey is stable with eight per cent of retention of its shares, while losing 92 per cent of its shares to Pakistan, Algeria, Sri Lanka, UAE and other countries. Other countries were also found to be stable with 22.00 per cent of retention of their shares, while losing a share of 78.00 per cent to Pakistan, Algeria, Turkey and Sri Lanka. From above analysis, it is clear that Pakistan is the largest buyer of Indian gram followed by other traditional buyers like Algeria, Turkey and Sri Lanka. The higher exports to Pakistan, Saudi Arabia, Sri Lanka etc., and retentions by major countries could be due to high domestic demand in their respective countries.

It is also revealed from Table 34 that Pakistan and 'other' countries were the stable markets for bengal gram among the importing countries, as reflected by high retention probability of 34.00

and 22.00 percents respectively. This was reflected in fact that India's share in total import of rice by Pakistan would be on increasing trend in the future years. Next to Pakistan and 'other' countries, Algeria is also a major importer of bengal gram, as its retention probability is 13.00 per cent.

Table 34: TPM of Bengal gram exports from India (2006-07 to 2016-17)

Countries	Algeria	Egypt	Jordan	Kuwait	Pakistan	Saudi Arabia	Sri Lanka	Tunisia	Turkey	UAE	Others
Algeria	0.130	0.030	0.010	0.030	0.150	0.080	0.080	0.040	0.020	0.170	0.250
Egypt	0.130	0.060	0.020	0.020	0.310	0.040	0.070	0.030	0.060	0.100	0.160
Jordan	0.130	0.070	0.010	0.020	0.230	0.060	0.070	0.060	0.080	0.130	0.150
Kuwait	0.120	0.050	0.010	0.030	0.260	0.050	0.130	0.040	0.110	0.080	0.130
Pakistan	0.140	0.040	0.010	0.020	0.340	0.040	0.070	0.040	0.120	0.070	0.110
Saudi Arabia	0.200	0.020	0.010	0.020	0.220	0.040	0.090	0.030	0.150	0.070	0.150
Sri Lanka	0.130	0.040	0.010	0.020	0.360	0.050	0.090	0.010	0.130	0.070	0.090
Tunisia	0.190	0.030	0.010	0.010	0.300	0.030	0.050	0.010	0.180	0.040	0.150
Turkey	0.120	0.020	0.010	0.020	0.340	0.040	0.080	0.030	0.080	0.060	0.200
UAE	0.150	0.020	0.010	0.010	0.350	0.050	0.100	0.050	0.060	0.050	0.150
Others	0.130	0.010	0.010	0.010	0.270	0.060	0.080	0.030	0.100	0.080	0.220

Raw Data Source: www.fao.org

Chillies: The major importing countries taken for the analysis of trade in rice exports during the post-WTO regime (2006-07 to 2016-17) were Indonesia, Malaysia, Sri Lanka, Thailand, UAE, USA, Bangladesh, Pakistan, Mexico and along with the remaining importing countries grouped under 'others'. That is, there are ten major countries importing (dry) chillies in large quantity and rest of countries are pooled under 'others' category. Malaysia was found to be the most stable and loyal importer of Indian chillies, as it retained its share of around 18.50 per cent, which was the highest among the importing countries. TPM of chillies exports (Table 35) revealed that it lost its remaining major share of 81.50 per cent to Sri Lanka, USA, Bangladesh and other countries. USA was also found to be stable with 15.50 per cent of retention of its shares, while losing major share of 77.00 per cent to Sri Lanka, Malaysia, UAE, Pakistan and other countries. Sri Lanka was also found to be stable with 14.80 per cent of retention of its shares, while losing its shares of 85.20 per cent to Malaysia, UAE, USA and Pakistan. Other countries were also found to be stable with 32.30 per cent of retention of their shares, while losing a share of 67.70 per cent to Thailand, Sri Lanka, UAE and Malaysia. From the above analysis it is evident that, Malaysia was the largest buyer of Indian chillies followed by other traditional buyers like Sri Lanka, USA, Bangladesh, UAE etc. The higher exports to Malaysia, Sri Lanka, Bangladesh etc., and retentions by major countries could be due to higher export competitiveness of chillies across these countries.

It is also revealed from Table 35 that 'other' countries and Malaysia were the stable markets for (dry) chillies among the importing countries, as reflected by high retention probability of 32.30 and 18.50 percents respectively. This was reflected in fact that India's share in total import of (dry)

chillies by Malaysia would be on increasing trend in the future years. Next to 'other' countries and Malaysia, USA and Sri Lanka are also the major importers of chillies, as their retention probabilities are 15.50 and 14.80 percents respectively. India could not retain the previous export shares to China, mainland at significant note and this reflects, it is an unstable market for chillies, as the probability of retention is nearly zero.

Table 35: TPM of Chillies exports from India (2006-07 to 2016-17)

Countries	Indonesia	Malaysia	Sri Lanka	Thailand	UAE	USA	Bangladesh	Pakistan	Mexico	China, mainland	Others
Indonesia	0.037	0.277	0.131	0.005	0.117	0.115	0.158	0.000	0.009	0.005	0.141
Malaysia	0.037	0.185	0.122	0.013	0.090	0.135	0.184	0.050	0.010	0.007	0.163
Sri Lanka	0.045	0.157	0.148	0.036	0.130	0.132	0.029	0.101	0.007	0.002	0.210
Thailand	0.045	0.212	0.159	0.034	0.138	0.088	0.115	0.004	0.009	0.011	0.179
UAE	0.042	0.216	0.131	0.015	0.110	0.107	0.093	0.076	0.028	0.022	0.155
USA	0.041	0.134	0.149	0.055	0.136	0.155	0.057	0.077	0.015	0.023	0.152
Bangladesh	0.036	0.150	0.102	0.088	0.099	0.087	0.054	0.053	0.035	0.043	0.024
Pakistan	0.048	0.122	0.139	0.146	0.107	0.069	0.088	0.010	0.023	0.009	0.234
Mexico	0.047	0.085	0.126	0.159	0.081	0.060	0.074	0.053	0.034	0.007	0.27
China, mainland	0.054	0.092	0.133	0.161	0.095	0.069	0.040	0.008	0.032	0.006	0.306
Others	0.071	0.079	0.146	0.150	0.108	0.066	0.019	0.000	0.027	0.004	0.323

Raw Data Source: www.fao.org

Cotton: The major importing countries taken for the analysis of trade in cotton exports during the post-WTO regime (2006-07 to 2016-17) were Bangladesh, China, mainland, Indonesia Japan, Malaysia Pakistan, Thailand UK Vietnam and along with the remaining importing countries grouped under 'others'. That is, there are ten major countries importing cotton in large quantity and rest of countries is pooled under 'others' category. China, mainland was found to be the most stable and loyal importer of Indian cotton as it retained its share of around 46.00 per cent which was the highest among the importing countries. TPM of cotton exports (Table 36) revealed that China, mainland lost its remaining share of 54.00 per cent to Pakistan, Vietnam, Japan, Indonesia and other countries. Vietnam was also found to be stable with 9.00 per cent of retention of its shares, while losing major share of 91.00 per cent to Bangladesh, Pakistan, China, mainland and other countries. Other countries are also found to be stable with 10.00 per cent of retention of their shares, while losing a share of 90.00 per cent to Bangladesh, China, mainland, China, Taiwan province, Pakistan and Vietnam. From the above analysis it is clear that China, mainland followed by other traditional

buyers like Pakistan, Bangladesh, Vietnam and Indonesia are the major importers of cotton from India. The higher exports to China, mainland, Bangladesh etc., and retentions by major countries could be due to higher export competitiveness of cotton across these countries.

It is also revealed from Table 36 that China, mainland and 'other' countries were the stable markets for cotton among the importing countries, as reflected by high retention probabilities of 46.00 and 10.00 percents respectively. This was reflected in fact that India's share in total import of cotton by China, mainland would be on increasing trend in the future years. Next to China, mainland and 'other' countries, Vietnam, Pakistan and Indonesia are also the major importers of cotton, as their retention probabilities are 9.00, 5.00 and 4.00 percents respectively. India could not retain the previous export shares to Japan and UK and this reflects these are unstable markets for cotton, as the probabilities of retention are zero.

Table 36: TPM of Cotton exports from India (2006-07 to 2016-17)

Countries	Bangladesh	China, mainland	China, Taiwan Province	Indonesia	Japan	Malaysia	Pakistan	Thailand	UK	Vietnam	Others
Bangladesh	0.030	0.480	0.030	0.050	0.010	0.000	0.150	0.050	0.000	0.040	0.170
China, mainland	0.010	0.460	0.030	0.050	0.060	0.020	0.200	0.026	0.000	0.060	0.090
China	0.120	0.430	0.020	0.080	0.020	0.020	0.120	0.060	0.000	0.020	0.110
Indonesia	0.080	0.550	0.030	0.040	0.000	0.010	0.110	0.020	0.000	0.040	0.120
Japan	0.110	0.570	0.030	0.040	0.000	0.010	0.090	0.020	0.000	0.040	0.008
Malaysia	0.180	0.540	0.010	0.020	0.000	0.020	0.160	0.010	0.000	0.020	0.040
Pakistan	0.140	0.700	0.010	0.010	0.000	0.010	0.050	0.010	0.000	0.030	0.040
Thailand	0.150	0.600	0.010	0.200	0.000	0.010	0.070	0.010	0.000	0.050	0.070
UK	0.220	0.460	0.010	0.030	0.010	0.000	0.080	0.010	0.000	0.100	0.090
Vietnam	0.310	0.210	0.010	0.030	0.010	0.010	0.240	0.020	0.000	0.090	0.080
Others	0.310	0.210	0.200	0.050	0.010	0.010	0.180	0.010	0.000	0.110	0.100

Raw Data Source: www.fao.org

VIII. CONSTRAINTS AND POLICY GUIDELINES FOR BOOSTING EXPORTS OF SELECTED AGRICULTURAL COMMODITIES FROM TELANGANA

i. Constraints in boosting agricultural exports: International trade is highly competitive not only in terms of price but also in terms of many other dimensions. Maintaining quality of the export products, meeting export commitments, complying with the Sanitary and Phyto-Sanitary (SPS) requirements, reducing chemical residues and others are some of the factors that largely determine the export trade of agricultural commodities in addition to price competitiveness. It has been observed that the export competitiveness of rice, chillies and cotton have picked up in recent years especially after 2005-06, which is an indicator of increasing comparative advantage of these commodities. However, potential commodities like maize and bengal gram are not export competitive in the recent period. In this back drop, it is of interest to know the constraints and problems in enhancing the exports and maintain the export competitiveness in the ensuing future. Based on the information collected from the sample farmers, the major constraints before them towards export of selected agricultural commodities were ranked and prioritized using the Garrett's ranking method (Table 37). 'Lack of technical guidance (capacity building) for the farmers on exports of commodities' was the most important constraint which ranked first with Garrett score of 69.47 and is followed by lack of lack of awareness about SPS standards of produce (69.13), Inadequate facilities for analysis of pesticide residues (68.92), lack of awareness on cost-effective production (68.07), lack of proper infrastructural facilities like storage, processing, information about export prices etc (65.17) and poor aggregation of farm produce (64.19). Addressing the above constraints on prioritized basis will definitely enhance the farmers' orientation to produce cost-effective and quality produce and the approach the exporters on collective basis. This, in turn, facilitates to increase their incomes from agriculture.

Table 37: Prioritization of Farmers' Constraints in the Export of selected commodities from Telangana

Constraint	Garrett's Score	Rank
Lack of awareness on cost-effective production	68.07	IV
Lack of awareness about SPS standards of produce	69.13	II
Lack of technical guidance on exports of commodities	69.47	I
Inadequate facilities for analysis of pesticide residues	68.92	III
Poor aggregation of farm produce	64.19	VI
Lack of proper infrastructural facilities like storage, processing, information about export prices etc.	65.17	V

Raw Data Source: Interviews held with Sample Farmers (n = 1000)

Addressing the above constraints on prioritized basis will definitely enhance the farmers' orientation to produce cost-effective and quality produce and the approach the exporters on collective basis. This, in turn, facilitates to increase their incomes from agriculture. The informal discussions held with the sample farmers also highlighted the following issues:

- Lack of knowledge on the part of farmers and other stakeholders of supply chain regarding export qualities of produce
- Rejection of exported commodities due to poor quality of produce
- Lack of awareness about exports promotional measures
- Difficulty in complying with SPS measures of different countries
- Quarantine approval from India is a major export barrier
- Declining comparativeadvantages for the commodities over the years
- Slow growth of agricultural sector in India compared to their trading partners
- More than 85 per cent of the farming community are small and marginal farmers with per capita land holding size less than two hectares and this could not result in economies of large scale and desired export competitiveness
- India in general and Telangana in particular could not adopt international quality standards for their products due to lack of adequate resources
- Hazard Analysis and Critical Control Point (HACCP) is still not mandatory for food producers, processor and handlers
- Barriers created by the existing infrastructure, technology and market imperfections (pace of increase of MSPs is higher than IPs in case of maize)
- There is lack of proper infrastructural facilities. Many times, exporters, when they carry their stock to sea port and if the stock is not loaded due to some reason or the other, exporters do not find godowns or proper place to store their stocks properly and safely. Further, it adds additional expenditure to the exporters.
- Many developing countries including India have neither a mechanism for ensuring coordination between Government agencies involved in human, animal, and plant-related standards, nor a common method for sharing information among themselves or with the public. Lack of coordination among national authorities is often cited as an obstacle to India's compliance with SPS issues. Communication between the public and private sectors is also deficient or non-existent in many developing countries. Such communication directly affects farmers' ability to meet domestic SPS requirements and may be even more important for exports because, Government's SPS agencies are frequently expected to play

an intermediary or complementary role in international trade, especially in the export of agricultural, aquatic, and forest products. Farmers must have detailed and authoritative information about the SPS requirements of importing countries. And the views of private sector stakeholders should inform all Government actions related to SPS matters (Victoria, 2003).

ii. Policy guidelines to boost export trade from India with special reference to Telangana: The study revealed that for the selected commodities, Indian exports showed less diversification across the member countries. That is, the export basket of India lacks focus and it is very much concentrated across few countries. The study also provides the analysis that the export growth for some commodities like maize and bengal gram is not because of competitiveness only. The growth itself pulls up the import demand and India is a beneficiary of that. However, considering competition from other member nations during post-WTO regime, India must take focused approach in improving competitiveness considering both macro (trade issues) and micro (firm specific) aspects. Since the export basket of the selected commodities is of narrow focus, the growth in their exports can be mainly driven by promoting both domestic and export competitiveness. Hence, it is essential to focus on cost-effective production and quality promotion to have a long run stability in the exports growth. To enhance the export competitiveness of selected agricultural commodities from India with special reference to Telangana, the following policy guidelines should deserve special attention:

- Focus on collaborative approach to bring synergy with number of organizations and institutions having inherent professional and specialized expertise in different areas for capacity building of farmers and various stakeholders to promote agri-export oriented production, export promotion, better price realization to farmers and synchronization within policies and programmes of Government of India. The focus should be on 'Farmers' Centric Approach' for improved income through value addition at source itself to help minimize losses across the value chain.
- To adopt the approach of developing product specific clusters in different agro climatic zones of the country to help in dealing with various supply side issues viz., soil nutrients management, higher productivity, adoption of market-oriented variety of crop, use of Good Agriculture Practices etc.
- To strengthen the capacity of Government officials responsible for food safety, animal and plant health, and agricultural trade to effectively implement SPS measures. More specifically, emphasis should be on improving technical capacity for testing, inspection,

certification and approval procedures, and quarantine treatments; enhancing scientific knowledge to perform risk assessment, determine appropriate levels of protection, and monitoring and surveillance; and improving effectiveness of SPS enquiry point and notification authority. The trained officials should disseminate the knowledge and information of SPS standards being followed by various importing countries and to promote the quality production in tune with their standards.

- India as one of the WTO members can benefit from participating in activities related to the SPS Agreement such as, greater awareness of the requirements of foreign markets, transparent and clearly structured procedures for settling disputes about the legitimacy of divergent national SPS measures, greater attention among developed country participants to problems that developing countries face in complying with SPS standards and greater international harmonization of national SPS measures and more technical assistance from developed countries.
- As pesticide residues in food commodities and their entry into the food-chain has become a major cause of concern all-over the world, it is high time to strengthen pesticides residue analysis labs throughout the country. This is so because, food safety has become crucial for all involved in the value chain and consumers have to be assured that they are not exposed to an unacceptable level of pesticide residues. This is of immediate concern because with the advent of WTO, presence of the pesticides residues above the permissible level is a major bottleneck in the international trade of food commodities. Capacity building programmes on Pesticide Residue Analysis are to be conducted to upgrade the knowledge and skills of the research personnel and scientists on the latest development in the methodologies and analytical techniques.
- During the post-WTO regime, the export competitiveness of rice, cotton and chillies is encouraging. Hence, to take advantage of this, newer markets especially where these commodities has good demand need to be explored for augmenting the exports. In order to achieve this goal, it is essential that consumer preferences in newer markets, market intelligence and impediments for augmenting exports need to be researched. Further, it is essential to make available to exporters the new markets' requirements of SPS restrictions.
- It is high time to maintain and update data base on export-import trade. This is important in the context of:
    - Identification of potential markets for the selected commodities

  - Comparative analysis of DMPs *vis-à-vis* the import price of the product(s).
  - Comparative analysis of export price of the product(s) from the country *vis-à-vis* the export price offered by other countries for the same product(s).
  - Total transaction costs of selected commodities and possible scope for reducing these costs.
  - Planning the seasonality (peak and lean periods) of exports of the selected commodities for realizing more comparative advantage and better prices.
  - Strengthening the requisite infrastructure (storage, processing, transport, grading, market intelligence etc), duly taking into consideration their export potential
  - Exporting the commodity to the member nations, where there is lower production/greater demand for the same.
- To take advantage of increased export opportunities of the above commodities in the post-WTO regime, export-oriented production regions should be identified. Districts that enjoy resources potential in terms of soil health, irrigation potential, market infrastructure, easy access to nearby ports etc., should be promoted as export oriented captive production centers. Such measures not only result in surge in exports but also contain the instability within acceptable limits.
- Developing data base on export-import trade is of immediate concern so as to:
  - compute price trends (DMPs vis-à-vis IPs) of selected agricultural commodities and accordingly the production of crops should be encouraged.
  - product specific support (MSP) should also consider the price trends of agricultural commodities in the international market. One notable feature is that Asian countries are gradually emerging as the major competitors for Indian exports. This is on account of stagnation in productivity of the crops. Another contributing factor might be the fluctuating trends in private capital formation in agricultural sector. Agricultural price movements in India are mainly influenced by international prices rather than output fluctuations (Sekhar, 2003). In view of this, while fixing the MSPs for the commodities, their trends in IPs should also be taken into consideration.
  - Assess the marketable surplus of selected commodities so that, the average export price at which the commodity can be transacted can be planned taking into consideration the number of importing countries preferring the same.
- More emphasis on SPS standards of the commodities suiting to the needs of importing countries. This is because, quality aspects of exports were the major constraints faced by

the stakeholders in the export of selected commodities. Hence, adequate infrastructures in the form of laboratories at regional level or at important export centers need to be established to facilitate exporters to test the quality aspects of commodities to be exported. Further, exporters need to be educated regarding quality dimensions, SPS requirements, and export intelligence. APEDA can initiate/commission research studies on marketing aspects especially on market intelligence, consumer preferences in the importing countries and related export dimensions.

- Increase the area under cultivation of crops taking into consideration the exports or imports of the respective commodities, so as to improve the trade balance
- Encourage the farmers through formation of Farmers Producers' Organizations (FPOs) that could facilitate better promotion of production, processing, marketing and export of quality produce besides outsourcing the required technologies.
- Farmers and exporters need a great deal of information regarding consumer tastes, preferences, trends in demand and supply of selected commodities in the importing countries, market intelligence reports and many other relevant data as well as information. But they have to depend on various agencies to collect this sort of information because they cannot undertake such studies independently due to cost, lack of expertise and other factors on their part. Hence, they need some institutional guidance to support them in this regard.
- Management (SWOT) analysis for competing countries is essential. WTO Cells should be strengthened across all the States in the country to frequently explore the trade opportunities for the selected commodities and measuring their export competitiveness from time to time that guides in the formulation of EXIM policy for the country. Even the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs) should initiate a separate Department for Agricultural Marketing to conduct research studies on different aspects of agricultural marketing.

IX. SUMMARY AND CONCLUSIONS

With the advent of economic reforms, the trade opportunities for Indian agricultural commodities have increased in the international market. The agricultural commodities exports performance has undergone paradigm shifts during post-WTO regime compared to pre-WTO regime. With reference to the present study, the selected commodities namely paddy, maize, bengal gram, (dry) chillies, and cotton have shown impressive growth rates in respect of area, production, productivity etc., both at All-India level and in Telangana during both pre-WTO and post-WTO regimes. Higher growth rates were registered for cotton followed by chillies. For other crops viz., paddy, maize and bengal gram, the growth rates are moderate. Factors responsible for increased growth rate are increased output prices, cultivation of HYVs and pests and diseases resistant varieties and rising export demand for these commodities. The instability analysis infers that, all the selected commodities have shown instability in terms of area, production and productivity during the reference period. In particular paddy, maize and chilli crops have registered a higher instability in area and production during post-WTO regime compared to pre-WTO regime, whereas in bengal gram, the instability in production is higher in pre-WTO regime compared to post-WTO regime. Paddy and cotton have marginally higher instability in terms of productivity during post-WTO regime against pre–WTO regime, whereas for other crops, the productivity showed relatively more stability during post-WTO regime compared to pre-WTO regime. Among all the selected crops, bengal gram and cotton have registered high instability with reference to production.

All the selected commodities have showed positive and significant growth rates for MSPs, DMPs, and IP during the study period. It is interesting that, the growth rate in MSPs is comparatively higher than the DMPs and IPs for all the crops (except chillies). The growth rates of DMPs are in tandem with the MSPs in post-WTO regime. DMPs of the selected commodities increased at a faster pace compared to the IPs during all the selected periods. Over all, DMPs and IPs are much volatile during post-WTO regime (2005-08) compared to pre-WTO regime particularly in food grain crops. In bengal gram, the prices instability is higher during post-WTO regime (2014-17) compared to other two periods. In case of commercial crops the price instability rate is higher in domestic prices against international prices and pre WTO period prices are more volatile than the post WTO period.

BI, its related indices and LFI are computed to determine the RCA of selected commodities being traded over the years during both pre-WTO (1971-1994) and post-WTO (1995-2017) regimes. The findings revealed that chillies and rice enjoy more comparative advantage for exports

during both Pre-WTO and Post-WTO regimes. However, maize showed the least RCA over the years and this implies it has less comparative advantage as compared to other exported commodities. All the four indices of RCA showed India enjoy RCA in the exports of rice and chillies. Among the consistency tests conducted for the four indices of RCA, the ordinal measure is relatively consistent compared to cardinal measure, is relatively more consistent than the cardinal test, at around 77 per cent, with the indices at greater than cut-off point (>0.70). Further, the four RCA indices are fairly stable for all the selected commodities (except bengal gram) especially during post-WTO regime, as indicated by the lower CV values. This will guide India should prepare long-term policy initiatives for promoting their (importers' need based) exports at the global level considering the RCA.

NPCs computed to analyze the export competitiveness of the selected commodities revealed that rice, cotton and chillies are found moderately competitive in the international market. Regarding bengal gram, though non-export competitive, there is marginal decline in the export competitiveness across the major importing countries like Algeria and Sri Lanka. However, maize is not export competitive across all the three major importing countries due to increase in MSP and DMPs at a faster pace compared to its IPs.

India is a major supplier of several agricultural commodities like rice, coffee, tea, spices, cashew, oil meals, fresh fruits, fresh vegetables, meat and its preparations and marine products to the international market. The comparative analysis regarding trends in agricultural exports vis-à-vis agricultural imports since the LPG phase revealed that, the share of agricultural exports in national exports is on the decline, while the share of agricultural imports in national imports is on the rise during 1991-92 to 2016-17. This concludes that the agricultural imports are increasing at a greater pace compared to agricultural exports. However, as Indian agriculture has increasingly been opened to global agriculture, the ratio of agricultural exports and imports as a percent of Agricultural GDP has increased from 4.9 percent in 1990-91 to 5.79 percent in 2016-17 (at current prices). For rice, Saudi Arabia (10.03%), Iran (7.87%), UAE (6.73%), Senegal (6.69%), Benin (5.74%), Nepal (4.76%), Bangladesh (4.53%), Iraq (4.37%), Guinea (3.82%) etc., are the major importers and in the post-WTO regime, the rice exports from India spread to around 143 countries in the world. However, in the recent period, China and Thailand are offering stiff competition to enter into India's traditional markets in Africa. Regarding maize, Malaysia, Bangladesh and Sri Lanka are the traditional importing countries and this indicates, for Indian maize, the export demand is mainly from Asian countries. However, the two major barriers for the maize sector in India in general and Telangana in particular include climate change and low competitiveness of Indian

maize in the international market. So, quality production, post-harvest management, supply chain linkages between industry and farms deserve special attention. Though India is the largest bengal gram producing country in the world, it still remained as the net importer of this commodity. However, the increasing demand for livestock feed and rising domestic demand from mounting population in the developing countries, the demand for bengal gram has increased in the global market. Accordingly, the exports from India has increased significantly during post-WTO regime. The ,major importers include: Pakistan (32.91%), Algeria (13.44%), Sri Lanka (8.99%), Turkey (7.58%), UAE (6%), Saudi Arabia (4.82%) etc. In total spices exports from India, chillies exports in terms of quantity hold a major share of 40 per cent. Major chillies importing countries from India include: Vietnam (16.7%), Thailand (15.71%), Sri Lanka (13.5%), UAE (9.49%), Malaysia (8.58%), USA (6.52%), Indonesia (5.75%) etc. However, the demand for Indian chillies from China, one of the major buyers, has dried up following the outbreak of novel Coronavirus there. Regarding cotton, though India is the third largest producer in the world, it exports only small proportion of the total production after meeting the domestic demand. However, India enjoys net exporter status in the international trade. Major trade destinations for Indian cotton exports are China, main land (30.91%), Bangladesh (27.14%), Pakistan (15.94%), Vietnam (9.62%), Indonesia (3.15%) and Turkey (1.91%). Indian cotton is found export competitive in China, Bangladesh, Pakistan, Vietnam, Indonesia and Taiwan and this hints that India's cotton will have no difficulty finding a market elsewhere. The exports both in terms of quantity and value of the selected commodities had shown positive and significant growth rates during post-WTO regime (except for quantum of exports of cotton). However, maize imports showed significant positive growth rates during post-WTO regime. This implies, India is losing comparative advantage for maize and hence, it is more cheaper now to import from international market. Rice being the staple food crop in India, the imports both in terms of quantity and value showed declining trend. It is further interesting that, whenever the average quantity and the average value of exports were higher, the variability co-efficient were low indicating stability in exports.

The trade directions of selected agricultural commodities from India was analyzed through the first order Markov chain approach. The TPM of the commodities revealed that Saudi Arabia for rice, Bangladesh for maize, Pakistan for bengal gram, Malaysia for (dry) chillies, China, mainland for cotton are the loyal destinations for the commodities.

Garrett's Raking Test conducted to prioritize the farmers' constraints in the export of selected commodities from Telangana highlighted that lack of technical guidance for the farmers on exports of commodities, about SPS standards of produce, inadequate facilities for analysis of

pesticide residues, lack of awareness on cost-effective production, lack of proper infrastructural facilities like storage, processing, information about export prices etc., are some of the problems being faced by the sample farmers in Telangana and they should be addressed on prioritized basis.

Policy guidance and institutional reforms have been launched in India from time to time to tackle the problems affecting both domestic and export competitiveness of agricultural commodities. These, in turn, facilitates to increase the farmers' incomes from agriculture. Capacity building programmes to farmers and various stakeholders on promoting agri-export oriented production, export promotion, better price realization to farmers. Promoting awareness to the research personnel and scientists on pesticide residue analysis is also needed to upgrade their knowledge and skills on the latest development in the methodologies and analytical techniques. Further, greater awareness of the requirements of foreign markets, SPS standards of their required products, transparent procedures for settling disputes among the trading partners, greater attention among developed country members regarding the problems being faced by India in complying with SPS standards, more technical assistance from developed countries etc., should deserve special attention. Formulation of EXIM policy with a long-term perspective for enhancing the export competitiveness of commodities in the existing potential markets, consumer preferences in newer markets, market intelligence and impediments for augmenting exports, maintain and update data base on export-import trade for conducting research to draw comparative analysis of DMPs *vis-à-vis* IPs, strengthening the requisite marketing infrastructure, emphasis on SPS standards of the commodities suiting to the needs of importing countries etc., should also be looked into to gain both domestic and export competitiveness of agricultural commodities.

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Appendix 1: Area, Production and Productivity of Paddy in Telangana and India

Year	Telangana			India			Telangana 's % share in national area	Telangana's % share in national production
	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)	Area (m. ha)	Production (m.tonnes)	Productivity (kg/ha)		
1980	1.050	1.952	1859	40.17	53.63	1335	2.61	3.64
1981	1.219	2.46	2018	40.73	53.25	1307	2.99	4.62
1982	1.142	2.272	1989	38.26	47.12	1231	2.98	4.82
1983	1.354	2.626	1939	41.24	60.10	1457	3.28	4.37
1984	1.012	1.819	1797	41.16	58.34	1417	2.46	3.12
1985	0.965	1.734	1797	41.14	63.82	1552	2.35	2.72
1986	0.908	1.582	1742	41.17	60.56	1471	2.21	2.61
1987	1.015	2.062	2032	38.81	56.86	1465	2.62	3.63
1988	1.390	3.263	2347	41.74	70.49	1689	3.33	4.63
1989	1.431	3.389	2368	42.17	73.57	1745	3.39	4.61
1990	1.413	3.394	2402	42.69	74.29	1740	3.31	4.57
1991	1.330	3.026	2275	42.65	74.68	1751	3.12	4.05
1992	1.058	2.305	2179	41.78	72.87	1744	2.53	3.16
1993	1.005	2.393	2381	42.54	80.30	1888	2.36	2.98
1994	1.055	2.672	2533	42.81	81.81	1911	2.46	3.27
1995	1.104	2.485	2251	42.84	76.98	1797	2.58	3.23
1996	1.36	3.565	2621	43.43	80.74	1859	3.13	4.42
1997	0.936	2.074	2216	43.45	82.54	1900	2.15	2.51
1998	1.537	4.189	2725	44.80	86.08	1921	3.43	4.87
1999	1.380	3.275	2373	45.16	89.68	1986	3.06	3.65
2000	1.549	4.417	2852	44.71	84.98	1901	3.46	5.20
2001	1.309	3.566	2724	44.90	93.34	2079	2.92	3.82
2002	0.955	2.012	2107	41.18	71.82	1744	2.32	2.80
2003	1.017	2.899	2851	42.59	88.53	2078	2.39	3.27
2004	0.857	2.209	**2578**	41.91	83.13	1984	2.05	2.66
2005	1.461	4.416	3023	43.66	91.79	2102	3.35	4.81
2006	1.489	4.256	2858	43.81	93.36	2131	3.40	4.56
2007	1.408	4.534	3220	43.91	96.69	2202	3.21	4.69
2008	1.692	5.361	3168	45.54	99.18	2178	3.72	5.41
2009	1.115	3.269	2932	41.92	89.09	2125	2.66	3.67
2010	1.979	6.536	3303	42.86	95.98	2239	4.62	6.81
2011	1.750	5.148	2942	44.01	105.31	2393	3.98	4.89
2012	1.419	4.648	3277	42.75	105.23	2461	3.32	4.42
2013	1.994	6.581	3300	44.14	106.65	2416	4.52	6.17
2014	1.42	4.54	3211	44.11	105.48	2391	3.21	4.31
2015	1.05	3.05	2913	43.50	104.41	2400	2.41	2.92
2016	1.68	5.17	3075	43.19	110.15	2550	3.89	4.70
2017	1.96	6.26	3192	43.79	112.76	2575	4.48	5.55

Source: Directorate of Economics and Statistics, Hyderabad, Government of Telangana; Agricultural Statistics at a Glance, 2017, Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare, Government of India

Annexure 2: Area, Production and Productivity of Maize in Telangana and India (1980-2015)

Year	Telangana			India			Telangana 's % share in national area	Telangana's % share in national production
	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)		
1980	0.30	0.67	2204	6.00	6.96	1159	5.06	9.63
1981	0.32	0.58	1835	5.93	6.90	1162	5.32	8.41
1982	0.32	0.70	2204	5.72	6.55	1145	5.58	10.74
1983	0.33	0.47	1451	5.86	7.92	1352	5.56	5.97
1984	0.30	0.42	1385	5.80	8.44	1456	5.19	4.94
1985	0.28	0.40	1440	5.80	6.64	1146	4.74	5.96
1986	0.29	0.43	1488	5.92	7.59	1282	4.88	5.66
1987	0.29	0.51	1754	5.56	5.72	1029	5.20	8.86
1988	0.28	0.45	1630	5.90	8.23	1395	4.68	5.47
1989	0.27	0.60	2231	5.92	9.65	1632	4.53	6.20
1990	0.28	0.58	2093	5.90	8.96	1518	4.73	6.52
1991	0.29	0.57	1993	5.86	8.06	1376	4.90	7.09
1992	0.28	0.76	2665	5.96	9.99	1676	4.76	7.57
1993	0.27	0.70	2563	6.00	9.60	1602	4.54	7.26
1994	0.28	0.76	2698	6.14	8.88	1448	4.58	8.53
1995	0.29	0.74	2591	5.98	9.46	1583	4.78	7.83
1996	0.30	0.95	3145	6.26	10.77	1720	4.84	8.85
1997	0.35	0.94	2714	6.32	10.82	1712	5.47	8.68
1998	0.35	1.23	3469	6.20	11.15	1797	5.71	11.02
1999	0.39	1.25	3168	6.42	11.51	1792	6.14	10.84
2000	0.45	1.28	2847	6.61	12.04	1822	6.81	10.64
2001	0.37	1.19	3205	6.58	13.16	2000	5.62	9.01
2002	0.45	1.16	2579	6.64	11.15	1681	6.80	10.43
2003	0.60	1.98	3313	7.34	14.98	2041	8.14	13.22
2004	0.53	1.35	2539	7.43	14.17	1907	7.16	9.53
2005	0.64	2.34	3666	7.59	14.71	1938	8.41	15.90
2006	0.59	1.63	2755	7.89	15.10	1912	7.49	10.78
2007	0.60	2.87	4757	8.12	18.96	2335	7.44	15.16
2008	0.60	2.19	3663	8.17	19.73	2414	7.33	11.12
2009	0.57	1.37	2400	8.26	16.72	2024	6.89	8.17
2010	0.51	2.07	4056	8.55	21.73	2540	5.96	9.52
2011	0.59	1.89	3200	8.78	21.76	2478	6.73	8.69
2012	0.66	2.94	4440	8.67	22.26	2566	7.61	13.21
2013	0.75	3.51	4681	9.07	24.26	2676	8.27	14.47
2014	0.69	2.30	3338	9.19	24.17	2632	7.51	9.52
2015	0.57	1.75	3057	8.81	22.57	2563	6.47	7.75
2016	0.80	2.66	3241	9.86	26.26	2664	8.13	10.14

Source: Directorate of Economics and Statistics, Hyderabad, Government of Telangana; Agricultural Statistics at a Glance, 2017, Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare, Government of India

Annexure 3: Area, Production and Productivity of Bengal gram in Telangana and India (1980-2015)

Year	Telangana			India			Telangana's % share in national area	Telangana's % share in national production
	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)		
1980	0.082	0.061	744	0.8348	0.5091	600	9.82	11.98
1981	0.082	0.076	927	0.8064	0.5147	600	10.17	14.77
1982	0.100	0.09	900	0.818	0.5389	700	12.22	16.70
1983	0.085	0.07	835	0.8081	0.5665	700	10.52	12.53
1984	0.078	0.09	1103	0.7948	0.6305	800	9.81	13.64
1985	0.089	0.13	1438	0.9041	0.8774	1000	9.84	14.59
1986	0.091	0.12	1264	0.8346	0.6292	800	10.90	18.28
1987	0.083	0.09	1072	0.7432	0.5798	800	11.17	15.35
1988	0.100	0.13	1270	0.805	0.6804	800	12.42	18.67
1989	0.120	0.16	1367	0.9078	0.8015	900	13.22	20.46
1990	0.103	0.11	1049	0.8162	0.719	900	12.62	15.02
1991	0.105	0.13	1238	0.8463	0.6175	700	12.41	21.05
1992	0.120	0.13	1117	0.9621	0.8621	900	12.47	15.54
1993	0.110	0.18	1664	0.93	0.8001	900	11.83	22.87
1994	0.100	0.20	1950	0.8292	0.7947	1000	12.06	24.54
1995	0.109	0.19	1761	0.8837	0.8097	900	12.33	23.71
1996	0.128	0.26	2039	0.9442	1.066	1100	13.56	24.48
1997	0.087	0.14	1655	0.84	0.87	1035	10.35	16.55
1998	0.107	0.23	2168	0.89	1.04	1171	12.01	22.24
1999	0.122	0.23	1918	0.96	1.05	1098	12.72	22.24
2000	0.110	0.22	2036	0.84	0.98	1176	13.15	22.77
2001	0.099	0.23	2303	0.88	1.07	1215	11.25	21.33
2002	0.096	0.18	1823	0.83	0.89	1081	11.60	19.56
2003	0.111	0.28	2477	0.77	1.24	1596	14.34	22.25
2004	0.107	0.29	2673	0.74	1.19	1607	14.51	24.12
2005	0.085	0.23	2729	0.65	1.01	1551	13.00	22.87
2006	0.093	0.28	3043	0.76	1.24	1627	12.19	22.78
2007	0.089	0.26	2933	0.81	1.30	1611	11.04	20.11
2008	0.081	0.29	3556	0.78	1.27	1630	10.40	22.68
2009	0.084	0.30	3568	0.77	1.20	1568	10.97	24.97
2010	0.077	0.24	3105	0.79	1.22	1544	9.76	19.62
2011	0.082	0.23	2789	0.80	1.28	1586	10.14	17.83
2012	0.083	0.30	3628	0.79	1.30	1643	10.41	22.99
2013	0.075	0.26	3463	0.77	1.49	1926	9.68	17.41
2014	0.073	0.25	3456	0.76	1.61	2109	9.63	15.78
2015	0.082	0.23	2789	0.81	1.52	1874	10.06	14.97
2016	0.124	0.48	3884	0.84	2.13	2517	14.72	22.71

Source: Directorate of Economics and Statistics, Hyderabad, Government of Telangana; Agricultural Statistics at a Glance, 2017, Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare, Government of India

Annexure 4: Area, Production and Productivity of Chillies in Telangana and India (1980-2015)

Years	Telangana			India			Telangana 's % share in national area	Telangana's % share in national production
	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)		
1980	0.029	0.007	241	6.58	4.33	657	0.44	0.16
1981	0.032	0.013	406	7.87	4.64	590	0.41	0.28
1982	0.035	0.013	371	7.4	5.29	715	0.47	0.25
1983	0.035	0.012	343	7.16	4.75	663	0.49	0.25
1984	0.032	0.010	313	6.91	4.56	661	0.46	0.22
1985	0.031	0.007	226	7.8	5.79	742	0.40	0.12
1986	0.028	0.007	250	6.98	4.53	649	0.40	0.15
1987	0.027	0.007	259	5.77	3.63	629	0.47	0.19
1988	0.025	0.009	360	6.81	5.13	**753**	0.37	0.18
1989	0.025	0.008	320	6.47	4.22	652	0.39	0.19
1990	0.025	0.008	320	7.52	5.36	712	0.33	0.15
1991	0.023	0.008	348	5.58	4.12	739	0.41	0.19
1992	0.024	0.008	333	6.45	4.42	684	0.37	0.18
1993	0.031	0.011	355	6.36	4.98	783	0.49	0.22
1994	0.040	0.021	525	7.54	6.44	853	0.53	0.33
1995	0.036	0.017	472	7.12	4.98	700	0.51	0.34
1996	0.036	0.022	611	6.85	5.57	813	0.53	0.39
1997	0.039	0.004	103	7.56	6.13	811	0.52	0.07
1998	0.035	0.003	86	8.47	6.8	803	0.41	0.04
1999	0.034	0.022	647	6.15	5.12	833	0.55	0.43
2000	0.034	0.024	706	5.19	3.86	744	0.66	0.62
2001	0.039	0.044	1128	6.42	5.47	853	0.61	0.80
2002	0.059	0.073	1237	5.91	4.24	717	1.00	1.72
2003	0.088	0.104	1182	7.05	5.72	811	1.25	1.82
2004	0.073	0.063	863	6.71	5.47	815	1.09	1.15
2005	0.074	0.104	1405	6.93	5.6	808	1.07	1.86
2006	0.102	0.139	1363	7.49	6.33	845	1.36	2.20
2007	0.118	0.162	1373	7.54	5.75	762	1.56	2.82
2008	0.119	0.187	1571	7.89	7.06	895	1.51	2.65
2009	0.121	0.175	1444	8.17	7.48	915	1.49	2.35
2010	0.109	0.148	1362	9.19	8.22	894	1.18	1.80
2011	0.085	0.072	849	8.3	7.7	928	1.02	0.94
2012	0.112	0.164	1464	8.52	8.83	1036	1.31	1.86
2013	0.113	0.195	1716	9.93	9.53	960	1.14	2.04
2014	0.059	0.081	1370	8.25	7.33	889	0.72	1.11
2015	0.070	0.050	721	8.4	7.06	840	0.83	0.71

Source: Directorate of Economics and Statistics, Hyderabad, Government of Telangana; Agricultural Statistics at a Glance, 2017, Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare, Government of India

Annexure 5: Area, Production and Productivity of Cotton in Telangana and India (1980-2015)

Years	Telangana			India			Telangana 's % share in national area	Telangana's % share in national production
	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)	Area (m.ha)	Production (m. tonnes)	Productivity (kg/ha)		
1980	0.150	0.010	47.000	7.820	1.190	152.330	1.900	0.580
1981	0.150	0.010	46.000	8.060	1.340	166.340	1.900	0.520
1982	0.150	0.010	74.000	7.870	1.280	162.740	1.880	0.850
1983	0.150	0.010	38.000	7.720	1.090	140.610	1.970	0.530
1984	0.170	0.020	132.000	7.380	1.450	195.900	2.280	1.530
1985	0.220	0.040	168.000	7.530	1.480	196.950	2.910	2.480
1986	0.190	0.030	132.000	6.950	1.170	168.950	2.790	2.190
1987	0.240	0.040	146.000	6.460	1.080	167.970	3.750	3.260
1988	0.300	0.030	83.000	7.340	1.490	202.440	4.140	1.700
1989	0.340	0.050	154.000	7.690	1.940	252.340	4.440	2.710
1990	0.337	0.060	184.000	7.440	1.670	224.910	4.530	3.710
1991	0.371	0.070	192.000	7.660	1.650	215.370	4.840	4.310
1992	0.423	0.070	173.000	7.540	1.940	257.020	5.610	3.770
1993	0.371	0.080	227.000	7.320	1.830	249.420	5.070	4.610
1994	0.453	0.110	239.000	7.870	2.020	256.750	5.760	5.370
1995	0.599	0.120	206.000	9.040	2.190	241.980	6.630	5.640
1996	0.579	0.150	254.000	9.120	2.420	265.240	6.350	6.090
1997	0.539	0.100	178.000	8.870	1.840	208.000	6.080	5.190
1998	0.756	0.180	243.000	9.340	2.090	223.640	8.090	8.800
1999	0.668	0.180	262.000	8.710	1.960	225.050	7.670	8.940
2000	0.631	0.170	273.000	8.530	1.620	189.630	7.390	10.660
2001	0.760	0.200	257.000	9.130	1.700	186.110	8.320	11.490
2002	0.550	0.120	216.000	7.670	1.470	191.150	7.130	8.070
2003	0.520	0.180	349.000	7.600	2.330	307.180	6.880	7.830
2004	1.080	0.200	185.000	8.790	2.790	317.850	12.230	7.130
2005	0.720	0.240	335.000	8.680	3.140	362.430	8.270	7.640
2006	0.730	0.250	347.000	9.140	3.850	420.730	7.980	6.590
2007	0.860	0.420	492.000	9.410	4.400	467.440	9.100	9.580
2008	1.090	0.430	396.000	9.410	3.790	402.580	11.610	11.410
2009	1.160	0.400	342.000	10.130	4.080	403.060	11.450	9.730
2010	1.400	0.520	369.780	11.240	5.610	499.330	12.420	9.200
2011	1.580	0.390	247.000	12.180	5.980	491.380	12.980	6.520
2012	1.810	0.690	380.000	11.980	5.820	486.000	15.130	11.860
2013	1.700	0.720	423.000	11.960	6.100	510.000	14.240	11.800
2014	1.690	0.610	360.000	12.820	5.920	462.000	13.210	10.300
2015	1.770	0.630	357.890	12.290	5.100	415.000	14.430	12.440
2016	1.410	0.500	354.000	10.850	5.630	519.000	13.000	8.850

Source: Directorate of Economics and Statistics, Hyderabad, Government of Telangana; Agricultural Statistics at a Glance, 2017, Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare, Government of India

Appendix 6: District wise TE Average of Area, Production and Productivity of paddy in Telangana (1980-2015)

Particulars	TE-averages	Adilabad	Nizamabad	Karimnagar	Medak	Hyderabad	Ranga Reddy	Mahabubnagar	Nalgonda	Warangal	Khammam	Telangana
Area (000 ha)	1980-82	69.33	148.33	162.00	110.67	1.00	45.67	137.33	201.00	138.67	123.67	1137.00
	1990-92	64.67	134.33	210.33	111.00	0.00	54.00	124.00	258.33	152.00	158.33	1267.00
	2000-02#	204.67	0.00	142.00	102.67	45.00	138.00	149.00	77.00	232.67	180.00	1271.00
	2010-12#	79.16	224.80	338.11	130.65	0.00	45.65	170.26	313.87	234.04	179.13	1715.66
	2013-15#	56.45	151.23	237.85	102.16	0.00	28.66	115.34	233.04	159.17	137.27	1221.15
Production (000 tonnes)	1980-82	101.67	330.67	381.33	197.67	1.00	75.00	228.00	441.67	256.00	215.00	2228.00
	1990-92	92.00	305.33	538.67	207.67	111.00	121.67	261.00	695.33	342.00	344.67	2908.33
	2000-02#	563.00	0.00	359.33	256.67	0.00	327.00	359.33	154.33	715.00	486.00	3331.67
	2010-12#	213.92	850.87	1166.26	431.49	0.00	112.53	440.94	990.46	707.79	529.61	5443.88
	2013-15#	146.16	552.45	838.08	344.57	1680.33	69.22	303.50	715.10	495.00	413.59	3877.66
Productivity (kgs/ha)	1980-82	1472.00	2226.00	2320.00	1794.33	0.00	1646.00	1639.00	2184.67	1846.67	1733.00	1955.33
	1990-92	1409.67	2245.33	2543.33	1852.00	2381.67	2246.33	2037.00	2694.33	2210.33	2173.00	2285.33
	2000-02#	2668.00	956.67	2444.67	2436.33	2393.00	2333.00	2322.33	1999.33	3039.00	2640.67	2561.00
	2010-12#	2694.00	3788.67	3451.00	3302.67	0.00	2455.00	2586.00	3162.33	3018.00	2930.33	3173.90
	2013-15#	2513.37	3398.67	3464.67	3221.36	0.00	2471.00	2545.95	3070.00	3086.21	3016.63	3112.14
CAGR												
Area	1980-1995	0.98	1.14	2.80	3.76	0.00	1.44	4.14	0.35	5.30	13.12	1.67
	1996-2015#	15.35	3.46	5.91	3.02	-6.58	3.90	2.49	17.46	17.12	5.16	3.73
Production	1980-1995	5.87	3.02	5.24	8.43	-3.13	4.12	12.14	3.01	14.21	23.35	4.12
	1996-2015#	32.91	8.16	14.45	11.80	-4.44	5.46	9.82	30.79	30.56	11.79	9.35
Productivity	1980-1995	3.93	1.60	3.93	3.14	2.03	1.45	1.87	2.07	5.04	5.85	1.73
	1996-2015#	8.85	-3.70	3.30	4.17	-3.64	2.41	3.58	3.27	2.92	3.05	2.38

Note: # - Post-WTO regime

Raw Data Source: Directorate of Economics and Statistics, Hyderabad, Government of Telangana

Appendix 7: District wise TE Average of Area, Production and Productivity of Maize in Telangana (1980-2015)

Particulars	TE-averages	Adilabad	Nizamabad	Karimnagar	Medak	Hyderabad	Ranga Reddy	Mahabubnagar	Nalgonda	Warangal	Khammam	Telangana
Area (000 ha)	1980-82	23.67	62.33	95.00	67.00	0.00	9.67	0.00	1.67	47.33	6.33	313.00
	1990-92	23.33	60.67	85.00	67.00	0.00	4.67	1.33	1.00	29.67	10.67	283.33
	2000-02#	22.67	0.00	19.67	94.33	12.00	54.00	52.33	29.00	103.00	56.67	423.67
	2010-12#	20.14	86.14	99.05	119.68	0.00	36.55	123.37	2.99	68.67	31.51	588.10
	2013-15#	22.54	64.12	102.46	129.14	0.00	48.32	170.24	3.74	100.72	30.22	671.49
Production (000 tonnes)	1980-82	32.00	157.00	246.67	101.67	0.00	15.00	0.00	3.33	87.00	8.00	651.00
	1990-92	34.00	148.33	236.00	116.33	0.00	8.33	4.00	2.67	61.33	26.67	637.67
	2000-02#	80.00	0.00	50.00	208.00	28.00	83.00	199.67	91.33	382.67	159.33	1210.00
	2010-12#	67.00	437.34	456.69	446.45	0.00	100.39	306.80	7.29	304.55	175.06	2301.58
	2013-15#	76.07	319.86	514.41	339.67	0.00	166.80	449.98	6.14	494.99	155.61	2523.54
Productivity (kgs/ha)	1980-82	1366.00	2509.67	2598.67	1511.67	0.00	1548.00	0.00	1969.33	1832.67	1357.67	2081.00
	1990-92	1454.67	2459.67	2778.67	1751.67	0.00	1967.67	2298.33	2133.33	2068.67	2427.00	2250.33
	2000-02#	2822.00	0.00	2570.33	2216.33	2314.00	1602.00	3809.67	3169.67	3726.00	2875.00	2877.00
	2010-12#	3316.00	5058.33	4589.67	3663.67	0.00	2647.33	2600.00	2485.67	4411.67	5510.00	3898.82
	2013-15#	3380.00	4850.67	4970.00	2573.67	0.00	3453.33	2659.67	1589.33	4903.67	5109.67	3692.00
CAGR												
Area	1980-1995	1.32	-0.49	0.48	-0.14	0.00	1.67	13.02	9.38	-0.14	14.05	0.34
	1996-2015#	63.54	-0.72	19.28	4.48	2.92	33.45	30.70	67.64	9.73	9.18	4.42
Production	1980-1995	9.46	5.56	8.92	11.28	0.00	31.39	24.28	21.77	4.04	24.66	6.94
	1996-2015#	56.66	1.90	33.31	20.70	10.52	45.25	37.95	64.50	19.62	12.18	10.43
Productivity	1980-1995	10.24	11.84	7.53	11.72	5.23	25.28	5.85	9.88	4.86	8.78	6.36
	1996-2015#	4.18	2.44	9.23	17.20	-1.76	15.80	10.60	0.19	5.82	4.70	8.28

Note: # - Post-WTO regime

Raw Data Source: Directorate of Economics and Statistics, Hyderabad, Government of Telangana

Appendix 8: District wise TE Average of Area, Production and Productivity of Bengal gram in Telangana (1980-2015)

Particulars	TE-averages	Adilabad	Nizamabad	Karimnagar	Medak	Hyderabad	Ranga Reddy	Mahabubnagar	Nalgonda	Warangal	Khammam	Telangana
Area (000 ha)	1980-82	2.67	5.67	1.00	12.00	0.00	4.67	3.33	1.33	0.00	0.00	32.00
	1990-92	1.67	3.00	0.00	11.67	0.00	4.00	1.67	0.00	1.00	0.00	24.00
	2000-02#	3.33	3.00	2.00	22.67	0.00	5.33	8.00	0.00	1.00	0.00	44.00
	2010-12#	11.69	23.70	1.65	30.68	0.00	5.68	26.54	0.47	1.18	0.26	101.85
	2013-15#	17.03	20.14	1.51	13.94	0.00	4.62	22.55	0.30	0.74	0.04	80.87
Production (000 tonnes)	1980-82	1.00	1.00	1.00	5.33	0.00	2.00	1.00	1.00	0.00	0.00	11.00
	1990-92	1.00	1.33	0.00	4.00	0.00	1.00	1.00	0.00	1.00	0.00	8.00
	2000-02#	3.33	3.67	2.50	23.67	0.00	5.67	8.33	0.00	1.00	0.00	47.00
	2010-12#	15.92	36.91	1.09	38.06	0.00	6.18	27.44	0.61	1.51	0.31	128.02
	2013-15#	21.84	30.38	2.00	18.38	0.00	5.24	29.60	0.42	0.84	0.06	108.75
Productivity (kgs/ha)	1980-82	240.33	116.00	379.67	429.00	0.00	425.00	324.00	332.33	0.00	0.00	339.33
	1990-92	282.67	409.00	0.00	346.00	0.00	259.00	267.67	0.00	328.33	0.00	333.67
	2000-02#	948.00	1020.00	1020.00	1030.00	0.00	1020.00	1020.00	0.00	1020.00	0.00	1023.67
	2010-12#	1303.00	1537.00	702.00	1238.67	0.00	1092.67	1024.67	1225.00	1266.67	1225.00	1225.08
	2013-15#	1253.33	7386.33	1332.00	1246.00	0.00	1128.33	1301.00	1269.00	1104.67	1269.00	1028.67
CAGR												
Area	1980-1995	8.33	-2.31	-3.13	2.22	0.00	1.35	16.15	0.00	0.00	0.00	0.64
	1996-2015#	21.36	21.46	17.51	0.58	0.00	0.49	11.37	1.10	4.94	-7.85	6.10
Production	1980-1995	8.33	5.21	0.00	10.53	0.00	4.17	12.50	0.00	0.00	0.00	7.61
	1996-2015#	38.09	37.72	20.22	29.83	0.00	16.57	56.06	5.75	17.65	-7.67	41.24
Productivity	1980-1995	29.37	13.42	12.83	9.19	0.00	3.10	14.06	11.34	10.39	6.71	5.49
	1996-2015#	29.41	85.41	30.28	23.09	0.00	26.05	61.67	23.73	27.05	23.73	31.11

Note: # - Post-WTO regime

Raw Data Source: Directorate of Economics and Statistics, Hyderabad, Government of Telangana

Appendix 9: District wise TE Average of Area, Production and Productivity of Chillies in Telangana (1980-2015)

Particulars	TE-averages	Adilabad	Nizamabad	Karimnagar	Medak	Hyderabad	Ranga Reddy	Mahabubnagar	Nalgonda	Warangal	Khammam	Telangana
Area (000 ha)	1980-82	8.00	5.67	14.67	9.67	0.00	5.33	8.33	3.33	16.00	17.00	88.00
	1990-92	5.67	3.67	16.67	7.67	0.00	4.00	7.00	6.67	32.00	26.00	109.33
	2000-02#	8.33	0.00	21.67	8.33	3.00	11.33	2.67	8.67	10.67	27.00	101.67
	2010-12#	3.44	2.00	4.80	1.83	0.00	1.09	8.66	7.40	23.26	30.72	83.20
	2013-15#	1.79	0.97	4.25	0.34	0.00	0.49	10.03	5.05	25.83	27.87	76.62
Production (000 tonnes)	1980-82	4.67	4.67	13.67	4.33	0.00	4.33	3.00	2.67	12.67	25.67	75.67
	1990-92	3.00	3.33	22.00	5.00	0.00	4.00	6.33	7.67	33.00	39.67	124.00
	2000-02#	14.33	0.00	73.00	10.00	6.33	14.33	5.67	7.00	21.33	57.00	209.00
	2010-12#	4.29	6.37	8.86	3.29	0.00	3.23	24.30	18.51	71.29	117.85	258.00
	2013-15#	3.10	3.55	11.20	0.21	0.00	1.64	29.69	13.92	78.53	105.02	246.87
Productivity (kgs/ha)	1980-82	554.00	854.00	926.00	372.00	0.00	854.00	406.67	854.00	820.33	1431.00	857.00
	1990-92	530.00	933.67	1296.00	672.00	0.00	1025.67	923.33	1118.33	1040.33	1489.00	1134.67
	2000-02#	1667.33	0.00	3307.00	1289.67	2061.00	1290.67	2143.00	793.67	1955.33	2104.33	2054.00
	2010-12#	1238.67	3280.67	1813.00	1818.67	0.00	3069.67	2936.33	2462.00	3039.67	3840.67	3114.87
	2013-15#	1654.00	3466.67	2627.33	614.67	0.00	3292.00	2991.33	2769.33	3044.33	3805.33	3236.00
CAGR												
Area	1980-1995	0.42	8.12	2.23	3.42	7.50	-0.21	3.42	12.07	7.76	3.85	2.52
	1996-2015#	-1.67	-6.88	0.42	-11.59	25.50	7.18	17.44	4.08	8.28	3.04	-0.46
Production	1980-1995	20.43	8.17	14.75	44.64	0.00	9.69	31.93	36.75	21.73	11.74	9.23
	1996-2015#	20.75	-3.72	13.28	-8.62	-1.68	17.81	16.44	19.39	22.68	5.00	3.90
Productivity	1980-1995	26.66	8.90	10.94	36.91	-5.60	14.82	25.20	19.80	10.76	7.47	6.44
	1996-2015#	21.75	1.44	5.95	1.18	2.53	8.73	6.21	7.16	6.85	3.34	9.14

Note: # - Post-WTO regime

Raw Data Source: Directorate of Economics and Statistics, Hyderabad, Government of Telangana

Appendix 10: District wise TE Average of Area, Production and Productivity of Cotton in Telangana (1980-2015)

Particulars	TE- averages	Adilabad	Nizamabad	Karimnagar	Medak	Hyderabad	Ranga Reddy	Mahabubnagar	Nalgonda	Warangal	Khammam	Telangana
Area (000 ha)	1980-82	132.67	5.67	0.00	1.00	0.00	0.00	5.33	0.00	4.67	0.00	150.00
	1990-92	164.00	13.00	28.67	7.33	0.00	16.00	29.33	24.67	57.67	36.33	377.00
	2000-02#	96.00	0.00	84.00	11.33	15.67	49.00	9.33	169.00	64.33	147.33	646.00
	2010-12#	352.17	21.36	240.67	100.11	0.00	44.78	189.36	222.77	256.73	168.35	1596.30
	2013-15#	314.57	15.95	215.74	130.08	0.00	61.99	257.43	328.47	239.62	159.23	1723.08
Production (000 tonnes)	1980-82	37.33	3.00	0.00	0.00	0.00	0.00	4.00	0.00	4.33	0.00	48.67
	1990-92	97.00	13.67	64.00	7.67	0.00	20.00	34.33	26.33	81.33	60.00	404.33
	2000-02#	85.67	0.00	172.67	17.00	24.00	65.33	13.67	182.67	113.33	279.00	953.33
	2010-12#	637.27	47.64	431.93	245.79	0.00	80.45	344.35	371.07	595.71	374.32	3128.53
	2013-15#	458.86	16.23	415.94	178.04	0.00	81.31	283.19	453.37	434.20	333.95	2655.10
Productivity (kgs/ha)	1980-82	47.67	82.67	55.67	55.67	0.00	0.00	140.00	0.00	164.00	0.00	55.67
	1990-92	99.33	183.00	387.67	183.00	0.00	209.67	205.00	183.00	240.67	287.00	183.00
	2000-02#	151.33	0.00	345.33	249.00	255.33	229.67	249.00	182.33	301.33	320.67	248.67
	2010-12#	308.67	385.67	304.33	388.00	0.00	287.00	305.33	276.00	397.33	379.67	332.26
	2013-15#	865.67	485.00	1091.33	722.33	0.00	682.67	576.33	728.33	1045.67	1209.67	858.76
CAGR												
Area	1980-1995	2.23	12.63	38.22	27.51	0.00	50.49	28.32	36.08	36.84	42.77	10.54
	1996-2015#	9.90	2.79	9.80	16.43	-1.34	9.94	43.55	17.52	10.38	8.72	8.61
Production	1980-1995	24.77	21.78	50.05	21.53	0.00	47.03	24.22	28.76	73.98	61.51	30.96
	1996-2015#	23.26	4.49	11.24	28.03	-2.38	13.43	118.08	25.78	12.98	14.58	11.34
Productivity	1980-1995	22.74	160.77	29.52	19.60	0.00	19.34	14.29	19.62	33.05	31.25	19.11
	1996-2015#	22.71	7.92	14.67	16.83	-2.45	18.23	20.85	18.24	15.72	20.60	16.16

Note: # - Post-WTO regime

Raw Data Source: Directorate of Economics and Statistics, Hyderabad, Government of Telangana

Appendix 11: NPCs of Paddy in major importing countries during Pre and Post-WTO regimes

Particulars	Saudi Arabia			Iran			UAE		
	1992-93	**2005-2006**	**2017-18**	**1992-93**	**2005-2006**	**2017-18**	**1992-93**	**2005-2006**	**2017-18**
Wholesale price (DMP- Rs/qtl)	700	1423.68	3850	650	1423.68	3850	650	1423.68	3850
AMC Cess 1%	0.7	1.42	3.85	0.65	1.42	3.85	0.65	1.42	3.85
Transport to market yard	5.11	10.85	15.63	5.11	10.85	15.63	5.11	10.85	15.63
Repacking in40 kg bags	15.23	20	30	15.23	20	30	15.23	20	30
New Gunny bags cost (each bags for 25kg/25rs.)	25.41	50.74	80.63	25.41	50.74	80.63	25.41	50.74	80.63
Loading cost	5.55	15.36	20.42	5.55	15.36	20.42	5.55	15.36	20.42
Transport from market yard to Chennai port	350.65	506.85	710	326.45	485.88	720.52	345.85	502.52	689.45
Margin (5% of wholesale price)	35	71.18	192.5	32.5	71.18	192.5	32.5	71.18	192.5
Total cost (up to sea port in Chennai) – Freight on Board Price (FOB)	1137.65	2100.09	4903.03	1060.9	2079.12	4913.55	1080.3	2095.76	4882.48
Ocean freight charges to destination	95.23	101.23	174.26	79.26	111.26	193.64	71.23	96.12	172.06
Wharfage charges, insurance, fumigation fees, health certificate etc.,/Handling/customs/cargo inspection charges	20.01	86.66	99.63	42.36	87.15	96.17	43.25	90.13	99.72
Total	115.24	187.89	273.89	121.62	198.41	289.81	114.48	186.25	271.78
Service tax (10%)	11.524	18.79	27.389	12.162	19.841	28.981	11.448	18.625	27.178
Landed price at importing country (Rs/qtl) – Cost, Insurance & Freight (CIF) Price	1264.41	2306.77	5204.31	1194.68	2297.37	5232.34	1206.23	2300.64	5181.44
Landed price at imported country (US$/qtl)	48.8	52.31	79.92	46.11	52.1	80.35	46.55	52.17	79.56
International price (US$/qtl)	78.79	53.74	95	25.44	48.94	95.6	58.2	52.17	94.5
NPC	**0.62**	**0.97**	**0.84**	**1.81**	**1.06**	**0.84**	**0.8**	**1.00**	**0.84**

Source: CACP, Government of India; Container Corporation of India, Hyderabad

Appendix 12: NPCs of Maize in major importing countries during Pre and Post-WTO regimes

Particulars	Indonesia			Nepal			Malaysia		
	1992-93	**2005-2006**	**2017-18**	**1992-93**	**2005-2006**	**2017-18**	**1992-93**	**2005-2006**	**2017-18**
Wholesale price (DMP- Rs/qtl)	320	543.59	1425	320	543.59	1425	320	543.59	1425
AMC Cess 1%	0.32	0.54359	1.425	0.32	0.54359	1.425	0.32	0.54359	1.425
Transport from market yard	5.1	10.9	15.6	5.1	10.9	15.6	5.1	10.9	15.6
Repacking in 25 kg bags	15.2	20.0	30.0	15.2	20.0	30.0	15.2	20.0	30.0
New Gunny bags cost	25.4	50.7	80.6	25.4	50.7	80.6	25.4	50.7	80.6
Loading cost	5.6	15.4	20.4	5.6	15.4	20.4	5.6	15.4	20.4
Transport from market yard to Chennai sea port	350.7	506.9	710.0	326.5	485.9	720.5	345.9	502.5	689.5
Margin (5% of wholesale price)	16.0	27.2	71.3	16.0	27.2	71.3	16.0	27.2	71.3
Total cost (up to sea port in Chennai) – Freight on Board Price (FOB)	738.3	1175.1	2354.4	714.1	1154.1	2364.9	733.5	1170.8	2333.8
Ocean freight charges to destination	22.05	34.26	56.23	21.34	46.92	61.25	22.1	35.12	54.16
Wharfage charges, insurance, fumigation fees, health certificate etc.,/Handling/customs/cargo inspection charges	16.05	23.83	24.36	23.64	21.15	35.26	16.95	22.65	26.14
Total	38.1	58.09	80.59	44.98	68.07	96.51	39.05	57.77	80.3
Service tax (10%)	3.81	5.809	8.059	4.498	6.807	9.651	3.905	5.777	8.96
Landed price at importing country (Rs/qtl) – Cost, Insurance & Freight (CIF) Price	780.21	1238.999	2443.049	763.578	1228.977	2471.061	776.455	1234.347	2423.06
Landed price at imported country (US$/qtl)	30.133	28.080	37.527	29.459	27.863	37.947	29.949	27.982	37.211
International price (US$/qtl)	12.2	13.79	31.94	10.24	13.94	27.56	11.86	16.323	28.052
NPC	**2.46**	**2.036**	**1.174**	**2.876**	**1.998**	**1.37**	**2.52**	**1.71**	**1.32**

Source: CACP, Government of India; Container Corporation of India, Hyderabad

Appendix 13: NPCs of Bengal gram in major importing countries during Pre and Post-WTO regimes

Particulars	Pakistan			Algeria			SriLanka		
	1992-93	2005-2006	2017-18	1992-93	2005-2006	2017-18	1992-93	2005-2006	2017-18
Wholesale price (DMP- Rs/qtl)	900	1722.00	5069.05	900	1722.00	5069.05	900	1722.00	5069.05
AMC Cess 1%	0.9	1.722	5.06905	0.9	1.722	5.06905	0.9	1.722	5.06905
Transport from market yard	5.11	10.85	15.63	5.11	10.85	15.63	5.11	10.85	15.63
Repacking in 25 kg bags	15.23	20	30	15.23	20	30	15.23	20	30
New Gunny bags cost	25.41	50.74	80.63	25.41	50.74	80.63	25.41	50.74	80.63
Loading cost	5.55	15.36	20.42	5.55	15.36	20.42	5.55	15.36	20.42
Transport to port	350.65	506.85	710	326.45	485.88	720.52	345.85	502.52	689.45
Margin (5% of wholesale price)	35	71.184	192.5	32.5	71.184	192.5	32.5	71.184	192.5
Total cost (up to sea port in Chennai) – Freight on Board Price (FOB)	1337.85	2398.706	6123.29905	1311.15	2377.736	6133.81905	1330.55	2394.376	6102.749
Ocean freight charges to destination	30.85	52.51	77.54	73.14	112.63	166.27	27.96	49.26	71.24
Wharfage charges, insurance, fumigation fees, health certificate etc.,/Handling/customs/cargo inspection charges	16.12	18.96	23.16	12.65	24.36	32.19	17.91	21.57	29.61
Total	46.97	71.47	100.70	85.79	136.99	198.46	45.87	70.83	100.85
Service tax (10%)	4.70	7.15	10.07	8.58	13.70	19.85	4.59	7.08	10.09
Landed price at importing country (Rs/qtl) – Cost, Insurance & Freight (CIF) Price	1389.52	2477.33	6234.07	1405.52	2528.43	6352.13	1381.01	2472.29	6213.68
Landed price at imported country (US$/qtl)	45.5479	56.1677	89.0707	46.0727	82.9086	208.2886	45.2999	81.0562	203.7289
International price (US$/qtl)	25.65	70.21	99.80	78.77	90.2	138.54	30.45	71.04	124.17
NPC	**1.7757**	**0.8000**	**0.8925**	**0.5849**	**0.9192**	**1.5035**	**1.4877**	**1.1410**	**1.6407**

Source: CACP, Government of India; Container Corporation of India, Hyderabad

Appendix 14: NPCs of Chillies in major importing countries during Pre and Post-WTO regimes

Particulars	Saudi Arabia			Iran			UAE		
	1992-93	2005-2006	2017-18	1992-93	2005-2006	2017-18	1992-93	2005-2006	2017-18
Wholesale price (DMP- Rs/qtl)	3628.94	3550.92	10406.31	3628.94	3550.92	10406.31	3628.94	3550.92	10406.31
AMC Cess 1%	3.62894	3.55092	10.40631	3.62894	3.55092	10.40631	3.62894	3.55092	10.40631
Transport to market yard	5.11	10.85	15.63	5.11	10.85	15.63	5.11	10.85	15.63
Repacking in 25 kg bags	15.23	20	30	15.23	20	30	15.23	20	30
New Gunny bags cost	25.41	50.74	80.63	25.41	50.74	80.63	25.41	50.74	80.63
Loading cost	5.55	15.36	20.42	5.55	15.36	20.42	5.55	15.36	20.42
Transport to Chennai port	350.65	506.85	710	326.45	485.88	720.52	345.85	502.52	689.45
Margin (5% of wholesale price)	35.00	71.184	192.5	32.5	71.184	192.5	32.5	71.184	192.5
Total cost (up to sea port in Chennai) – Freight on Board Price (FOB)	4069.52	4229.45	11465.90	4042.82	4208.48	11476.42	4062.22	4225.12	11445.35
Ocean freight charges to destination	53.05	89.26	122.59	51.96	94.26	139.61	46.96	85.81	132.07
Wharfage charges, insurance, fumigation fees, health certificate etc.,/Handling/customs/cargo inspection charges	13.91	15.81	29.86	18.27	16.82	21.67	19.62	19.31	20.27
Total	66.96	105.07	152.45	70.23	111.08	161.28	66.58	105.12	152.34
Service tax (10%)	6.70	10.51	15.25	7.02	11.11	16.13	6.66	10.51	15.23
Landed price at importing country (Rs/qtl) – Cost, Insurance & Freight (CIF) Price	4143.18	4345.03	11633.60	4120.07	4330.67	11653.83	4135.46	4340.75	11612.92
Landed price at imported country (US$/qtl)	159.91	98.54	178.65	141.58	98.20	178.951	159.61	98.428	178.37
International price (US$/qtl)	79.62	64.73	216.8	56.66	50.2	196.52	94.02	51.07	112.62
NPC	**2.008**	**1.522**	**0.82405**	**2.498**	**1.95**	**0.910**	**1.69**	**1.92**	**1.58**

Source: CACP, Government of India; Container Corporation of India, Hyderabad

Appendix 15: NPCs of Cotton in major importing countries during Pre and Post-WTO regimes

Particulars	China, Mainland			Bangladesh			Pakistan		
	1992-93	2005-2006	2017-18	1992-93	2005-2006	2017-18	1992-93	2005-2006	2017-18
Wholesale price (DMP- Rs/qtl)	1549.19	2130.73	4716.25	1549.19	2130.73	4716.25	1549.19	2130.73	4716.25
AMC Cess 1%	1.55	2.13	4.72	1.55	2.13	4.72	1.55	2.13	4.72
Transport from market yard	5.11	10.85	15.63	5.11	10.85	15.63	5.11	10.85	15.63
Repacking in 25 kg bags	15.23	20.00	30.00	15.23	20.00	30.00	15.23	20.00	30.00
New Gunny bags cost	25.41	50.74	80.63	25.41	50.74	80.63	25.41	50.74	80.63
Loading cost	5.55	15.36	20.42	5.55	15.36	20.42	5.55	15.36	20.42
Transport to port	350.65	506.85	710.00	326.45	485.88	720.52	345.85	502.52	689.45
Margin (5% of wholesale price)	35.00	71.18	192.50	32.50	71.18	192.50	32.50	71.18	192.50
Total cost (up to sea port in Chennai) – Freight on Board Price (FOB)	1987.69	2807.84	5770.15	1960.99	2786.87	5780.67	1980.39	2803.51	5749.60
Ocean freight charges to destination	33.99	57.85	82.64	28.64	52.67	78.96	26.91	48.61	77.54
Wharfage charges, insurance, fumigation fees, health certificate etc.,/Handling/customs/cargo inspection charges	15.89	18.23	26.28	18.02	19.61	23.62	19.24	22.35	24.51
Total	49.88	76.08	108.92	46.66	72.28	102.58	46.15	70.96	102.05
Service tax (10%)	4.99	7.61	10.89	4.67	7.23	10.26	4.62	7.10	10.21
Landed price at importing country (Rs/qtl) – Cost, Insurance & Freight (CIF) Price	2042.56	2891.53	5889.96	2012.32	2866.38	5893.51	2031.16	2881.57	5861.86
Landed price at imported country (US$/qtl)	78.82	65.57	90.44	77.69	64.99	90.51	78.42	65.35	90.01
International price (US$/qtl)	107.69	104.30	117.81	127.91	109.24	154.86	69.27	115.26	146.95
NPC	0.73	0.63	0.77	0.61	0.59	0.58	1.13	0.57	0.61

Source: CACP, Government of India; Container Corporation of India, Hyderabad