Export performance of cereal crops in India

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M.Sc. Agriculture

DOCTOR OF PHILOSOPHY
IN
AGRICULTURE
(AGRICULTURAL ECONOMICS)

DEPARTMENT OF AGRICULTURAL ECONOMICS
COLLEGE OF AGRICULTURE, PARBHANI
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BY

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M.Sc. Agriculture

A thesis submitted to

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani

In partial fulfillment of the requirements for the degree of

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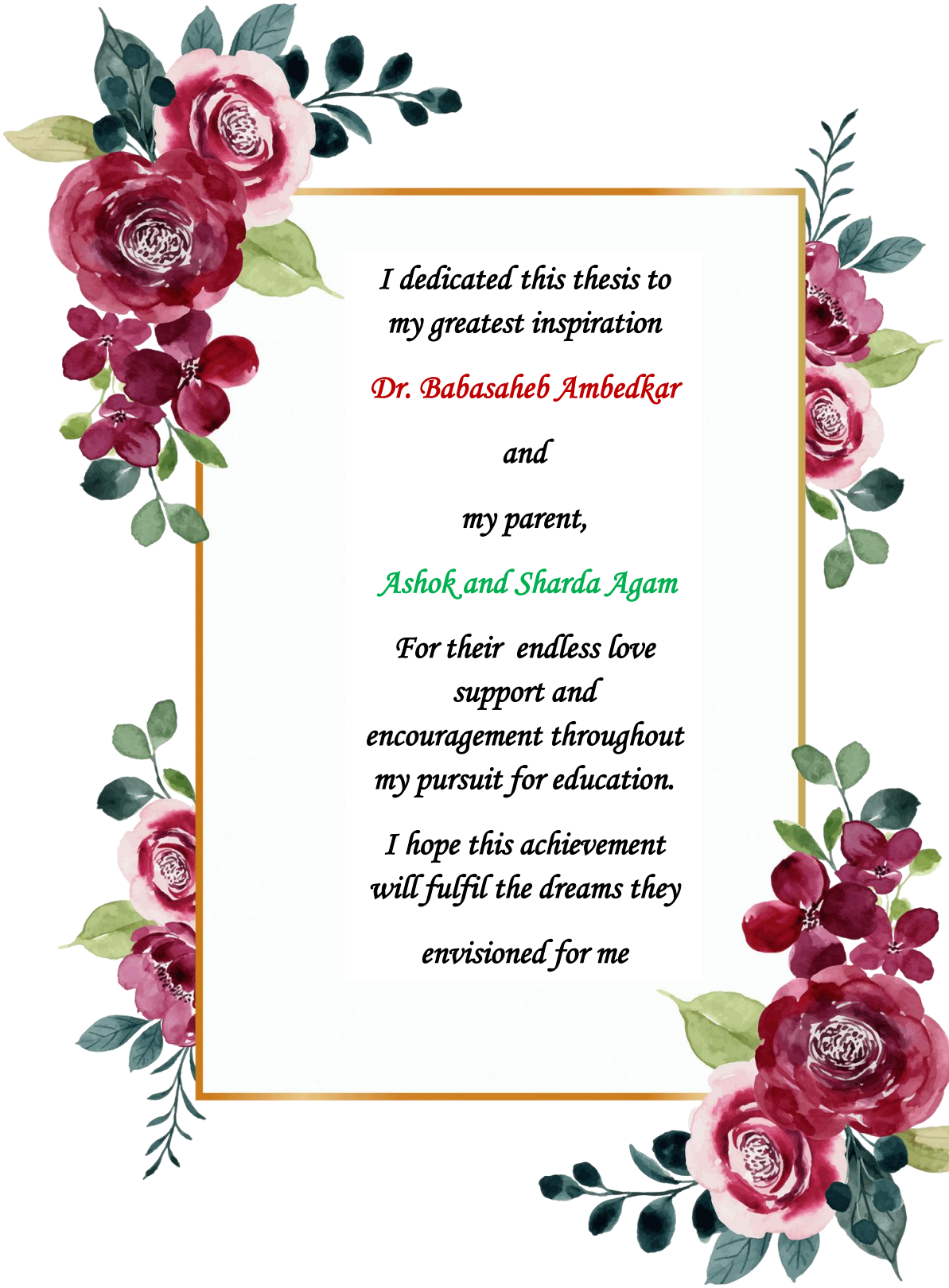

I dedicated this thesis to
my greatest inspiration

Dr. Babasaheb Ambedkar

and

my parent,

Ashok and Sharda Agam

For their endless love
support and
encouragement throughout
my pursuit for education.

I hope this achievement
will fulfil the dreams they

envisioned for me

DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled, "**EXPORT PERFORMANCE OF CEREAL CROPS IN INDIA,**" submitted by me is based on the actual work carried out by me under the guidance and supervision of **DIGAMBAR SHIVRAM PERKE**. The extent of information derived from the existing literature have been duly cited and referenced. The existing research work or its any part is not submitted anywhere else for the award of any degree or diploma.

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Place: VNMKV, Parbhani

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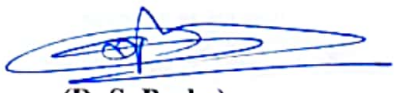

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2019 A/11 P

C O N T E N T S

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ABRIVIATIONS USED

$	-	Dollars
%	-	Per cent
/	-	Per
Acre	-	43560 sq
CAGR	-	Compound Annual Growth Rate
CDVI	-	Cuddy Della Valle Index
APEDA	-	Agricultural and Processed Food Product Export Development Authority
CV	-	Coefficient of Variation
EPR	-	Export Performance Ratio
et al.	-	et alia (and association)
FAO	-	Food and Agriculture Organization
Fig	-	Figure
GDP	-	Gross Domestic Product
Ha	-	Hectare
HS	-	Harmonized System
i.e.	-	that is
Kg/ha	-	Kilogram per hectare
MSP	-	Minimum Support Price
Mt	-	Metric tonne
No.	-	Number
NPC	-	Nominal Protection Coefficient
R^2	-	Coefficient of determination
RCA	-	Revealed Comparative Advantage
RSCA	-	Revealed Symmetric Comparative Advantage
Sr. No.	-	Serial number
UAE	-	United Arab Emirates
USA	-	United States of America
Viz	-	Namely
CACP	-	Commission for Agriculture Cost & Price
Agmarknet	-	Agricultural Marketing Information Network

THESIS ABSTRACT

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1	**Title of the thesis**	:	Export performance of cereal crops in India
2	**Full name of the candidate**	:	Agam Priyanka Ashokrao
3	**Full Name of the Research Guide**	:	Perke Digambar Shivram
4	**Department**	:	Agricultural Economics
5	**College/University**	:	College of Agriculture V.N.M.K.V. Parbhani
6	**Degree to be awarded**	:	Doctor of Philosophy

ABSTRACT

The history of Indian exports is very old. During ancient times India exported spices to other parts of the world India is the second largest in wheat, rice and seven in maize export. The Export-Import Policy (EXIM Policy), announced under the Foreign Trade (Development and Regulation Act), 1992, would reflect the extent of regulations or liberalization of foreign trade and indicate the measures for export promotion. Export intensity has been closely associated with foreign market knowledge. It is an essential resource for internationalization. As a result of economic liberalization, the agricultural reforms have come upfront in India. The reforms aimed at generating a favorable policy framework for agricultural development and were expected to provide a powerful thrust to growth and modernization of agriculture in future through favorable terms of trade. Indian trade policy for agricultural commodities is guided by the twin objectives of ensuring national food security and building export markets for enhancing the farmer's income. In global market, there is huge demand for cereals and it is creating a favorable environment for the export of Indian cereals viz., wheat, rice, maize. It is an opportunity for the country to increase the production of cereals and their export share in total cereal exports of the world. The present study emphasis on export performance of cereal crops in India. In addition to this, compound growth rate and instability index, Export Performance analysis, Nominal Protection Coefficient (NPC), Markov Chain analysis

were used. The objectives of study were analysed with the help of secondary data collected for the years from 1990-91 to 2019-20.

The absolute change in area, production, productivity and export of annual compound growth rates in area of maize was 0.95, 2.93, 1.22 and 1.98 per cent per annum during periods I, period II, period III and overall period at national level. The production of maize was significantly increased in period second. Thus, at overall level, increase in production was due to improvement in yield and area expansion. Wheat crop revealed the area expansion growth by 1.71, 1.20, 0.30 and 0.88 per cent per annum in period I, period II, period III and overall period. The production growth of wheat was much faster than area growth in India. The area of rice in India was increased by 0.08 per cent per annum during overall period. The production of rice was increased at the rate 2.07 per cent per annum and it was possible due to yield improvement by 1.98 per cent per annum in overall period. Yield improvement was main reason for increase in production of rice.

Maize export in terms of quantity, value and unit price grew at a positive and significant growth rate 40.66 per cent, 13.16 per cent and 1.99 per cent per annum during the overall period. It revealed that, export growth in terms of quantity and value was much higher than unit price in entire period.

Export unit price of wheat recorded positive but non-significant growth in period I the export of wheat in terms of quantity and export value was declined by 71.10 and 67.47 per cent during period II respectively. The export unit price of wheat grew significantly at the rate of 12.54 per cent per annum in the same period. The quantity as well as export value of wheat showed positive but non-significant growth in period III.

During overall period, the rice export in terms of quantity, value and unit price displayed positive and highly significant growth of 10.41 per cent, 13.16 per cent and 2.46 per cent per annum

Maize crop showed low level of instability in area as compared to production and yield during entire period. In India, area under wheat crop was found relatively stable as

CDVI was 1.85, 1.87 and 2.52 per cent in consecutive periods. Fluctuations in area of wheat were slightly increased over the period of time.

Instability in production and productivity of rice at national level was increased during period III of study compared to period I.

The export instability in terms of quantity of maize was higher in period I, which was further declined in period II and period III.

Export value Instability of maize was declined over the period of time. Instability indices of wheat revealed that, the export unit price was more stable as compared to export quantity and export value in three sub-sequent periods and overall period.

The export instability in terms of quantity of rice was higher in period I. instability in export value of rice was declined over the period of time and it became more stable in period III. Rice export indicated that, the fluctuations in export quantity and export value were quite higher as compared to export unit price in entire study period.

Indian maize found comparatively disadvantageous in international market due to the low production and less productivity of seed variety over last three decade. Indian maize became disadvantages in the international market due to relatively weak international prices

Indian wheat had a comparative disadvantage as the estimated RCAs were less than unity during entire study period**.** India was not comparatively advantages in wheat export throughout the study period. The Export Performance Ratio (EPR) for export of rice was estimated to compare the export competitiveness of India. The estimated RCAs were higher than unity revealed that, the Indian rice had a comparative advantage during entire study period.

The positive values of RSCA gave a clear indication of comparative advantage of Indian rice, which was increased over the period of time. It highlighted the fact that, India was competitive in rice export throughout the study period and India had great potential in rice export globally. Maize was moderately competitive in global market as farmers received less price in domestic market. It indicated that, Indian maize trade was advantageous. the NPC values of maize was observed to be 0.76 during the overall period

which implied that, maize was moderately competitive in global market as farmers received less price in domestic market (867.14 Rs/Qtl) than the global price (1135.37 Rs/Qtl).The NPC value for wheat was 1.00 and 0.96 during period I and period III which showed that, wheat was moderately competitive in international market.

The value of NPC for rice in first period was 0.82 which indicated that, rice was moderately competitive in global market. Bangladesh, Vietnam and Malaysia were the only countries that were found to be the loyal markets among the major importing countries of Indian maize and Jordan, UAE and Turkey were the loyal markets of Indian wheat. South Africa, Bangladesh and Kenya were the only countries that were found to be the loyal markets among the major importing countries of Indian rice during period I. Saudi Arabia, Russia, Sri Lanka and Indonesia were the most unstable importers.

For Appropriate export promotion policies need to be evolved to diversify the trade concentration to the other countries and also to find new markets besides expanding the existing markets in major importing countries.

Key Words: Growth rate analysis, Instability analysis, Export Performance analysis, Nominal Protection Coefficient.

CHAPTER I

INTRODUCTION

CHAPTER-I

INTRODUCTION

1.1 Background information

Export are the base of the overall growth performance of any country. By increasing the rate of exports, any developing country can pave a way for the development by earning international liquidity thereby sort out the problem of reserves to start up of any project to come out the circle of poverty. So, it becomes a paramount importance for the country like India to start export promotion measures to boost up the pace of its exports and India has already taken many steps to increase the level of its exports (Bala L M. and Sudhakar, 2017). Indian economy is dependent on agriculture. India is the leading exporter of the cereals to the global markets. As a result of economic liberalization, the agricultural reforms have come upfront in India. The reforms aimed at generating a favourable policy framework for agricultural development and were expected to provide a powerful thrust to growth and modernization of agriculture in future through favorable terms of trade. Indian trade policy for agricultural commodities is guided by the twin objectives of ensuring national food security and building export markets for enhancing the farmer's income.In global market, there is huge demand for cereals and it is creating a favourable environment for the export of Indian cereals *viz.*, wheat, rice, maize, sorghum, pearl millet and barley. It is an opportunity for the country to increase the production of cereals and their export share in total cereal exports of the world. (Geetha and Srivastava, 2019).

Agriculture is an important sector in India. It is indispensable for the sustenance and growth of the Indian economy. On an average, about 70 per cent of the households and 10 per cent of the urban population is dependent on agriculture as their source of livelihood. India is the top producer in the world in milk, and second largest in wheat and rice. Agricultural production is prone to several risks which affect both producers and consumers. In order to enhance investment and achieve a sustained increase in production, coherent and integrated long-term strategies and policies are required to reduce risk aversion and build flexibility among Indian rural producers. There is a need to provide remunerative prices for farmers in order to increase the incomes of farmers.

1.2 Historical Background

Agriculture sector in India is one of the conventional and age-old habits which help to identify the culture and behavior Indian population. Indian agriculture not only needs the demands of Indian population and also exporting to various countries. The history of Indian exports is very old. During ancient times India exported spices to the other parts of the world. India was also famous for its textiles which were a chief item for export in the 16th century. Textiles and cotton were exported to the Arab countries from Gujarat. During the Mughal era India exported various precious stones such as ivory, pearls, tortoise stones etc. But during the British era, Indian exports declined as the East India Company took control of foreign trade. (Paramasivan C and Pasupathi R, 2017) India is not only the largest producer of cereal well as largest exporter of cereal products in the world. India is the world's second largest producer of Rice, Wheat and other cereals. The huge demand for cereal products. Rice, Wheat and Other cereals. The huge demand for cereals in the global market is creating an excellent environment for the export of Indian cereals products rice (including basmati and non basmati) occupy the major share of 95.70 per cent in India total cereals export. Whereas other cereals including wheat represent only 4.3 per cent share in total cereals exported from India. (Soumya P. and Yeledhalli R. A., 2020)

The Export-Import Policy (EXIM Policy), announced under the Foreign Trade (Development and Regulation Act), 1992, would reflect the extent of regulations or liberalization of foreign trade and indicate the measures for export promotion. Although the EXIM Policy is announced for a five-year period, announcing a Policy on March 31st of every year, within the broad frame of the Five-Year Policy, for the ensuring year. A very important feature of the EXIM policy since 1992 is freedom on various dimensions. Licensing, quantitative restrictions and other regulatory and discretionary controls have been substantially eliminated. The Commerce Ministry, Government of India announces the integrated Foreign Trade Policy (FTP) in every five years. This is also called EXIM policy. This policy is updated every year with some modifications and new schemes. New schemes come into effect on the first day of financial year, i.e., April 1, every year. The Foreign Trade Policy which was announced on August 28, 2009 is an integrated policy for the period 2009-14. Export-Import (EXIM) Policy frames rules and regulations for exports and imports of a country. This policy is also known as Foreign Trade Policy. It provides policy and

strategy of the government to be followed for promoting exports and regulating imports for attaining a share of at least 1 per cent of global merchandise trade. This policy is periodically reviewed to incorporate necessary changes as per changing domestic and international environment. In this policy, approach of government towards various types of exports and imports is conveyed to different exporters and importers. Export refers to selling goods and services to other countries, while import means buying goods and services from other countries. Now in the era of globalization, no economy in the world can remain cut-off from rest of the world. Export and import play a significant role in the economic development of all the developed and developing economies. With the growth of international organizations like WTO, UNCTAD, ASEAN, etc., world trade is growing at a very fast rate.

1.3 Domestic and Global Scenario of Cereal crops

India has consistently maintained trade surplus in the agricultural products over the years. India's agricultural and allied exports during 2019-20 were Rs. 2.52 lakh Crores and imports were Rs. 1.47 lakh Crores. The export of Agri and allied commodities during Apr, 2020 - Feb, 2021 were Rs. 2.74 lakh crore as compared to Rs. 2.31 Crore in the same period last year indicating an increase of 18.49 per cent. Country has witnessed significant growth of 132 per cent in export of (Non-Basmati) Rice. Export of Non-Basmati Rice has gone up from Rs 13,030 crores in 2019-20 to Rs 30,277 crores in 2020-21. This increase in exports is on account of multiple factors, mainly being India capturing new markets namely, Timor-Leste, Papua New Guinea, Brazil, Chile, and Puerto Rico. Exports were also made to Togo, Senegal, Malaysia, Madagascar, Iraq, Bangladesh, Mozambique, Vietnam, Tanzania Rep and Madagascar.

Agri & Allied basket witnessing significant increase in export during April, 2020 to February, 2021 as compared to corresponding period during 2019-20, have been Spices (Rs 26257 crore vs Rs 23562 crore; growth 11.44per cent), Sugar (Rs 17072 crore vs Rs 12226 crore; growth 39.64 %), Raw Cotton (Rs 11373 crore vs Rs 6771 crore; growth 67.96 %), Fresh Vegetable (Rs 4780 crore vs Rs 4067 crore; growth 17.54 %) and Processed Vegetables (Rs 2846 crore vs Rs 1994 crore; growth 42.69 %) etc. The imports of Agri and allied commodities during April, 2020 – Feb,

2021 were Rs. 141034.25 Crore as compared to Rs. 137014.39 Crore in the same period last year witnessing a slight increase of 2.93 per cent.

In global market, there is huge demand for cereals, pulses and cash crops,it is creating a favorable environment for the export of Indian cereals *viz.*, wheat, rice, maize, other cereals.Aggregate cereal export (mostly rice, wheat and maize) in 2020-21 are forecasted at 18.4 million tonnes, 43 per cent above the five - year average and high demand on the international markers. Rice exports in 2021 are forecasted at a record of 16.2 million tonnes. Export of maize and wheat are forecasted at 2 and 1million tonnes, (Food and Agriculture Organization of the United Nation) respectively, almost two and three times more than the last five year averages.

The commodities which posted significant positive growth in exports were, Rice (38.34 %) Basmati rice (26.09 %), Non Basmati Rice (12.45 %), Maize (0.88 %).wheat (0.38 %).Cereals exported 40 per cent share in 2019-2020 from the total allied agriculture export from India.

Maize or corn (*Zea mays*) is cultivated globally being one of the most important cereal crops Worldwide. Maize accounts for one-third of total cereal trade in the world. The harmonized system (HS) code for maize is "1005.Maize the food of the gods that created the earth is a cereal crop which is cultivated throughout the world (Srikala, 2017). Maize is considered as multi faceted crop which is used as food, feed, and fodder and in recent past it was emerged as source of bio-fuel. (Bansal and Singh, 2020). Maize is the third most important crop after rice and wheat in India in terms of its area coverage and contribution to total food grains production. It is grown in almost all agro-ecological regions, contributing about 22 million tonnes of grain production from about 9 million hectares of land. The production pattern as well as its consumption pattern has dramatically changed in India in the recent past. However, the average crop yield of 2.5 t/ha is still very low as compared to the other Asian countries (Kumar, *et al.*, 2014)

India ranks 4th and 7th in terms of global maize acreage and production, contributing to about 4.6 per cent and 2.4 per cent respectively. Maize is the 3rd most important food grain for our country (after rice and wheat). It is the fastest growing cereal crop in terms of area, production as well as productivity.

In India, maize was sown in around 16.98 lakh hectares (41.95 lakh acres) as on 31st January 2020 which is higher than 14.78 lakh hectares(36.52 lakh acres) covered during corresponding period of last year Globally, maize is amongst the most widely produced and consumed cereal crops. In 2019, about 1.15 billion MT of maize was produced covering acreage of about 197 million Ha across 170 countries. During this year, global consumption of top three cereals (maize, wheat and rice) stood at 2,365 million MT of which maize held about 48 per cent share. Over the last decade, both global production as well as consumption increased at a CAGR of about 3.4 per cent. Just above 15 per cent of global production was traded internationally with about 89 per cent exports contributed by five exporters - USA, Brazil, Argentina, Ukraine and European Union. Over the last few decades, maize cultivation has shifted from being grown only during the kharif in traditional areas (such as Rajasthan, Uttar Pradesh and Bihar), primarily to be used as food, to being grown across non-traditional areas (such as Andhra Pradesh, Madhya Pradesh and Karnataka), across seasons and majorly produced for industrial use. However, the production system continues to be largely rain-fed. Over the last decade, maize consumption in India grew at a CAGR of 5.6 per cent while production grew at just about 2.9 per cent. Maize off-take by the feed industry grew fastest at a CAGR of 8.8 per cent followed by industrial segment (primarily starch), which grew at a CAGR of 6.2 per cent. Off-take for food grew at a CAGR of 0.8 per cent. With domestic demand for maize growing faster than production and the fact that maize provides the right opportunity for crop diversification and increasing farmer income (specially for small and marginal farmer in rained areas), there is an imminent need to identify and address key barriers hindering growth of the Indian maize ecosystem. Multiple challenges across the value chain are impacting farm prices on one hand, while constraining the availability of good quality produce to the consumer at reasonable price on the other. In 2019-20, India's major export destinations were Nepal (313322.69MT), Bangladesh PR (9962.19MT), Myanmar (4802.03MT), Pakistan (1647.33MT) and Bhutan (11205.99MT).

Wheat (*Triticum* spp.) is the most important food grain of India and it has been described as the "King of Cereal". India has second rank in world wheat production. It is the staple food of millions of Indians, particularly in the northern and north-western parts of the country. Wheat is a cereal grain, originally from the South West Asia, but

now cultivated worldwide Wheat is a *rabi* crop which is sown in the beginning of winter and is harvested in the beginning of summer. The sowing of wheat crop normally begins in September - October in Maharashtra and the harvesting is done in January-February. This grain is grown on more land area than any other commercial food. World trade in wheat is greater than for all other crops combined. Globally, wheat is the leading source of vegetable protein in human food, having higher protein content than other major cereals, maize or rice. In terms of total production tonnages used for food, it is currently second to rice as the main human food crop and ahead of maize, after allowing for maize's more extensive use in animal feeds. Along with this wheat can be used in cement. Wheat and other cereals posted huge growth over last year, i.e., increasing from Rs. 425 Crore to Rs. 3283 Crore and Rs. 1318 Crore to Rs. 4542 Crore, respectively. On specific demand from countries, NAFED has exported 50,000 MT wheat to Afghanistan and 40,000 MT wheat to Lebanon under G2G arrangement. India has witnessed tremendous growth of 727 per cent for Wheat export. Wheat production has increased to a record 107.06 million tonne (MT) for the crop year 2019-20 (July-June), up by 1.3 per cent world production. The United States Department of Agriculture (USDA) estimates that the in terms of country, China is the leading producer of wheat in the world followed by India. India's share in global wheat production was recorded at 93,500,000 tonnes (13.18) percent in the year 2019-20. In 2019-20, India's major export destinations were Nepal, Bangladesh, UAE, Somalia Afghanistan, and India's wheat export in 2019-20 has increased by 18.50per cent over the corresponding period of the previous year. India's share in global exports was around (0.28) per cent in the year 2019-20. World area of wheat is (21429188) and total production of wheat (734045174) 2018-2019. Top five producers of wheat are china (11189180), India (781366358), USA (5844943196), Russian federation (4875362344) and France (3618024884). In India area was 29647 (000'ha), production 92458 (000't), productivity 3119 (kg/ha). The harmonized system (HS) code for wheat is "1001". The HS codes of wheat products

Rice (*Oryza sativa*) as a cereal grain, rice crop is one of the main food grain crop domesticated. Rice is the most widely grown cereal in the world and is staple food for more than 60 per cent of world's population. China is the largest producer of rice contributing for over 30 per cent of the world's rice output. India occupies the second position accounting for about 22 per cent followed by Indonesia. Rice is one

of the most important exportable agricultural commodities from India with the third-highest worldwide production of rice, 503.17 million metric tons (USDA), is the export of Rice (Basmati, Non-Basmati rice). The global markets for Indian rice are highly dynamic and the barriers to trade are being lowered gradually all around the world. The export of rice is also related with the buffer stock of rice held by the government. Because of comfortable buffer stock, India became a major exporter of rice in 2012. There is a strong demand for Indian rice in the international markets (Udhayakumar M. and Karunakaran K.R., 2020). Indian economy and is the oldest and largest occupation of India. In agriculture rice is one of the most important food harvest of India and second across the world. Agriculture is still one of the priority sectors of the rural economy. (Agrawal, 2021). Rice export by India is in three categories which is Basmati, non-Basmati and other. Any rice other than Basmati Rice is named as Non- Basmati rice. Rice is an important commodity which is being exported to different countries Basmati and non-basmati and other rice are exported from India to different countries. India is the leading exporter of the Basmati Rice to the global markets. During 2015-16 the country had exported globally about 40.45 Lakh MT of Basmati Rice and 63.66 Lakh MT Non-Basmati rice for the worth of Rs. 2, 2718.44 crores and Rs. 15,129.09 crores respectively. India had exported around 5.04 million tonne in the 2019-20 seasons. In 2017-18, India had exported 8 million tonne the highest export of non-basmati rice. Indian prices are very economic which makes massive export of rice possible" Indian non-basmati rice varieties are around ten -percent economic than Thailand and Vietnam, Inida's price are at $370-380 per tonne as against $460 470 a tonne in Thailand and Vietnam. Both Thailand and Vietnam put a halt to export during lockdown but India continued to export and it gave a boost to India's rice export. During lockdown the demand for rice rose as it cooks easily and was simplest and quick food to put on table and Biryani even tops the menu and gave huge opportunity for exports to India. (Agrawal, 2021).

"Rice is life" is a sign of the importance of rice as a primary food and income source especially in many developing countries. (Thanh and Singh, 2006). Rice constitutes around 44 per cent of total foodgrain consumption in the country and it occupies 23 per cent of gross sown area of India. Production of rice has tremendous impact on food and nutritional security, not only in India but also throughout the world. (Mishra *et. al.*, 2014). Rice is positively influenced by trade liberalization and

it is emerged as significant export crop. Traditionally, India used to export basmati rice and a small quantity of non basmati rice. The share of non basmati rice was below 10 per cent until 1989-90 and it has witnessed a quantum jump and its share in the total rice export increased to 54 per cent after trade liberalization. (Ramesh Chand, 2009). In India rice is one of the most important exportable agricultural commodities. (Adhikari *et al.,* 2016). The export of rice is also related with the buffer stock held by the government. Because of comfortable buffer stock, India became a major exporter of rice in 2012 There is a strong demand for Indian rice in the international markets. The increasing consumer demand for rice and India's strength for production of basmati as well as non-basmati rice, coupled with liberal export policy, and large public stock have created ample scope for rice export. In recent years, the African countries have also shifted to Indian non-basmati rice because of price competitiveness. (Chandrashekhar, 2013). The future performance of any product in international markets can be judged in the light of its past performance. Therefore, evaluation of past performance of rice is necessary to work out its export potential, challenges and opportunities. Rice export from India is determined by various factors and therefore, reliable estimates of determinants of export are essential for the formulation of appropriate policies. The export promotion policy of a country must be in tune with the fast changing and dynamic international markets for commodities, India's direction of foreign trade has exhibited a structural shift during the last decade. India has comparative advantage in agriculture, so that there is considerable scope for raising farm income and employment by stepping up agro-based exports without jeopardizing and indeed by consolidating the food security already achieved. (Naseeruddin and Sundaresan 1999). Agricultural exports can thus serve as the bigger safety net in the process of structural adjustment in India. (Leelavathi *et al.,* 2015).

1.4 Objective of the study

1. To study the growth in area, production, productivity and export of cereal crops in India
2. To measure instability in area, production, productivity and export of cereal crops in India
3. To study the export performance of cereal crops in India
4. To assess export competitiveness of cereal crops in India
5. To analyse direction of trade of cereal crops in India

1.5 Hypotheses of the study

1. There is a significant growth in area, production, productivity and export of cereal crops in India
2. Indian maize and wheat is comparatively disadvantageous in international market
3. Indian rice has comparative advantage in international market
4. Indian maize and rice has moderately competitive in global market
5. Indian wheat is non competitive in global market
6. The trade direction of export of maize and wheat trends towards Asian countries globally, trade of Indian rice is diversified

1.6 Scope of the study

Export intensity has been closely associated with foreign market knowledge. It is an essential resource for internationalization. As a result of economic liberalization, the agricultural reforms have come upfront in India. The reforms aimed at generating a favorable policy framework for agricultural development and were expected to provide a powerful thrust to growth and modernization of agriculture in future through favorable terms of trade. Indian trade policy for agricultural commodities is guided by the twin objectives of ensuring national food security and building export markets for enhancing the farmer's income. In global market, there is huge demand for cereals and it is creating a favorable environment for the export of Indian cereals *viz.*, wheat, rice, maize. It is an opportunity for the country to increase the production of cereals and their export share in total cereal exports of the world.

1.16 Limitations of the study

The present study is focused on only cereal crops (Rice, Wheat and Maize.) which are grown in India. The other form of cereals products *viz;* wheat flour, poultry feed, starch, noodles, bakery products are having major share in export but they are not included. Moreover, the study is based on secondary data collected from various published sources. Often data from various sources may not agree with each other and some efforts to choose the better among them are inevitable care has been taken to avoid personal bias in such decision. However, the limitations inherent in secondary data are to be recognized.

CHAPTER II

REVIEW OF LITERATURE

CHAPTER- II

REVIEW OF LITERATURE

Review of literature can provide researchers with information about the relevant previous research they have conducted in the research field, thereby helping them to determine the theoretical framework and methodological issues related to the research. The review of literature help researchers have a better and more accurate understanding of current research issues, and also help modify and improve this research. Since the literature directly related to current research is very limited, Literature related to different aspects of the current investigation, titled "Export performance of cereal crops in India." Keeping in view of the objectives of the study, reviews are presented under the following headings:

2.1Growth in area, production, productivity and export of cereal crops

2.2 Instability in area, production, productivity and export of cereal crops

2.3 Export performance of cereal crops

2.4 Export competitiveness of cereal crops

2.5 Direction of trade of cereal crops

2.1 Growth in area, production, productivity and export of cereal crops in India

Shete *et al.* (1997) studied an annual compound growth of area production and productivity of total cereals, pulses, oilseeds, sugarcane and cotton crops during different time period viz, period- I (1956-57 to 1966 67) period-II (1967-68 to 1977-78) and period-III (1978-79 to 1989-90). Increase in the production of cereals during period-I was due to area expansion and during subsequent period it was combined with productivity improvements in all the regions. The productivities of pulses declined in period-I. Maharashtra continued to be the deficient state of oilseeds production during the sixties and seventies and experienced some dramatic changes in production during the eighties.

Bhatnagar and Saxena (2000) estimated area, production of wheat in Haryana. Growth performance of production of wheat is better than its growth in area and yield. Area and production have decreased in third decade but it has not affected the average

yield of wheat. An estimate of area, production and yield of wheat in Haryana has been obtained for next years with 95 percent confidence limit.

Singh and Goyal (2005) revealed that, the extent of growth in value terms has been invariably higher than the amount of growth in quantity terms expect in case of jaggery and confectionery, alcoholic and beverages and milled products. Wheat topped the list both in export earnings and quantity exported with 63.10 per cent and 53.08 per cent annual growth rates, respectively. Instability indices for both export earnings and quantity exported, were highest for animal casings (183.75 per cent) and (172.70 per cent) indicating that animal casing was most vulnerable commodity in terms of export earnings and quantity exported. Guar gum recorded least instability (9.73 per cent) in terms of quantity exported while export earning instability was observed least (9.13 per cent) in mango pulp. The instability has been by and large higher of quantity exported than the export earnings with some expectations like guar gum, dried nuts, fresh grapes, buffalo meat, groundnut and other cereals.

Sahni (2014) analyzed the trends in India's exports. Using the time series data for the period 1980-81 to 2010-11. Studied tea, coffee, rice, tobacco and spices. The C.G.R. of India's exports of agriculture and allied products is found to be only 1.9 percent during the pre -reform period but it is found to be higher *i.e.* 9.7 percent during the post-reform period. The C.G.R of India's exports of rice is found to be negative during pre -reform period. The fall in export volume, in face of the buoyant market conditions is due to decline in domestic availability following the drought conditions and because of ban placed on exports of non -basmati rice to augment domestic supply. But during the post-reform period exports of rice has shown a remarkable growth as C.G.R is found to be 10.08 percent. Bulk of these exports found their ways to the gulf region and the USA.

Singh *et al.,* (2014) studied Instability in Rice Production in Gujarat: A Decomposition Analysis. The growth rates of rice area, production and productivity during (1982-83 to 2011-12) were 0.41, 1.25 and 0.83 percent per annum. Productivity of rice crop was worked out using exponential function. The growth estimate 30 years data shows that negligible increase there was slight change in area under rice cultivation in Gujarat state. During the period 1982-83 to 2011-12, there was slight increase in area by 0.41 per cent per annum. Production and productivity of rice shown positive growth. Growth in area was ranges between 0.01 to1.88 percent

PA. The production growth was ranges between 0.91 to 2.76 %PA. Productivity growth was positive in the selected districts as well as in the state.

Najeeburahman (2014) studied the performance of India's Basmati rice export from 1992-93 to 2012-2013 owing to its commercial significance. Export CAGR was highest in Kuwait, Qatar and UAE. As the export of basmati rice has almost doubled during the study period, it can be inferred that Basmati rice has a better export potential. During the aggregate study period with regard to the export quantity and export value, the total basmati rice export grew at a CGR of 11.11 and 6.80 respectively. The second period i.e., 2003-2004 to 2012-2013 showed higher order growth rate at 17.30 per cent in terms of export quantity and 13.70 per cent in terms of export value as compared to the first period *i.e.* from 1992-1993 to 2002-2003 which recorded a growth rate of 8.20 and11.8 per cent, respectively.

Limbore and Khillare (2015) conducted an analytical study on the production and export of wheat in India. The study reported that maximum wheat production was recorded during 2011-2012 with 97880 MT. There was steady fluctuation during the study period. Since 2009-2010, production of wheat steadily increased with maximum production achieved in the year 2011-2012. After this the production decreased considerably by 766. 4 MT. India's position in export is reverse as that of production. In production, India ranks second globally but still it lags behind the major wheat exporting countries like USA, France, Australia, Russia and Germany in export. The study also revealed that compared to the export quantity, the export value earned was relatively low that brings to the conclusion that India must strengthen its export strategies and increase the export of wheat to effectively utilize its export potential.

Oladele and Kenamara (2015) analyzed the trends in production and export of wheat in India. Data were obtained for a period of 40 years (1970-71 to 2011-12). India had shown a significant growth in the production of wheat but had fallen short in export market. The compound growth rate in the export over the selected period showed a very high negative growth rate area had registered a significant annual growth rate of 1.76 per cent while production and yield had shown similar significant increases at a rate of 4.14 and 3.05 per cent, post-WTO had shown slight decline in area by 1.12 per cent, production by 2.68 per cent and yield by 1.55 per cent. On the overall, area had registered a growth rate of 1.41 per cent per annum while production and yield had shown an annual growth rate of 3.34 per cent and 2.32 per cent,

respectively. Export of wheat has shown a high negative growth rate of - 49.02 per cent per annum.

Pangayar *et al.*, (2015) studied the Statistical Analysis of Trends in Maize in India. The secondary data collected from 1970-71 to 2013-14 thus, the result showed that the percentage of growth was higher in terms of production (223.14 per cent) followed by productivity (91.41 per cent) and area (60.63per cent) at the same time, linear growth rate was found to be high in terms of production as well as in area than productivity. The study showed that the increase in production of maize over the years has been mainly due to parallel expansion in area.

Adhikari *et al.,* (2016) viewed Export of Rice from India: Performance and Determinants Markov chain analysis .The study is based on the time series data on export quantity, value and unit value which were compiled from various sources for a period of 33 years (1980 To 2013) annual compound growth rates (ACGR) for export of basmati rice and total rice in terms of quantity, During period 1980-1994, the quantity of rice export recorded a positive but non-significant compound growth due to lower domestic production and restriction of minimum export price till 1991. In contrast, the export value and unit value registered a positive growth rate of 13.74 per cent and 13.48 per cent per annum. The export of basmati rice in quantity grew at the rate of 12.11 per cent per annum during the period 1995-2012.the overall period 1980-2012, the total rice export in terms of quantity, value, and unit value grew at a positive and significant growth rate of 10.87 per cent, 17.74 per cent, and 6.20 per cent per annum respectively.

Ayalew and Sekar (2016) studied Trends and regional disparity of maize production in India the growth rate of maize area, production and productivity in major producing states of India for the period 1980- 1981 to 2011-2012. The result demonstrates that the maize area, production and productivity in India have increased at the rate of 1.88per cent, 4.20 per cent and 2.28 per cent per annum. The area and production growth of maize was the maximum in Maharashtra (9.19 per cent and 12.24 per cent, respectively) which was followed by Karnataka (7.98 and 8.48) and Andhra Pradesh (8.68 per cent).

Devi and Kalabarani (2016) studied Problems & Prospects of rice (basmati and non-basmati). The secondary data has been used for the study purpose. The pertaining to different aspects in rice exports were collected for 26 years from 1990-1991 to 215-2016 and the collected data are used to analyse It is evident that in the

linear model, that the export of rice increased by the 15 per cent per year. The compound growth rate works out to 17.10 per cent.

Suresh and Mathur (2016) analyzed Export of agricultural commodities from India: Performance and prospects. The export performance commodity based on their contribution to the total agricultural export. The growth rates were estimated by using semi-log growth model. The annual growth rate of agricultural export (16%) was less than the growth experienced in case of total merchandise export (19.0%). The exports of cereals Rice and maize were the major cereals exported accounting for 71% and 16%, respectively. The trade volume of basmati rice has increased at an annual growth rate of 27.7%. India has the advantage of niche markets in case of basmati rice, notably in west and middle Asian countries. Unlike basmati rice, the share of other rice commodities like non-parboiled and non-basmati rice varieties have declined from 32% to 7%, and have registered a negative growth in value terms (-0.8%). The export of parboiled rice has increased the export value of maize increased annual average growth rate of 44.6% especially due to productivity increase in states like Andhra Pradesh, Bihar and Karnataka. India's exports of wheat have not registered significant growth.

Bala and Sudhakar (2017) analyzed the trend in exports of agricultural commodities from India. The changes in the comparative advantage. However, there was a change in the composition of export characterized by an increase in the share of meat (and meat products), cereals, spices, sugar, oilseeds, cotton and guar gum and a decline in the share of the fish (and fish products), vegetables, fruits and some traditional export commodities like tea and coffee. In the total export of US$ 30 billion in 2012-13, the major items of export were cotton (17.3%), cereals (16.4%), fish and marine products (7.6%) and meat (6.9%). Notwithstanding the decline in share of some commodities, all the commodity groups have registered significant positive growth rates. The high level of instability points to the vulnerability part of the demand. This is quite noticeable in case of sugar, in which case the export has expanded at the rate of close to 25%year, but with a high instability of 45%. This is mainly owing to the policy shifts in case of sugar, which includes restriction on its export at the time when domestic prices rise.

Tewari *et al.,* (2017) find out the Growth and Instability in Wheat Production: A Region Wise Analysis of Uttar Pradesh the growth and instability in terms of area, production and productivity of wheat. The growth was examined by compound annual

growth rate. The study relates to 1990-91 to 2013-14 which is further divided into five sub-periods area, production and productivity of wheat in all the four regions show increasing growth rate at 1 per cent level of significance during the period 1990-91 to 2013-14. During this period, the compound annual growth in production is 2.3 per cent and in productivity is 1.4 per cent of wheat in Uttar Pradesh. The positive growth in area, production, productivity of wheat can be seen in subperiods I, II and IV. During the sub-period III (2000-01 to 2004-05), the production and productivity of wheat shows negative growth rate *i.e.* -1.6 per cent and -2.2 per cent, respectively. While area under wheat shows positive (0.5 %) growth rate in eastern Uttar Pradesh.

Anjum and Madhulika (2018) studied the pattern of growth and instability in Indian Agriculture with regard to area, production and productivity of principal crops between the periods of 1990-1991 to 2016-2017. Rice, Wheat, Maize, were the crops used in the study. The study period was divided into three periods, Period I from 1990-1991 to 1999-2000, Period II from 2000-2001 to 2009-2010 and Period III from 2010-2011 to 2016- 2017. The annual growth rate of the area under rice was 0.0062 percent during the first sub-period. -0.0071 in the second period and then increased to 0.0043 per annum in the third sub-period. The growth rate of area under wheat has shown continuous decline throughout the entire period. For maize, there was increase in the growth rate in the second sub-period but it fell down in the third sub-period. 0.0093, 0.0250, 0.0200 respectively. Wheat have shown the highest growth of production per annum. From period II onwards. The annual growth rate of production of rice and wheat has declined in the second sub-period and then increased in the third period. For maize, the growth rate first increased and then declined.

Kumar and Singh (2018) observed the growth and trends in area, production, productivity and trade of sugarcane producing in India. The results of trade revealed that the export and import of sugar gained at the rate of 3.04 per cent and 18.84 per cent respectively. Policy intervention is required to encourage the production of sugarcane crop in India. Further, the crop productivity needs to be improved through high yielding varieties of seeds, improved cultivation technologies and better soil and water management. The area under sugarcane is increasing day by day but its productivity is almost stagnant. So, there is needed to make efforts for improvement in productivity.

Singh *et al.,* (2018) estimated the growth rate of wheat crop Varanasi division of eastern Uttar Pradesh, India. The researcher viewed the coefficient of variation is

16.93 in Varanasi division. Linear and compound growth rates were 2.47 and 2.48 per-cent per annum, respectively. The production of wheat exhibited a positive trend. Productivity showed a coefficient of variation 15.69 per-cent. Linear and Compound growth rate were 1.72 and 1.63 per-cent, respectively. Growth Rate of production of Varanasi division was 1.63 per cent and can further go up by intervention of Technology and improved Irrigation System. The study showed that Varanasi has production and productivity more suffered badly in drought year.

Geetha and Srivastava (2019) conducted a study on export of Maize from India: Performance and Determinants. The growth of export quantity and export value in pre WTO has found to be not significant, while unit value had negative growth. In post WTO period, the export quantity, value and unit value grew significantly at the rate of 38.74, 42.12 and 2.43 per cent per annum, respectively. The growth rate of 40.92 and 41.91 percent per annum have been noticed in export quantity and value during the overall period, respectively has not significant growth.

Kamboj (2019) analysed Economic analysis of production and export of basmati rice in Haryana.The production of basmati rice in Haryana. The study reported that the area and production of basmati rice declined with CAGR of -1.09 per cent and -0.59 per cent. The productivity of basmati rice increased positively and significantly at the rate of 0.50 per cent.

Nemade *et al.,* (2019) studied the India's rice export: An economic analysis and this study was based on the secondary data, collected for the period of 25 years from 1992-93 to 2016-17. The percentage share of agricultural export with respect to national export and the per cent share of rice export with respect to agricultural export. The results are indicated that, the growth rate for export quantity during period I study of period I revealed that, there was a positive but insignificant growth in export quantity of rice in India with 14.91 per cent. Whereas during period II and overall period positive and highly significant growth was observed in the quantity of rice exported from India with the growth rates of 8.58 and 9.49 per cent respectively. Period II showed highly significant and positive growth at 19.77 per cent. The growth for overall period of study for export value of rice was observed to be positive and highly significant with 16.01 per cent. During the study of overall period, maximum growth rate in Export value of Rice was observed in Yemen republic with 37.68 per cent followed by Iran, UAE, Kuwait and Saudi Arabia with 34.30, 20.34, 15.29 and 11.25, respectively.

Swamy *et al.,* (2019) observed Growth Rate Analysis of Maize area, Production and Productivity: Special reference to Karnataka. The study focused on trends in area, production and productivity of maize crop in north eastern Karnataka districts. The result showed that the area, production and productivity of maize in NEK region was increased at a growth rate of 8.59 per cent, 6.77 per cent and 10.13 per cent, respectively during 1998-2014.

Dey *et al.,* (2020) examined the Rice and wheat production in India: An overtime study on growth and instability, growth wheat area, production and productivity these two eminent crops over a period of 1950-51 to 2015-16 there has been not much increase in the area under rice cultivation in India. The growth trend shows that the area under rice grew at a compound growth rate of 0.52 per cent. The study of the sub-periods shows that there has been positive growth rate in all the sub-periods except in the sixth sub period which shows negative growth rate *i.e.* -0.64 per cent. 1950-51 to 2015- 16 at a significant growth rate of 1.69 per cent. The production under rice grew at a compound growth rate of 2.5 per cent the wheat production has recorded a significant growth rate of 4.11 per cent which is comparatively more than rice.

Shailza *et al.,* (2021) studied Structural Changes in Basmati Rice Exports from India: A Markov Chain Analysis. The timeseries data was obtained for the post-liberalization era for 30 years from 1990-91 to 2019-20. The CAGR of basmati rice export was analyzed for the last three decades. During Decade I, *i.e.* 1990-91 to 1999-2000, basmati rice recorded a positive and significant growth rate of 12.65 percent per annum in quantity terms and 12.02 percent per annum in value terms. The higher quality demand, comfortable production level of basmati and trade liberalization measures led further increase in the export of basmati rice from the country During Decade II, the exported quantity of basmati rice experienced significant growth at 10.96 percent per annum due to increased competition whereas the export value reported 21.06 percent per annum significant growth rate due to better prices fetched by Indian Basmati rice in the international market. Decade III, although it remained the principal exporting commodity and reported an increase in export in absolute terms the CAGR observed of exported basmati rice reduced both in quantity as well in value terms.

Thus, the above said reviews concluded that, growth in area, production, productivity and export of selected cereal crops *viz*., maize, wheat and rice were

estimated at region national level Yield of maize has shown positive and significant trend in entire study periods but maximum yield growth. The production of maize was significantly increased; the production growth of wheat was much faster than area growth in India. The production of wheat was significantly increased. Area, production and yield of rice in India was increased Oladele and Kenamara (2015, Limbore and Khilare (2015), Sendhil *et al.* (2012), Anjum and Madulika (2018), Day (2020) observed that the wheat area was increased significant growth in area production also increased. Sahni (2014); Pangayar *et al.*, (2015); Limbore and Khilare (2015); Ayalew and Sekar (2016); Adhikari (2016), Devi and Kalabarani (2016); Anjum and Madhulika (2018); Nemade *et al.*, (2019), Dey *et al.,* (2020); Shailza *et al.*, (2021).

The summary of above review can be stated that, the growth trend shows that the area under rice grew wheat production has recorded a significant growth rate, national export and the per cent share of rice export was increased.

2.2 Instability in area, production, productivity and export of cereal crops in India

Mamatha (1995) analysed the instability with respect to area, production, productivity and export of selected spices from India over the period 1970-71 to 1991-92. The area, production and productivity of pepper exhibited low variation over the study period. However, the total value and unit value realized from exports exhibited high variation at 64.42 per cent and 38.89 per cent respectively. The area, production and productivity of chillies in India were quite stable over the study period as indicated by low coefficients of variation. But the quantum and total value of chillies exported exhibited a very high variation with coefficients of variation at 77.65 per cent and 123.72 per cent respectively. The area, production and productivity of both turmeric and ginger were found be quite stable. Whereas, the export of ginger was found to be unstable with high coefficients of variation.

Wakraja (1999) examined the instability in export earnings for a sample of six countries between 1961 and 1971. The least instability index was recorded for Kenya, where the instability index of the total agricultural export earnings was 24.10 per cent. However, in terms of export value, fruits and vegetables were more stable as export crops with their magnitudes ranging between 12.30 and 26.34 per cent, respectively. The unstable commodity in export earnings both in terms of value and quantity was coffee with an instability index of 55.05 per cent.

Singh *et al.,* (2003) worked out the growth rate and stability of different crops viz, rice, wheat, sorghum, maize and bajra. The data on the area and production were obtained from the year 1974-75 to 1997-98. The highest stability index was observed for wheat followed by rice. Variation due to climate parameter was highest in Bajra and lowest in wheat. The growth rate of productivity index was positive for all crops except Sorghum and highest in wheat.

Singh and Goyal (2005) revealed that, the extent of growth in value terms has been invariably higher than the amount of growth in quantity terms expect in case of Wheat topped the list both in export earnings and quantity exported with 63.10 per cent and 53.08 per cent annual growth rates, respectively. Instability indices for both export earnings and quantity exported, were highest for animal casings (183.75 per cent) and (172.70 per cent) indicating that animal casing was most vulnerable commodity in terms of export earnings and quantity exported. Guar gum recorded least instability (9.73 per cent) in terms of quantity exported while export earning instability was observed least (9.13 per cent) in mango pulp. The instability has been by and large higher of quantity exported than the export earnings with some expectations like guar gum, dried nuts, fresh grapes, buffalo meat, groundnut and other cereals.

Bal Krishan and Chanchal (2014) examined agricultural growth and instability in western Himalayan Region, India. Growth and instability in area, production and yield for major crops was examined at regional level with the help of Cuddy-Della Valle Index. The instability index of area was found low for all the major crops. The instability index of barley was low (14.9%) as compared to millet (27.7%) and mash (32.1%). Potato showed high growth rate (5.8%) with the low instability index value (32.4%). The results concluded that, area under all cereals and pulses except maize was showing negative growth rate with low instability index value. Area under the horticulture crops showing positive growth rate with low instability.

Kumar *et al.* (2014) examined the growth and instability in maize production in the major districts of major maize growing states in the country. The growth and instability in the yield was studied and it was found that, Tamil Nadu (3.49%, 6.70%) and Odisha (1.00%, 0.98%) have noticed high growth in yield with high and low instability, respectively. Andhra Pradesh (9.83%, 19.31%), Karnataka (14.5%, 18.22%) and Chhattisgarh (1.21%, 0.73%) have grasped medium growth in yield with medium instability while Maharashtra (8.99%, 9.71%) and Punjab (1.66%, 2.50%)

have accrued medium growth in yield with low instability. Rajasthan (13.12%, 8.64%) alone has more than 13 per cent area, but had slow growth in the yield with high instability. More disappointing situations appeared from Gujarat (5.91%, 3.43%), Madhya Pradesh (9.84%, 5.49%) and Bihar (7.44%, 7.75%), where the maize has witnessed negative growth in yield with high, medium and low instability.

Sahni (2014) analyzed the trends in India's exports. Using the time series data for the period 1980-81 to 2010-11. studied tea, coffee, rice, tobacco and spices. The C.G.R. of India's exports of agriculture and allied products is found to be only 1.9 percent during the pre -reform period but it is found to be higher *i.e.* 9.7 percent during the post-reform period. The C.G.R of India's exports of rice is found to be negative during pre -reform period. The fall in export volume, in face of the buoyant market conditions is due to decline in domestic availability following the drought conditions and because of ban placed on exports of non-basmati rice to augment domestic supply. But during the post-reform period exports of rice has shown a remarkable growth as C.G.R is found to be 10.08 percent. Bulk of these exports found their ways to the gulf region and the USA.

Sendhil *et al.,* (2014) studied the performance of wheat production in India. The study was primarily based on the secondary data. Few states like Punjab, Bihar, Haryana, Chhattisgarh, Rajasthan and Uttar Pradesh were the most consistent states in wheat production during the 2001-02 to 2011-12. Instability in wheat production, growth instability matrix for area, production and productivity of wheat across sates. Instability (Coefficient of variation) Maharashtra (4.59) [23.48], Gujarat (10.66) and Jharkhand [38.22] Madhya Pradesh (4.47) [21.39], Maharashtra, Karnataka, Gujarat (13.74) and Jharkhand [44.64] Karnataka (5.34) [22.65].

Sihmar (2014) presented his findings on the growth and instability in agricultural production in Haryana. The instability has been low and also declined over the time in wheat and rice and there is clear evidence of crop diversification towards rice, wheat, cotton and other crops. Instability is declining in a few crops such as wheat, Paddy, Sugarcane not in India but it is in Punjab, five more states, namely, Haryana, J and K, Kerala, Bihar and Rajasthan recorded a statistically significant declining trend. The instability in wheat, rice and sugarcane has been low. The trend of instability is still high in pluses and coarse cereals because area under these crops is shifted towards rice and wheat and increased the instability in the production of these crops.

Singh *et al.,* (2014) studied Instability in Rice Production in Gujarat: A Decomposition Analysis. The growth rates of rice area, production and productivity during (1982-83 to 2011-12) were 0.41, 1.25 and 0.83 percent per annum. Productivity of rice crop was worked out using exponential function. The growth estimate 30 years data shows that negligible increase there was slight change in area under rice cultivation in Gujarat state. During the period 1982-83 to 2011-12, there was slight increase in area by 0.41 per cent per annum. Production and productivity of rice shown positive growth. Growth in area was ranges between 0.01 to1.88 percent PA. The production growth was ranges between 0.91 to 2.76 %PA. Productivity growth was positive in the selected districts as well as in the state.

Oladele and Kenamara (2015) studied trends in production and export of wheat in India. This study was considered as a secondary research for which time series yearly data were obtained for a period of 40 years (1970-71 to 2011-12) instability in wheat production at national level for the selected period. The values of instability highest instability was observed in the production of wheat in the overall period (9.3%) and pre-WTO (7.09%) which was slightly affected by very high instability in the yield during the same periods. In terms of area under cultivation of wheat in overall period and the pre-WTO periods, the instability indices were 4.60 per cent and 4.68 per cent, respectively. However, the instability in the post-WTO period in terms of area (3.23%), production (6.43%) and yield (4.02%) were the lowest as compared with other periods under study. the instability index in the export of wheat (161.56%) was very high, which signified that India could not meet up in the world wheat market despite her volume of production of wheat.

Adhikari *et al.,* (2016) viewed Export of Rice from India: Performance and Determinants Markov chain analysis The study is based on the time series data on export quantity, value and unit value which were compiled from various sources for a period of 33 years (1980 to2013) The Instability Index was computed using Cuddy-Della Valle Index, The instability index of basmati rice and total rice exports in terms of quantity, value and unit value is iinstability of 46.23 per cent, 53.23 per cent and 50.68 per cent during period I, period II and overall period. The export value recorded instability of 41.22 per cent, 43.53 per cent, and 37.40 per cent during period I, period II and overall period, respectively. The quantity exported has been more stability during period I than period II and overall period. However, the export value was found more unstable during period II than period I and overall period, while unit

value realization was more stable during period I as compared to period II and overall period.

Satishkumar *et al., (*2016) studied Growth, Export Performance and Competitiveness of Basmati and Non-Basmati Rice of India-an Markov Chain Approach The instability was measured by estimating the coefficient of variation of production, area and yield of rice. The coefficient of variation is most stable during period III (1975-84, CV is 2.58 %) as compared to others periods. The period I (1955-64, CV is 4.94 %) was observed as most instable due to high growth rate in this period, followed by period VI (2005-14, CV is 3.83 %), period V (1995-04, CV is 3.16 %), period IV (1985-94, CV is 2.88 %) and period II (1965-74, CV is 2.80 %). In case of rice production, it was observed that the most stable growth was in the period VI (2005-14, CV is 6.46 %) and period V (1995-04, CV is 7.43 %) The instability in these sub periods is due to the high growth rates in rice production in these periods. The stability of rice yield is observed during the period V (CV is 5.64 %) followed by period VI (CV is 6.05 %). The high instability was observed in rice production (CV is 39.70 %), followed by rice yield (CV is 32.33 %) and rice area (CV is 9.23 %). The results indicate that there was considerably increase in rice production followed by rice yield and rice area during the study period.

Suresh and mathur (2016) analysed Export of agricultural commodities from India: Performance and prospects. The export performance commodity based on their contribution to the total agricultural export. The data was use time series 2000-2013 analyzed by using major analytical techniques like of instability were measured by using Cuddy Della Valle index (CDVI). The exports of cereals accounted for more than US$ 6.4 billion during 2012-13.Rice and maize were the major cereals exported.

Tewari (2017) observed the Growth and Instability in Wheat Production: A Region Wise Analysis of Uttar Pradesh the growth and instability in terms of area, production and productivity of wheat The results of instability index (Cuddy-Della Valle index) that the instability is low in case of area under wheat as compared to production and productivity in all the regions and the state, as a whole. The instability in production and productivity was found to be high in sub-period III in most of the regions of Uttar Pradesh. The high instability in III sub-period can be supported by the results of growth analysis where negative growth was observed in that sub-period.

Nasim *et al.*, *(*2018) examined growth and instability of sugarcane cultivation in India. The instability index was estimated by constructing Cuddy- Della Valle index for the period from 2000-01 to 2015-16. The instability analysis showed that, area under sugarcane was stable in the states like Uttar Pradesh (3.61), Uttrakhand (7.51) and Gujarat (9.36) while, the yield of sugarcane was stable in Uttar Pradesh, Uttrakhand and Tamil Nadu.

Seidu and Kundu (2018) examined the growth and instability in cotton cultivation in northern India using secondary data from 1966-67 to 2013-14. The study assessed the trends, growth and instability in area, production and yield of cotton in Haryana using semi-log linear function, compounded annual growth rate and Cuddy Della Valle Index. The study revealed that, instability was high and also inclined at an annual rate of 30.96% in area, 25.76% in production and 28.04% productivity in the same order.

Mondal and Chattopadhyay (2019) examined instability of selected fruit crops and crop-groups in West Bengal during 2000-01 to 2014-15. Instability of selected crops was measured by using Cuddy-Della Valle index. The results showed that, the production instability of crop-groups like, all crops combined (6.20), total foodgrains (5.43), total non-foodgrains (6.92), total fruits combined (3.46) and total vegetables combined (4.25) were found to belong to the category of low values in the country. The production instability of total vegetables combined was very low with CDV index value 1.29 but the production instability of total non-foodgrains (11.20) was found to be of medium size in the State.

Nemade *et al.*, (2019) studied India's rice export: An economic analysis was based on the secondary data, collected for the period of 25 years from 1992-93 to 2016-17. to study the variability in the export of rice, coefficient of variation and "Cuddy and Della's instability index" were used as the measures of variability, The overall study showed less instability at 45.84 per cent. The highest CV was observed during the overall period in Iran with 149.81 per cent followed by Yemen Republic, UAE, Kuwait and Saudi Arabia with 94.24, 90.19, 55.67 and 37.19 per cent respectively. Highest instability was observed in Iran with 115.89 per cent and least instability was observed in Saudi Arabia followed by Kuwait with 18.96 and 21.67 per cent respectively. Highest CV and instability was observed in Iran with 188.45 and 144.77 per cent respectively. Least instability was observed in Saudi Arabia followed by Kuwait with 86.21 and 24.95 per cent respectively. Similarly, the CV was very less among all countries in Saudi Arabia and Kuwait with 86.21 and 101.35 per cent respectively.

Senapati and Goyari (2019) examined instability in agricultural productivity in Odisha. The instability in yield was estimated using Cuddy- Della Valley index for two sub-periods. The instability in yield of rice, potato, maize, groundnut and sugarcane was reduced in most districts during the post-green revolution period. The yield of gram had also become more stable in all the districts except Phulbani and Puri.

Dey *et al.,* (2020) conducted the Rice and wheat production in India: An overtime study on growth and instability, instability in rice and wheat area, production and yield in India for the overall period (1950-51 to 2015-16) and sub-periods is presented in During the entire period, highest variation was noticed for production in comparison to area and yield. The variation in rice production was 43.8 per cent, while the variation in area and yield were 11 per cent and 35.3 per cent respectively, while in wheat the variation in production was 65.3 percent and the variation in area and yield were 30 percent and 45.5 percent, respectively. During sub period analysis in rice highest variation was noticed in first sub period, it was 4 per cent variation in area, 14.6 per cent and 11.3 per cent variation in production and yield respectively.

Gade *et al.,* (2020) worked out the instability in production and yield of chilly in India during the period from 1995-96 to 2017-18. Coefficient of variation of chilly production and yield was observed to be 0.26 per cent and 0.30 per cent respectively and that was highly instable. Cuddy -Della Valle Instability index (CDI) for production and yield was observed to be 0.13 per cent and 0.12 per cent respectively. Results revealed that production as well as yield showed higher instability rate.

Saisri and Dhandhalya (2020) studied dynamics of castor instability in major States of India. The Cuddy and Della instability index in area, production and productivity were estimated from year 1976-77 to 2017-18. The results of instability analysis indicated that, medium instability was found in area and productivity whereas high instability was found in production in overall study period in India. Rajasthan showed the highest instability of 56.90 percent in area, 74.21 percent in production during the study period and the highest instability in productivity in 1986-87 to 1995-96. However, the higher production instability was observed in all states during all periods under study.

Singh and Bansal (2020) studied instability in area, production and yield of pulses in Punjab. The instability was examined by estimating Cuddy-Della Valle

Index (CDVI) using time series data from 1985-86 to 2017-2018. The results of instability showed that, highest instability in area was observed in case of mung bean (42.8%) and peas (35.6%) while lowest in case of urad bean, *i.e.*, 17 percent. In case of production, the variation was observed higher in mung bean, followed by chickpeas. The variation in productivity was observed low as compared to that in area and production.

Sood *et al.*, (2020) examined instability of pulses in Rajasthan. The Cuddy Della Valle Index was estimated for the period of 2000-01 to 2017-18. The instability analysis clearly indicated that, chickpea and pigeon pea crops were more stable compared to other pulse crops in the state. The total pulses showed moderate level of instability in area and yield which were 18.33 per cent and 23.55 per cent, respectively, while the instability in the production of total pulses was high with the instability index of 33.65 per cent at the state level.

Salunkhe *et al.*, (2021) estimated instability in area, production and productivity of chickpea in Maharashtra. The instability was computed by using Cuddy Della Vella index for a period of 37 years *i.e.* 1980-81 to 2017-18. The instability analysis showed that, the area, production and productivity of chickpea were unstable for the entire period in all the regions of the Maharashtra state except in Konkan region. The area under chickpea in all the districts, regions and state was more or less unstable and fluctuating. However, the productivity was stable in the district *viz*; Nashik, Pune and Amravati district of the State.

Shailza *et al.*, (2021) observed the Structural Changes in Basmati Rice Exports from India In order to study the variation in the export trade of basmati rice of India, an attempt was made to analyze the instability in the export of basmati rice over the period 1990-91 to 2019-20 The instability during Decade II was observed to be highest (more than 30 percent) for quantity as well as the value of basmati rice export, followed by decade I and decade III, respectively The variability in quantum exported, varying demand, etc., might be the reasons for higher instability during decade II and I. Similarly, variability in quantum exported, devaluation of the Indian rupee, change in export policies, and volatile world prices in the global market might be the reasons for the variable export earnings from basmati rice. In the last decade (2011-2020), the exports of basmati rice have stabilized in exports and export earnings compared to previous decades.

Tambe *et. al.,* (2021) estimated instability in area, production and productivity of soybean by using Cuddy-Della Valle index for the period of 1986-87 to 2017-18. Instability analysis showed that, for overall period area under soybean was highly fluctuating and unstable in all the districts of Maharashtra except Latur district. In case of chickpea production, coefficient of variation was unstable for all the districts of Maharashtra during overall period. The production was mainly depending on area under chickpea crop and productivity. Whereas, the area was fluctuating in all the districts. The productivity was stable in the district *viz*; Nashik, Pune and Amravati district of the State.

The summary of above review can be stated that, there was low level of instability in area, production, yield and export of maize, while wheat and rice, area under wheat crop was found relatively stable Instability in production and yield of wheat was increased, instability in production and productivity of rice at national level was increased Anjum and Madhulika 2018; Mamatha 1995; Wakraja 1999; Singh *et al.,* 2003; Sihmar 2014; Bal Krishan and Chanchal 2014; Kumar *et al.* 2014; sendhil *et al.,* 2014; Oladele and Kenamara 2015 ; Satishkumar *et al.,* 2016; Suresh 2016 Singh and Goyal 2005; Sahni 2014; Adhikari 2016; Tewari 2017; Nasim *et al.,* 2018 Seidu and Kundu (2018) Mondal and Chattopadhyay 2019; Senapati and Goyari 2019; Nemade *et al.,* 2019; Dey *et al.,* 2020; Gade *et al.,* 2020; Saisri and Dhandhalya 2020; Singh and Bansal 2020; Sood *et al.,* 2020; Tambe 2021; Salunkhe *et al.,* 2021; Shailza *et al.,* 2021 .

2.3 Export performance of cereal crops in India

Balassa (1965) The RCA index has been widely used to analyse changes in trading patterns. To begin with calculated RCA index empirically. It had been changed a few times (1977, 1979 and 1986). 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 exportsBalassa utilized 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.

Batra and Khan (2005) studied the Revealed Comparative Advantage: An

analysis for India and China. India enjoyed comparative advantage in case of rice in the world market. "The ban on the exports of non-basmati rice while permitting the export of basmati rice in the recent past might also have contributed to expansion of area under basmati rice

Thanuja (2006) conducted study on export performance and competitiveness of ginger from India. The export growth between pre WTO and post WTO period in terms of quantity and values were found to be declining and negative. The correlation analysis revealed that the selected markets in three states were well integrated and the pair of Bangalore-Trivandrum market was highly integrated.

Bardhan (2007) studied the India's Trade Performance in Livestock and Livestock Products; study was based on time series data pertaining to the period 1980-2004. The data on value of exports/imports for India, the values of export performance ratios (EPR) reveal that India enjoyed comparative advantage in the export of meat and meat preparations and eggs during the period 1980-2004, while the EPR in case of meat and meat preparations has consistently declined since the early eighties (from 2.07 in 1980-82 to 1.5 in 2002-04), that for eggs has shown a remarkable increase since early nineties and reached its peak in T.E 2004. This indicates that eggs export offers India significant comparative advantage in regard to earning valuable foreign exchange. Although the EPR of live animal's export was more than unity till T.E 1988, India lost the comparative advantage in this item thereafter, more so in the post-WTO phase. The EPR's of animal fats and milk and milk products in the T.E 2004 registered a sharp rise than the previous triennium, which indicates that India has the potential to have comparative advantage in world export of these two commodities.

Kumar and Mathura (2007) worked out the Competitiveness and Determinants of Tomato Export from India. The export performance ratio (EPR) has been estimated to examine the export competitiveness of India in tomato and tomato products. The Export Performance Ratio/Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) for export in tomato and tomato products were estimated to compare the export competitiveness of India and had been RCAs in both tomatoes and tomato products were far less than unity and the RSCAs were negative, almost -1.This indicates that India was not competitive in tomato export throughout the study period; however, an increasing trend in RCAs and RSCA was

observed during recent years with a reversal in some years. The RCAs declined during 1994-1997, but the trend reversed afterwards in the case of tomato, but a mixed trend was observed in processed tomatoes.

Kumar *et al.*, (2008) stated that Export performance ratio has been used to estimate the competitiveness export. The export has increased by about 128.5- times with an impressive annual compound growth rate of 37.46 per cent, as against only 4.38 per cent in the world market, India has been exporting cucumber since long, though in small quantities and irregularly. The gherkin exports from India are of recent origin.

Sohinoj and Mathur (2008) in this study has ascertained the changes in comparative advantage status of India's major agricultural exports vis-a-vis other Asian players during the post reforms period (1991-2004). India has been able to maintain its comparative advantage. A brief perusal of the RSCA estimates Indian rice exports showed varying levels of comparative advantage in different years of the study period. In 1991, the estimated value of RSCA was 0.39 which improved to 0.61 in 1995 but dropped to the lowest value of 0.27 in 2001. By the year 2004, it recovered to reach 0.51. However, India's status remained inferior to its major Asian competitors in almost all the years. For Pakistan, the index ranged from 0.74 to 0.76 between 1991 and 2004, while for Thailand, it varied between 0.61 and 0.54 during this period. For Vietnam, it was a little higher at 0.77 during 1991 but dropped to 0.62 by the year 2004. Therefore, it can be concluded that India along with other major players are enjoying a comparative advantage for their rice exports, though at varying levels.

Nwachukwu *et al.,* (2010) The Revealed Comparative Analysis (RCA) and multiple regression were employed as analytical tools using data set from various institutional sources that ranged from 1990 to 2005. To analyzed the international competitiveness and export performance of Nigeria in cocoa trade, the export performance ratio which draws heavily from the Revealed Comparative Advantage theory was estimated. Nigeria has been highly competitive in the export of cocoa over the period under study. The RCA appreciated slightly in 2000 – 2005 owing to the economic reform of the democratic government that injected a new lease of life into the various sectors of the economy.

Singh *et al.,* (2013) studied Direction of Tea Export and Its Destination and Performance. The data on export of tea and its products were collected for the period 1980 to 2004The study estimated the comparative advantage in tea trade with the help

of Export Performance Ratio (EPR)The export competitiveness of tea was ascertained using the Export Performance Ratio (EPR) .During the early 1990s, the EPR recorded an increasing trend. However, during the late 1990s the EPR fell sharply, revealing erosion of comparative advantage of Indian tea. The trend was reversed through corrective measures in the form promotional efforts of the government, which needs to be sustained on a long term basis.

Samuel *et at.,* (2014) analyzed the production, growth and export competitiveness of raw cotton in India. The Export Performance Ratio (EPR) / Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) for the export of cotton from India were analysed. It can be seen that RCAs are below unity till 2002 and in 2004. The ratio has been increasing from 2005 onwards. The comparative advantage in cotton exports showed a significant increase from 0.17 in 2000 to 9.58 in 2007. The estimated RSCA indices give a clear indication of comparative advantage of India in cotton and the indices reveal that India's comparative advantage in cotton exports is increasing over the years. The value of RSCA was-0.70 in 2000 and fell to -0.77 in 2002 but kept increasing in the following years. The RSCA value showed an increasing trend from -0.70 in 2000 to 0.81 in 2007. The positive RSCA from 2005 can be attributed to the increase in the exports due to the increase in cotton productivity with the introduction of Bt technology.

Kumareswaran (2018) studied Dynamics of Tea Export in India, to measures the comparative advantage of the commodity of tea exports, Export Performance Ratio (EPR), Export performance ratio is the method to analyzed the performance of tea over the years. In this study, export performance was computed for a period of 30 years from 1986- 2015. Export performance and continuously decreasing in the overall period of study. The EPR value of tea was continuously decreasing with minor fluctuation are from 21.25 (in 1986) to 3.84 (in 2015). This ratio was continuously decreasing at increasing rate over the years and reached to minimum of 3.84 during 2015 which revealed that EPR value was decreasing more than seven times. Performance ratio reached the maximum 25.21 in the year of 1988 and 1989. The EPR of tea during the early 1990s recorded an increasing trend. 1990s the EPR fell sharply, revealing erosion of comparative advantage of Indian tea. Showing increasing trend.

Kumareswaran *et al.,* (2019) studied the production and export performance of coffee in India. To measures the comparative advantage of the commodity of coffee exports, Export Performance Ratio (EPR), as suggested by Balassa (1965) was used.

The result showing that coffee had a stable and positive fluctuation trend in the export performance ratio.

Agrawal (2021) studied the "A trend analysis on rice exports from India. Indian prices are very economic which makes massive export of rice possible. The rice commodity is larger export cereal of India. During 2008 to 2014-15 one can see rice export increased due to bumper crop of good quality and domestic production. And from 2016 to 2018 a down fall of export of rice was observed from India due to tight supplies and growing domestic demand. India's competitive advantage in rice export.

Atla *et al.,* (2021) conducted study on the export competitiveness of Indian paddy in international market by using Export Performance Ratio (EPR) the paddy had a comparative advantage 1973-74, 1977-78, 1978-79, 1997-98, 2001-02 and 2011-12, in this period the 0.62 means less than unity for paddy export which indicates that the domestic prices received by the farmers in the country were lower than the international prices. The values of Export Performance Ratio for overall study period have been found more than unity except some years such as 1970-71 to 1973-74 and 1975-76 to 1977- 78, in this period the EPR values were less than unity. On an average the Export Performance Ratio (EPR) was 11.74 means greater than unity for paddy export which indicates that the paddy has comparative advantage in export. The EPR is greater than one in almost all the years. This indicates that paddy enjoys competitive advantage in the international market.

Export Performance Ratio was used to measure the comparative advantage of Indian cereal crop.The Export Performance Ratio as suggested by Balassa (1965). The above reviews concluded that India enjoyed comparative advantage in case of rice in the world market (Batra and Khan, 2005); India has been able to maintain its comparative advantage (Sohinoj and Mathur, 2008) also the rice commodity is larger export cereal of India found in (Agrawal, 2021); research paddy has comparative advantage in export. (Atla *et al.,* 2021).

2.4 Export competitiveness of cereal crops in India

Gulati *et al.,* (1994) concluded that the commodities like rice, banana, grapes, sapota, leeches, onion, tomato and mushroom were highly competitive with NPC less than 0.75, while wheat, mango, potato and tomato paste were moderately competitive with NPC ranging between 0.75 to 1.00.

Mamatha (1995) calculated the Nominal Protection Coefficient's (NPC) for Indian coffee by taking United States coffee price as the reference price. The NPC of coffee types namely plantation, Arabica and Robusta under the exportable hypothesis were 1.3, 1.3, and 1.85 respectively in1995, indicating that Indian coffee exports were not competitive and it was not efficient exportable commodity.

Desai (2001) examined the export potentialities of mango from India by using nominal protection coefficients for the period 1990-1998, which is the ratio of domestic price to the border price. The findings of the study indicated that on an average, the nominal protection coefficients value in fresh mango (0.89), and mango slices (0.45) were lower than one indicating their competitiveness in international market.

Jayesh (2001) used the nominal protection coefficient technique for the export competitiveness of Indian pepper. Under the exportable hypothesis, the nominal protection coefficient values were found to be lesser than unity (0.849) in Calicut and (0.817) in Sirsi markets, indicating that the Indian pepper is competitive in the international market and which is an efficient export-oriented commodity.

Sadavatti (2007) examined the global competitiveness of basmati rice using Nominal Protection Coefficient (NPC). The major export destination of basmati rice during the study period was Saudi Arabia, Kuwait, United States and the UAE. The study reported that when NPC of basmati rice was 0.82, higher export rate was recorded. During the study period, it was noted that the export of basmati rice to the United States expanded to a greater rate.

Yeledhalli and Kulkarni (2009) studied the direction of trade and export competitiveness of onion. Values of nominal protection coefficient. They revealed that Malaysia has shown the increasing trend while UAE has shown a declining trend. UAE and Sri Lanka have been very loyal markets for Indian onion market. The NPC for onion was 0.947 during 2000-2001 under exportable hypothesis while under the importable hypothesis it was 0.311. This implied that domestic prices of onion received by farmers were below the international prices in India. The DRC ratio worked out to be less than unity (0.23) indicating high export competitiveness of onion. The policy implications in the form of subsidies, simplified export licensing procedures may be directed in view of potential exports for onion from India.

Yogesh (2010) studied the 'Artificial market prices and subsidies implication for Indian agriculture'. Found that rice was fairly competitive in international market

under exportable hypothesis for the period of 1993- 94 to 1997-98 and then it became non-competitive upto 2002-2003. He also stated that, as India signed the WTO, it reduces its support in form of subsidies to small and marginal farmers and the market prices in India increased sharply. As a result, Indian price of rice rose sharply and become noncompetitive in market due to artificially lower world prices of U.S. in the rest of the years.

Mhaske and yeledhalli (2011) stated that The South Asian Association for Regional Cooperation is constituted by Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Markov chain analysis was used to analyze the direction of trade. Maldives is stable market for rice with high retention probability of 41.54 per cent among the SAARC countries for reference period. Bangladesh is most stable market for all four commodities such as rice, wheat, mango and onion as reflected by retention probabilities of 22.86, 45.40, 39.29 and 24.00 per cent, respectively among the SAARC member countries. It was observed that India was in a competitive position in rice, mango and onion with the NPCs values of 0.98, 0.975 and 0.893, respectively for the period of 2008-09.

Thumar *et al.,* (2012) analysed the export competitiveness of selected seed spices grown in India by estimating nominal protection coefficient (NPC) for the year 2007-08 under exportable hypothesis. Their finding showed that export of coriander was found moderately competitive to Canada (0.57) and less competitive to South Africa (1.00). The export of cumin was moderately competitive to Japan (0.57), less competitive to Netherland (0.93) and non competitive to Bangladesh (1.46). The export of fennel found non competitive indicating that fennel exported from India was not profitable. The export competitiveness for the fenugreek indicated that the NPC values were between 0.75 and 1.00 thereby concluding less profitable export of fenugreek.

Singh *et al.,* (2013) studied Direction of Tea Export and Its Destination and Performance. The comparative advantage was also studied using the net protection Coefficient (NPC) which is given as the ratio of domestic price tea. The NPC less than 1 means the country is competitive in that commodity The Nominal Protection Coefficient (NPCs) for Indian tea has been less than one for all reference years indicating that the Indian tea is price efficient. In mid 1990s NPCs showed an increasing trend revealing the erosion of export competitiveness. However, of late the

NPC has started declining, revealing the gain in competitiveness. This turnaround in export performance could partly be attributed to improvement in exports to UAE, the UK and Iraq, and to some extent to CIS. Another important factor in improvement in export performance has been increase in exports to newer markets such as Pakistan, Australia, etc. Such a trend showed diversification of our export market portfolio leading to improvement in our global competitiveness in the long run.

Akmal *et al.*, (2014) examined the competitiveness of Basmati rice exports from Pakistan. The study inferred that UAE is the major importer of Pakistani Basmati rice followed by Iran, Saudi Arabia, Oman and UK. an analysis on structure of export and competitiveness of Pakistan's basmati rice over the period 1987-88 to 2011-12 by using revealed comparative advantage (RCA) and regional revealed comparative advantage (RRCA) approaches. Results demonstrate that overall Pakistan's share in world basmati market has declined from 47% in 1987-92 to 32% in 2008-12 periods at global level and also at regional level *i.e.* Iran, Saudi Arabia and United Arab Emirates (UAE) markets. However, Pakistan has increased its market participation in Oman and United Kingdom (UK) from 60 % to 83 % and 14% to 39 % respectively during the period under analysis. Iran, Saudi Arabia, Sultanate of Oman, UAE, and UK have shown a high geographic concentration in basmati exports from Pakistan however registered a decline in export concentration over time.

Goverdan *et al.*, (2014) studied Trend and trade competitiveness of rice export in India conducted for twenty years period (1990-91 to 2009-2010) revealed that the rice has shown moderately competitiveness of rice exports of India. The average NPC of rice during the period 1990-91 to 2009-10 was 0.96 indicating its moderate export competitiveness. The average NPC of rice during the period from 1990-91 to 1994-95 was 1.01 indicating non competitiveness. For the period 1995-96 to 1999-2000 was 0.89 indicating moderate competitiveness. In 2000-01 to 2004- 05, the average NPC was 1.02 indicating non competitiveness where as in 2005-06 to 2009-10 the average NPC was 0.94 it was less than unit indicating its moderate competitiveness. The rice was fairly competitive in international market under exportable hypothesis scenario from 1993- 94 to 1997-98 and after that non competitive till to 2002-2003.

Rani *et. al.,* (2014) conducted Competitiveness of Major Crops in Post-WTO Period in Andhra Pradesh. Rice, maize, cotton and groundnut are the major crops in Andhra pradesh. There are significant changes in the competitiveness and policy

environment and its implications for crop competitiveness in post-WTO regime. Trade competitiveness of rice showed that the state had improved competitiveness in rice production as shown by domestic resource cost (DRC) and nominal protection coefficient (NPC) levels. Maize NPC values shows non-competitiveness. The state is an efficient and competitive producer of cotton and its area increased steeply. Welfare gains in all crops were much larger than the respective welfare losses due to liberalization. The net effect to the economy of the state due to liberalization was substantial in rice and maize.

Reddy *et al.,* (2014) conducted the competitiveness of rice in Andhra Pradesh in pre and post-WTO period. The results showed that, the Nominal Protection Coefficient of input transfer was less than one in both the periods. It was 0.34 in both the periods which implies that the average market prices of these inputs are only 34 per cent of world prices. Nominal Protection Coefficient (NPC) was used to find out competitiveness of rice in Andhra Pradesh.

Sharma and Bugalya (2014) conducted a case study of cotton crop on Competitiveness of Indian agriculture sector. Result shows that India has comparative advantage in production and export of cotton in recent years. This study highlights that USA has 14 percent share in world production; however, its share in world export is 38 percent. USA exports 86 percent of cotton production to other countries. The cost of producing cotton is highest in USA, which is 4.5 to 6 times higher than India. During 1995-2010, USA has given about $37 billion to cotton producers though various programmes like counter-cyclical payments, decoupled income, commodity certificates etc. Despite high cost of cotton production, USA is enjoying artificial comparative advantage in cotton market due to high level of domestic support given to farmers and big corporation in USA.

Sharif *et al.*, (2015) measured the competitiveness of cereals and their products export from Pakistan for a five years period (2008-13) using RCA index attempt to measure the competitiveness of cereals and their products exports from Pakistan in global market. The main purpose was to assess the trade performance of cereal products export in the form of comparative advantage and to understand the factors limiting possibility of further exploiting that advantage. It was revealed that the RCA index for rice and corn (37.63 and 99.4 respectively in 2012) remained reasonably high while for wheat and mille, it generally remained below the break

even point during the period under study. For the overall cereals case RCA remained higher than the break even point showing that Pakistan enjoys an RCA for cereals in general. Urgent efforts are required to further improve the RCA in rice through brand name marketing, improved quality control, and economic dialogue aimed at increasing market access for Pakistan's Basmati rice in markets of Europe and North America. There is a need to revisit not only export strategy but also production of Basmati for international marketing to maintain and increase RCA in Basmati rice. Measures are proposed for standardized, normalized and scientific administration track in production and marketing of Basmati rice of Pakistan.

Devi and Kalabarani (2016) worked out the Direction of Trade and Export Competitiveness of chillies in India The global competitiveness of chilli was evaluated using nominal protection co-efficient (NPC) which is a measure of actual divergence or distortion between any given commodity's domestic price and international (border) price. The estimated NPCs have indicated that the Indian chilli was price competitive during the study period 2006-07 to 2010-11. A comparison of competitiveness of Indian chilli against Chinese red chilli has revealed that Indian red chilli is globally price competitive for three years in the study period of five years, 2006-07 to 2010-11. The NPC value less than one indicates global competitiveness of the commodity under consideration; the NPC value less than 0.5 denotes high competitiveness and from 0.5 to 1.0 shows moderate competitiveness. Under the exportable hypothesis, the estimated NPCs varied from 0.46 to 0.69 during the period 2006 07 to 2010-11 indicating that Indian red chilli was globally price competitive.

Makama *et al.,* (2016) in their study on the export competitiveness of Indian rice reported that the average Nominal Protection Coefficient (NPC) was 0.48. This indicates that the domestic price received by the farmers was lower as compared to the international price and therefore has a high rate of comparative advantage worldwide. The study concludes that India needs to increase its specialization in production and export to increase its foreign exchange rate. The average value of NPC for the years 2010, 2011, 2012 and 2013 were less than unity (0.47) which indicates that the domestic prices received by the farmers in the country were below the international prices. This shows or rather proved that the domestic producers of Rice in the country were net taxed. It also indicates that Rice has a high degree of comparative advantage in the international markets.

Audichy *et al.,* (2017) estimated export competitiveness of different importing countries for groundnut using Nominal Protection Coefficient (NPC) for the period 2009-10 to 2013-14. The competitiveness of different importing countries for groundnut was estimated by computation of Nominal Protection Coefficient (NPC) values for different importing countries for the period 2009-10 to 2013-14. For the purpose of calculating NPC, the export of groundnut was found to be moderately competitive to Indonesia, Malaysia, Philippines, UAE, Thailand, Ukraine, Singapore, UK and China while Pakistan was the only country to which export of groundnut was found to be less competitive during the year 2009-10

Deepika (2017) studied Export Performance and Factors Affecting Competitiveness of Plantation Commodities in India India is losing export competitiveness in plantation commodities to low cost producers in Asia, Africa and Latin America and also to European countries who export value added products which is posing a threat to plantation sector in India. While the post-liberalisation scenario is seen more favourable for trade in value added food products, India is also facing risks in terms of meeting the required certifications and international food safety standards. The proliferation of regional and free trade agreements has led to changes in the direction of trade in plantation commodity exports causing additional challenges. In this context, the study examines the changing scenario of plantation exports of India, India's current position in major markets, prices realised for India's plantation products in the world market and factors influencing the competitiveness of plantation commodities for select major plantation commodities of India.

Phougat (2017) attempt to examine the competitiveness of Indian agricultural under WTO regime. Export competitiveness of wheat and rice have studied for a period of 20 years *i.e.* from 1995- 96 to 2014-15. Export competitiveness of rice has been studied for two states Punjab and Andhra Pradesh. Rice being the most traded commodity from export competitiveness from 1995-96, we observe that the difference between world reference price and domestic price for the rice was more than Rs. 300 per quintal which led NPC to 0.69 indicating that rice in the particular year was exportable commodity as the international market had been offering better price than the domestic price. 1995-96, NPC value was 0.68 indicating that world reference prices, were higher than domestic prices. The world reference price of the wheat was Rs. 266 higher than the domestic price. But the coming three years from 1997-98 onwards had an unfavorable NPC. It was 1.47 in 1997-98, 1.63 in 1998-99, 1.81 in

1999-2000. NPC was at 1.32. Such sharp increase and decrease in the international as well as domestic prices brings in swings of exports and imports.

Shridevi and Kulkarni (2017) attempted to assess export competitiveness and direction of trade of Indian cotton analyses the India's exports have been rising sharply in the past few years. Export was highest in 2007-08 accounting 80 lakh bales. It declined in 2008-09 to 50 lakh bales due to recession led lower demand. In 2009-10, the export was 65 lakh bales within short period. Several factors have contributed to the variability in exports; these included large domestic consumption, fluctuations in production due to vagaries of weather, competition from other cotton growing countries and insufficient exportable surplus of cotton production during certain years and the absence of a steady export policy. Primarily, the export of cotton depends on domestic production and government's intervention in its export trade Exports of cotton have significantly increased over the years.

Srikala *et al.,* (2017) the analysis of export competitiveness revealed that the Indian rice has moderate degree of competitiveness as Nominal Protection Coefficients during all the years studied ranged between 0.5 to 1.0. The competitiveness of Indian rice was examined using Nominal Protection Coefficient (NPC). If NPC is less than 0.5, it is highly competitive and if it ranged between 0.5 and 1.0, it can be judged as moderately competitive. The commodity is not competitive for export if it exceeds unity. Rice was found to be moderately competitive as NPCs during all the years studied, were in between 0.5 to 1.0. From these results, it can be inferred that the domestic prices (Nizamabad) of rice have been consistently lower than the international prices (Boston, USA), indicating Indian rice trade is advantageous in this regard. This is reinforced by the Nominal Protection Co-efficient which were less than one *i.e.*, 0.61, 0.66 and 0.61 during 2012-13, 2013-14 and 2014-15.

Lamtule *et al.,* (2018) observed that direction and Competitiveness of Cotton Export under WTO Regime, study attempts to examine the direction and competitiveness of cotton export during pre- and post-WTO period. The findings of the study reveal 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.

Madan and Sharma (2018) in this study analyses trade competitiveness of wheat export of India for the time period 1991 to 2016 using Nominal Protection Coefficient (NPC), temporal behaviour of NPC and Constant Market Share Analysis. The results revealed 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 & during 2011-12 to 2015-2016, but not competitive during 2001-02 to 2010-11. Constant Market Share Analysis suggests that export growth of wheat is attributed only to world trade effect or growth in the size of world trade and market distribution effect or concentration of Indian wheat exports in the market, which are relatively growing. 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.

Nemade *et al.*, (2019) computed India's rice export: An economic analysis, was based on the secondary data, collected for the period of 25 years from 1992-93 to 2016-17. In this studied Export competitiveness of rice in India for assessing the market competitiveness of Rice, Nominal Protection Coefficient (N.P.C.) rice export was observed during the year 2010-11 at 28.20 per cent with the NPC of 0.72 followed by the year. Indian Rice experienced the lowest export advantage at 75.89 per cent with the NPC 0.24 during the year 2009-10 as the domestic price of Rice was very low as compared to the than the international price.

Chakraborty and Garg (2020) conducted their study in the competitiveness of Agricultural Export from India. The result showed that from 2003- 2010, agricultural sector was highly competitive in nature and contributed greatly for its growth. But From 2011- 2018, this sector lost its market share as it became less competitive in nature. This can be improved if we focus on producing globally competitive agro commodities.

Kolhe (2021) observed her research export performance of maize from India, the NPC value of maize export was worked out to be 0.86, which clearly shows that in international market maize experience moderately export competitiveness and the

commodity is protected in international market. During period I (1999-2000 to 2018-2019) and period II (2009- 10 to 2018- 19) crop observed NPC value of 0.84 and 0.86, respectively, which shows that crop was protected and indicates that moderate competitiveness of maize crop in the entire study period

Above reviews reveals that export Competitiveness indicates to what extent a commodity of a country enjoys or does not enjoy competitive advantage in the international market. It is indicated by Nominal Protection Coefficient (NPC) which is the ratio of domestic price of cereal crops and international price of cereal crops. The related studies from research of researcher found that the rice are highly competitive.

Gulati *et al.,* 1994; Sadavatti 2007; rice was fairly competitive in international market Yogesh (2010); rice has shown moderately competitiveness (0.96) of rice exports of India Goverdan *et al.,* (2014). Akmal *et al.,* 2014; Srikala *et al.,* (2017). Export competitiveness of wheat are non competitive in nature (Phougat 2017). (Madan, 2018) Indian wheat has not been competitive in a regular manner under both exportable and importable hypothesis.

2.5 Direction of trade of cereal crops in India

Gemtessa (1991) analyzed the direction of coffee trade using Markov chain model. The share of Ethiopian coffee exports to USA drastically declined during 1979 to 1989. However, the results showed that West German market would be the potential market for Ethiopian coffee. The market share of Ethiopian coffee to USA, France, USSR and other countries were diverted to West Germany's market. It was also projected that the market share of Ethiopian coffee export to West Germany would increase to 32 per cent by 2000 mainly because of West Germany's preference for Ethiopian mild.

Lakshiminarayana (1993) made an attempt to study the direction of trade of Indian silk exports by employing first order Markov process. The major importing countries considered for the analysis were USA, West Germany, UK, France, Italy and Japan. He found that exports to USA were very stable and would remain highly prefer to Indian silk. In addition the results indicated that the export of silk from India to UK, West Germany and Japan would switch over to USA over a period of time.

Nagaraja (1997) analysed the direction of trade of the Indian horticultural commodities exports by employing a first order Markov process which helped in identifying the gains and losses in export value. It revealed that the other fresh fruit,

vegetables and processed fruits and vegetable export retained their share of 56.7 per cent and obtained 68.5 per cent and 24 per cent of onion and garlic respectively. Whereas grapes, onion and mango juice sustained their original share of 59.8 per cent, 19.4 per cent and 49 per cent, respectively.

Ajjan *et al.,* (1998) analysed the direction of Trade of Senna and Periwinkle in India using Markov chain analysis. The probability of Germany and USA to retain their import shares in the years (Senna) to come are estimated to be 0.8258 and 0.8188 which clearly indicated that these two countries would retain their import share in the same position in 1997 also. For periwinkle, France had a high retention of the export share (probability of 0.8826) while Germany and others had as low as 0.2644 and 0.0543 respectively which clearly indicated that the chances of maintaining the import share of France is 88.26 per cent and in other two cases the chances of maintaining the import share is practically low or nil for the year 1996.

Mandanna *et al.,* (1998) analyzed the structural change in India's tobacco exports for the period from 1980-81 to 1994-95 using Markov chain analysis. The study revealed that the USSR, the largest market for un-manufactured Indian tobacco showed a high degree of preference. The markets of Western Europe, Asia, and the Middle East had taken the place of the USSR. However, in case of manufactured product, only cigarettes had a dominant presence in the export basket. The diversification of export markets was clearly evident, necessitating efforts in the direction of brand building for Indian tobacco.

Murthy and Subramanyam (1999) measured the dynamics of changes in the exports of onion from India to different countries with the help of a Markov chain model. From one step transitional probabilities the model is extended to n-step for future forecasting. The results have shown Malaysia, UAE and Singapore were having high probability of retention and will continue to be the major importers in future also. As revealed in the low values of probability of retention, Saudi Arabia and others were unstable importers of Indian onion. In the next decade, Sri Lanka and Bangladesh are likely to increase their imports from India though it may come at the cost of United Arab Emirates.

Sreenivasamurthy and Subramaniyam (1999) analyzed the direction of Indian onion trade by using Markov chain model during the years 1980-81 to 1994-1995. The major gainer among importers of Indian onion was Malaysia which was having a transition probability value 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 gain of 0.3488. On the other hand, Saudi Arabia which was having zero probability of retention of its own share of exports of onion from India was likely to gain to some extent from Bangladesh and 'other countries'.

Ananthi (2000) analyzed the direction of trade of Basmati and non-basmati rice in India using Markov chain analysis the study period was 1987 – 88 to 1998 – 99. The results indicated that in the countries such as Saudi Arabia, UAE and UK shows the probability of getting more share of import at the cost of countries such as Bahrain Kuwait and USA. In the case of non-basmati rice all the major countries which import Indian rice will lose their share and the probability of the minor countries importing at present may be dominant over the other countries.

Balappa Shivaraya (2000) studied the changes in trade directions of exports of selected vegetable using Markov chain analysis. The results of the study revealed that UAE and Malaysia were the loyal markets for 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.

Mahesh *et al.,* (2000) observed 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.

Siju (2001) studied the direction of trade of cashew kernels from India using Markov chain analysis for the export data from 1985-86 to 1999-2000, and found that USA was the most stable market with a high probability of 0.5639 in retaining cashew kernel export from India. Next to USA, Netherlands had a probability of 0.1289 in sustaining cashew kernel export.

Hugar (2002) studied the changes in the share of exports of onion from India to different countries. Markov model with first order finite Markov chain property was used to analyze the export shares by countries and forecast the export of onion, which follows stochastic process. Using one step transition probability, shares of major importers of onion from India were compared with observed export shares. One step and five step transition probabilities were also found to predict the export shares of countries for one year and five years after the base year. His results indicated that

Malaysia and UAE were stable markets of onion export from India.

Ashalatha (2004) analysed the probability retention using Markov chain analysis in cashew during 1995-96 to 2002-03. It was observed that the USA and Netherlands are stable importers of Indian Cashew kernel with high probability of retention while Australia is moderately stable importer. UK, Japan, UAE and Singapore were the unstable importers. And USA and Netherlands will continue to be the major importers of Indian cashew kernel in future also although other importers like UK, Japan, UAE, Singapore and Australia are likely to increase their share at the cost of USA and 'Other countries'.

Mahadevaiah *et al.,* (2005) conducted stability analysis of raw cotton export markets of India – Markov Chain Approach. Transitional probability matrix for the pre-reforms period (1981-82 to 1990- 91) and post-reforms period (1991-92 to 1998-99) It is evident that China has been the only stable importer of Indian cotton, as reflected by the high probability of retention that increased from 0.0832 during the pre-reforms period to 0.3155 during the post-reforms period. This implied that the share of import by China increased from 8.32 per cent during the pre-reforms period to 31.55 per cent during the post-reforms period. Japan and Korea have depicted low probability retention of 0.0979 and 0.2026, respectively, during the pre-reforms period which reduced to almost zero during the post- liberalization period The first period was China, Japan, Indonesia and other minor importers as a group. China, in addition to its higher probability of retention is likely to gain from the switch over from the UK and Bangladesh with a high probability of 0.9279 and 0.8864, respectively. Japan has zero probability of retention of its own share of imports of Indian cotton but is likely to gain 65 per cent from Korea, 25 per cent from other countries and 9 per cent from China.

Reddy (2008) studied the changing direction of Indian soymeal export during the period of 2000 to 2007. The Markov chain analysis was used to estimate the transitional probability matrix in order to find out probability of retention. The major importing countries considered for the analysis were Indonesia, Korea, Thailand, China, Japan and Vietnam. It was found that Indonesia is a stable market followed by Vietnam with the probability of retention 0.7449 and 0.2946 respectively.

Angles *et al.,* (2011) studied the direction of trade by Markov chain analysis in turmeric in south India from 1979 – 1980 to 1998 – 1999. The results show the major

turmeric importing countries were UAE, USA, UK, Iran and Japan. The transitional probability over the study period shows the stability of the countries, its losses to other countries and its gain from other countries. It is evident that the UK had the highest retention of its share over the study period with 42.99%.

Nethrayini *et. al.,* (2012) Export Performance of Rice in India Annual export data for the period 1998-99 to 2009-10 were used to analyze the direction of trade and changing pattern of exports of basmati and non-basmati rice. The trade directions of commodities exports were analyzed using the first order Markov chain approach. The major basmati rice importing countries namely Saudi Arabia, Kuwait, UK, UAE, USA was considered while rest of the world considered as 'other' countries. Similarly for non-basmati rice Saudi Arabia, Bangladesh, Nigeria, South Africa, UAE were considered while rest of the world considered as 'other' countries.

Rajur and Patil (2013) analyzed the dynamics of change in the export trade of Indian chilli through the estimation of Markov transitional matrix during the period from 1998-99 to 2003-04. Their results showed that Sri Lanka found highly loyal market for export of Indian chilli with probability of retention of 25.10 per cent followed by USA (19.40 %) and others (34.70%). Bangladesh, Malaysia, Uganda and Indonesia were unable to retain their previous market share. At last, they concluded that the export of Indian chilli does not have any strong preference in any of the export market, except Sri Lanka.

Kusuma and Basavaraja (2014) studied the Stability analysis of mango export markets of India: Markov Chain approach India is native to mango and is also the largest producer of mangoes with 44.14 per cent of the total world production. The export of fresh mangoes has increased from ` 35.2 crores in 1991-92 to`162 crores in 2010-11 the markov chain analysis was attempted through linear programming method to assess the transition probabilities for the major mango markets. The major Indian mango export markets were categorized as stable market (Bangladesh, U.K, U.A.E) and unstable markets (Nepal, Saudi Arabia) based on the magnitude of transition probabilities. The major export markets for Indian mangoes are Bangladesh (46.22 %), U.A.E (33.26 %), Nepal (6.06 %), Saudi Arabia (3.63 %) and UK (3.06 %). The increasing share of other countries clearly shows the need to explore and exploit the market potential of other countries.

Leelavathi *et al.,* (2015) studied trade competitiveness of cotton crop of Andhra Pradesh. Changes in direction of cotton trade showed by transitional

probability matrix. ‘Others’ had high retention to the extent of 0.731 percent and fairly small transfer probability of 0.149 to Japan, 0.049 to Italy, 0.042 to China and 0.031 to Belgium. They had gained all of China and Belgium’s share, 0.379 of Japan’s share and 0.213 of Bangladesh’s share. Italy also had a fair degree of retention of 52.9 percent. However, its share to the tune of 19.2 percent was lost to Japan, 20.1 percent to ‘others and 7.8 percent to Belgium. Bangladesh had probability retention of 0.501. It gained from Japan’s market share (47.2 percent), but there was a tendency to lose its market share of 28 percent to China, 21.3 percent to ‘others’ and 0.7 percent to Belgium. China, Japan and Belgium were not stable markets for Indian cotton exports. Though China had lost all it share to ‘others’, it gained from Bangladesh 28 percent Japan 14.9 percent and ‘others’ 4.2 percent share. Belgium had lost all its share to ‘others’ but there was a tendency to from the markets of Italy, Bangladesh and others.

Adhikari (2016) computed the Export of Rice from India: Performance and Determinants Markov chain analysis, were applied to estimate trend, the study has observed that rice contributed substantially to the national income. It was projected that during 2013-14, the major markets for Indian basmati rice would be Iran (30.64 %), Saudi Arabia (25.68 %) and others (21.75 %). The projected exports to Saudi Arabia have exhibited an increasing trend in both absolute value and percentage to total export. The reason behind increasing projected exports to Saudi Arabia is that it is likely to gain 53.27 per cent market share from UK and 35.70 per cent from ‘others’. Similarly, the projected value of basmati export to Kuwait has shown an increasing trend. The projected market share is likely to increase marginally from 7.54 per cent to 9.30 per cent from 2013-14 to 2017-18. In the case of Iran and Iraq, the projected value has shown a decreasing trend, in both absolute and relative to total export from India. The reason for showing a decreasing trend by Iraq was that it had totally lost its market share to Iran, although it had gained small market shares from Iran and Kuwait

Bhavani Devi *et al.,* (2016) studied the direction of trade of chillies by Markov chain analysis study export performance of chillies. From study it was clear that Malaysia, Bangladesh and Pakistan were the most unstable importers of chillies as they could not retain their original shares. Sri Lanka, USA, and UAE could be termed as stable importers and potential destinations for the Indian chillies in future.

The actual share of Bangladesh in chilli export had fluctuations over the study period on the whole, it decreased from 21.03 to 20.10 per cent, whereas with respect to prediction share, it increased from 21.26 to 24.83 per cent.

Satishkumar *et al.,* (2016) conducted the study on Growth, Export Performance and Competitiveness of Basmati and Non-Basmati Rice of India-An Markov Chain Approach. The share of basmati rice has increased from 22.61 per cent in 2003-04 to 34.50 per cent in 2013-14. Whereas, the share of non-basmati rice has decreased from 77.39 per cent in 2003-04 to 65.50 per cent in 2013-14 However, the average share of basmati rice is 43.70 per cent and non-basmati rice is 56.30 per cent in total rice export during the study period. The share of non-basmati rice was below 10 % until 1989-90 and it has witnessed a quantum jump and its share in the total rice export increased to 54 per cent after trade liberalization the major basmati rice importers from India, *i.e.* Iran, Saudi Arab, Iraq, Kuwait and UAE were considered for analysis. Iran and Saudi Arab were the stable markets among the major importers of Indian basmati rice as reflected by the probability of retention at 92.77 per cent and 85.21per cent. The UAE, Iraq and Kuwait retained 65.76, 58.78 and 17.64 per cent of total export from India. The remaining countries retained 75.86 per cent of export from India. Bangladesh and Senegal countries retained 51.55, 39.87 and 38.62 per cent of total export from India.

Srikalaa *et al.,* (2017) viewed that the changing pattern of rice exports were estimated by obtaining the transitional probability matrices for the annual export data of rice (in terms of quantity). Six major importers of rice were considered for analysis. The rice trade with the remaining countries was pooled under other countries. The countries pooled under others category retained 76.91 per cent of its original share, which implied that even though they import in lower quantities, there was high stability. They have retained most of their original share. It gained 100, 65.61, 41.44 and 29.64 per cent of Saudi Arabia, Nepal, Bangladesh and Sri Lanka share's, respectively. Bangladesh was one of the stable major importers of Indian rice as reflected in probability of retention at 0.3826 *i.e.*, the probability that Bangladesh retained its import share from one period to another about 38.26 per cent.

Bansal and Singh (2020) analyzed the likely export of maize from India: A Markov Analysis. For the direction of trade (export of maize), first-order Markov Chain Analysis was applied. The major countries for the analysis are Indonesia,

Malaysia, Vietnam, Bangladesh and Nepal and remaining importing countries were grouped as others (Mexico, Japan, Italy, Spain) Nepal remained as the most stable market among the major importers of Indian maize as reflected by the higher probability retention at 0.8498 *i.e.*, the probability that Nepal retain its exports share over the study period was 84.90 percent. Vietnam has retained of 39.14 percent of its original share. Others and Indonesia retained their export share to the tune of 48.05 percent and 43.38 percent, respectively. Thus Nepal, Malaysia is the most reliable and loyal market for Indian maize. While Bangladesh lost 5.0 per cent share to Vietnam, 37.22 per cent to Malaysia and 45.05 per cent to other countries where as it gained 21.40 per cent of Indonesia's share. Other's countries gained 9.9 per cent from Nepal, 45.05 per cent from Bangladesh, 9.27 per cent from Malaysia and 7.38 per cent from Indonesia and they lost 43.84 per cent to Bangladesh and 8.12 per cent to Vietnam. Indonesia lost to the tune of 21.40 per cent to Bangladesh, 15.72 per cent from Malaysia, whereas it gained 60.86 per cent from Vietnam. Maize holds a prominent position in Indian agriculture. The result of Markov Chain analysis revealed that Nepal and Malaysia were the most stable importer of the Indian maize with probability of retention of 84.95 and 53.70 per cent.

Myneni *et al.,* (2020) studied stability analysis of Indian cotton: An Markov chain approach. The gain and losses in market share of Cotton by major importing countries was examined by first order Markov process. A major share of India's previous year cotton export to China market was retained to the tune of 79 per cent during the current period. Remaining 21 per cent *i.e.*, 14 was diverted to Bangladesh, 3 per cent was diverted to Vietnam, 0.6 per cent was diverted to Thailand, 2 per cent was diverted to Indonesia and 2.1 were diverted to Hong Kong. After China major share of India's previous year cotton export to Bangladesh market was retained to the tune of 66 per cent remaining 34 per cent i.e., 2.2 per cent was diverted to Italy, 21 per cent was diverted to Vietnam, 2.7 per cent was diverted to Thailand, and 7.8 per cent was diverted to Indonesia, Also Indonesia has the probability to gain 31 per cent of market share of Hong Kong alone. With regard to Vietnam 43 per cent of the previous period cotton import from India were retained during the current period. The remaining 57 per cent was diverted to Bangladesh with a major share of 29 per cent followed by Indonesia 20 per cent, Thailand 7 per cent, and Italy 0.6 per cent. India's previous cotton export to Hong Kong market retained to the level of 41 per cent during the current period.

Soumya and Yeledhalli (2020) studied the direction of trade and changing pattern of export of cereals from India. The results reveal that for export of cereals from India the most reliable markets are Nepal, Indonesia and Saudi Arabia and least reliable markets are Bangladesh, Iran, Senegal, UAE and Benin. The major importing countries are Nepal, Iran, Bangladesh, Saudi Arabia, Senegal, UAE, Benin. Nepal retained 70.92 per cent of its original share followed by others (69.02%), Indonesia (61.53%) and Saudi Arabia (47.35%). Iran lost 55.26 per cent of its share to Bangladesh. Saudi Arabia lost 40.66 per cent of its share to UAE. Senegal lost 66.13 per cent of its share to Benin. UAE lost 98.50 per cent of its share to others category. Benin lost 40.84 per cent of its share to Senegal and 57.56 per cent of its share to other countries.

Shailza *et al.,* (2021) observed the Structural Changes in Basmati Rice Exports from India: A Markov Chain Analysis. Trade directions of Indian basmati rice export were analyzed with the help of Markov chain analysis by using time series data from 2000-01 to 2019- 20. it was observed that during the period 2000-2006, the highest retention capacity was 78.68 percent which signified that Yemen retained 78.68 percent of its previous year exports in the current year. Saudi Arabia served as the largest importer, but Yemen served as the most stable importer of Indian basmati during the year 2000-2006. Saudi Arabia was next in order retaining 73.97 percent of its previous year's exports in the current year gained mainly from Kuwait (9.69 percent) and United Kingdom (64.15 per cent).

The above reviews reveals that the direction of trade of Cereals crops was examined using first order Markov model (Dent, 1967) Indian cereals crops export to major countries for the period of ten years were utilized for analyzing the transitional probability matrix. With regard to the present application, major importers of Indian cereal crops were contemplated. (Shailza *et al.,* 2021); The rice export from Indian countries such as Saudi Arabia, UAE and UK shows the probability of getting more share of import, (Ananthi, 2000); non-basmati rice Saudi Arabia, Bangladesh, Nigeria, South Africa, UAE were considered while rest of the world considered as 'other' countries. (Nethrayini, 2012). Satishkumar *et al.,* 2016; Adhikari 2016. Bansal and Singh (2020) major maize importing countries are Indonesia, Malaysia, Vietnam, Bangladesh and Nepal. (Soumya and Yeledhalli, 2020) and (Shailza *et al.,* 2021).

CHAPTER III

METHODOLGY

CHAPTER- III

METHODOLOGY

This chapter discusses various methods, techniques and tools that were employed to achieve the objectives of the research work formulated in the beginning. The purpose of any investigation is to find the relevant conclusion in order to draw and conclude meaningful conclusion. It is an important step for the researcher to apply suitable method and procedure for the explanation of methodology adopted to justify the objective of the study. The present examination was entitled the "**Export performance of cereal crops in India**". This chapter deals with the nature and source of data, period of the study and analytical tools and techniques used to draw the inferences. The area under consideration for analyzing various position of, entire India was considered at aggregate level so as to facilitate data compilation and prices on intermediate market. The data regarding Export of cereal crops from India for last 30 (1990-1991 to 2019-2020) years collected. The descriptions in respect of methods & tools which is used in the study are statedbelow.

3.1 Description of the study area

3.2 Nature and Source of data

3.3 Selection of cereal crops

3.4 Study Period

3.5 Statistical tools and Methods

3.1 Description of the study area

The study was conducted at all India level. Growth and Instability in area, production, productivity of cereal crops (maize, wheat and rice) used at national level were considered.

3.2 Nature and Source of data

The present study was based on the secondary data collected from official website of Agricultural Processed Product Export Development Authority (APEDA)

(https://apeda.gov.in/apedawebsite/), government reports, articles, magazines and Internet. The secondary data of cereal crops was collected from different sources

like. Directorate General of Commercial Intelligence and Statistics (DGCIS), Indiastat.com., Food and Agricultural Organization and CACP (commission for Agricultural cost and prices) reports, For Domestic price of cereals crop was collected from various published reports, journals, official's record of government, Ministry of Agricultural and Farmers Welfare and International Trade Centre. The domestic price of rice was collected from West Bengal (Bankura) market, for maize crops domestic price was collected from Andhra Pradesh (Amravati) market and Wheat crops domestic price was collected from Madhya Pradesh. And export data of cereal crops was collected for HS code (Maize-**1005**, Wheat- **1001** and Rice-**1006**) Time series data on cereals export was collected for the period of 30 years from 1990 to 2020.

3.3 Selection of cereal crops

For the study of export performance of cereal crops, among the cereal crops only the major cereal crops were considered for research purpose. Major cereals selected are on the basis of their area, production, and yield and export demand of these crops viz. Maize, Wheat and Rice.

3.4 Study Period

The secondary data for cereal crops was used for 30 years, from the year 1990-91 to 2019-2020. The entire study period was divided into three sub-period and overall for better analysis.

i) **Period I :1990-91 to 1999-00**

ii) **Period II: 2000-01 to 2009-10**

iii) **Period III: 2010-11 to 2019-20**

iv) **Overall: 1990-91 to 2019-20**

3.5 Statistical tools and Methods

The different analytical techniques used for the study were - Growth rate analysis, Instability analysis, Export Performance analysis, Nominal Protection Coefficient (NPC), Markov Chain analysis.

3.5.1 Estimation of Growth Rates

3.5.2 Degree of instability

3.5.3 Analysis of Export Performance

3.5.4 Export Competitiveness

3.5.5 Markov Chain Analysis

3.5.1 Estimation of Growth Rates

The growth rates in area, production, productivity and export of selected crops in India was studied by using compound growth rates.

The growth rate was estimated using following model

$$\mathbf{Y_t = a.b^t}$$

Where

Y_t = Dependent variable for which growth rate is to be estimated

a = Intercept

b = Regression coefficient

Log transformation of the above equation log

$$Y_t = \text{Log } a + t \log (b)$$

Compound Growth rate (%) = {antilog (b)-1}x100

Where,

b =log (b).

The significance of the regression coefficient tested using the student's 't' test.

3.5.2 Degree of instability in area, production, productivity and export of cereal crops

In order to study the instability in the area, production, yield and export of cereal crops, Coefficient of variation and Cuddy Della Valle's instability was used.

Coefficient of variation (CV) = $\frac{\sigma}{\bar{X}} \times 100$

Where,

σ = Standard deviation

$$\sigma = \sqrt{\frac{\Sigma(X - \bar{X})^2}{n}}$$

Where,

$\bar{X}$= Arithmetic mean

X = Variable

n = Number of observations

The simple Coefficient of Variation (C.V) often contains the trend component and thus over estimates the level of instability in time series data characterized by long term trends. To overcome this problem, this study was use the instability index (I.I) given by Cuddy della Valle (1978) which corrects the coefficient of variation, Cuddy Della Valle's instability is estimated as follows.

Cuddy Della Valle's Instability Indices (C.D.I):

C.D.I. was used to measure instability of cereal crops which is close to approximation of the average year to year per cent variation adjusted for trend. The algebraic form of it is;

$$\text{Instability Index} = CV\sqrt{(1 - R^2)}$$

Where,

CV = Simple Estimates of coefficient of variation in per centand

R^2 = Coefficient of determination from a time trend regression (linear) adjusted by the number of degree of freedom.

3.5.3 Analysis of Export Performance

A measure of international trade specialization that identifies the comparative advantage or disadvantage a country has for a commodity with respect to rest of the world is known as the Export Performance Ratio (EPR). In the present study, there for Export Performance Ratio was used to measure the comparative advantage of Indian cereal crops. As the EPR is based on the observed trade flows, it is also called as Revealed Comparative Advantage. The Export Performance Ratio as suggested by Balassa (1965) is expressed as-

$$EPR/RAC = \frac{S_{it}}{S_{wt}}$$

Where,

S_{it} = Share of Cereal crops in India's total agricultural export, and

S_{wt} = Share of Cereal crops in the total world agricultural export

If the EPR/RCA = 1 or EPR/RCA> 1, it implies that India has a comparative advantage in the export of cereal crops and EPR/RCA< 1 implies that India has a comparative disadvantage in cereal crops export. However, RCA suffers from the problem of asymmetry. The index was made symmetry by the methodology followed by Samuel *et al.* (2014) as Revealed Symmetric Comparative Advantage. It is expressed by equation:

$$RSCA = \frac{(RCA - 1)}{(RCA + 1)}$$

It varies from -1 to +1 and a commodity is said to have a comparative advantage in its export if the RSCA value is positive and vice-versa.

3.5.4 Export Competitiveness

Export Competitiveness indicates to what extent a commodity of a country enjoys or does not enjoy competitive advantage in the international market. It is indicated by Nominal Protection Coefficient (NPC) which is the ratio of domestic price of cereal crops and international price of cereal crops. The coefficient shed light on whether a country is competitive in the export of that commodity in the free trade scenario or not. In the present study, Nominal Protection Coefficient was computed to determine the extent of competitive advantage enjoyed by the Indian cereals in the context of free trade by using the formula.

$$NPC = \frac{P_d}{P_r}$$

Here the International price was calculated by dividing export value with export quantity and the international unit price of cereal crops (US$/ tonne) was converted into domestic unit (Rs./qtl).

Where,

Pd= Domestic price of cereal crops (Rs./qtl)

Pr= International price of cereal crops (Rs./qtl)

NPC > 1 or NPC = 1 indicates that the commodity is protected in the international market and

NPC < 1 indicates that the commodity is not protected in the international market.

3.5.5 Markov Chain Analysis (MCA)

The direction of trade of Cereals crops was examined using first order Markov model (Dent, 1967). MCA was worked out for the estimation of transitional probability matrix P. The elements Pij of the matrix P resembles the probability that export will shift from country i to country j with a time interval (Dent, 1967; Lee et al., 1970). The elements of the matrix that are arranged diagonally determine the probability that the export share of a country will be retained. Hence, an examination of the diagonal elements indicates the loyalty of an importing country to a particular country's export (Atkin and Blandford, 1982).

The data of Indian cereal crops export to major countries for the period of ten years were utilized for analyzing the transitional probability matrix. With regard to the present application, major importers of Indian cereal crops were contemplated. The average exports to a particular country were considered to be a random variable which depend only on the past export to that country which can be denoted algebraically as

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

Where,

E_{jt} = Exports from India to j^{th} country during the year t

E_{it-1} = Exports to i^{th} country during the period t-1

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

e_{jt} = The error term which is statistically independent of E_{it-1}

t = Number of years considered for the analysis

r = Number of importing countries

The transitional probabilities P_{ij} which can be arranged in a (c * r) matrix have the following properties

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

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

Thus, the expected export shares of each country during period‘t’ was obtained by multiplying the export to these countries in the previous period (t-1) with transitional probability matrix.

Estimation of the P_{ij}

In the present study, Minimum Absolute Deviations (MAD) estimation procedure was employed to estimate the transitional probability, which minimizes the sum of absolute deviations (Fisher, 1967; Wagner, 1959). The conventional linear programming techniques used, as this satisfies the properties of transitional probabilities of non-negativity restrictions and row sum constraints in estimation.

The linear programming formulation is stated as

Min OP* + I e

Subject to,

XP* + V=Y

GP* = 1

P*e≥0

Where,

0 = vector of zeroes.

P* = vector in which probability P_{ij} are arranged.

I = appropriate dimensioned column vector of units.

E = vector of absolute error (|U|).

Y = vector of export to each country.

X = block diagonal matrix of lagged values of Y

V = vector of errors

G = grouping matrix to add the row elements of P as arranged in P* to unity.

After calculating the transitional probability matrix, the expected shares of export of Indian Cereal crops were calculated by

$$Y_{it} = \sum_{i=1}^{r} y_{it-1} \times P_{ij} \, (j = 1,2,3 \ldots r)$$

Where,

Y_{jt} = Predicted proportions of j^{th} country's share at time 't'.

Y_{t-1}= Observed proportion of i^{th} country share at time't-1'.

P_{ij} = Estimated transitional probability matrix.

CHAPTER IV

RESULTS AND DISCUSSION

CHAPTER-IV

RESULTS AND DISCUSSION

This chapter is devoted to express the results obtained from the present study. The discussion regarding growth rates, instability index, export performance, competitiveness and direction of trade of cereal crops briefly discussed in this chapter, The findings of the present investigation are been undertaken with a view to study "Export performance of cereal crops in India" Keeping in view the objectives of the study, the data collected from various sources were analysed using suitable analytical techniques. The results obtained from this study have been presented and discussed critically in this chapter under four major and other sub heading.

4.1 Growth in area, production, productivity and export of cereal crops

4.2 Instability in area, production, productivity and export of cereal crops

4.3 Export performance of cereal crops

4.4 Export competitiveness of cereal crops

4.5 Direction of trade of cereal crops

4.1. Growth in area, production and productivity of cereal crops

An attempt in this session has been made to examine the changes in compound growth rates (CGR) of area, production, yield and export of selected cereal crops *viz*., maize, wheat and rice were estimated at national level for three sub-periods and overall period i.e. 1990-91 to 2019-20. The Period-I starts from the year 1990-91 to 1999-00, period II starts from the year 2000-01 to 2009-10 and third period III starts from 2010-11 to 2019-20. The compound growth rates (CGR) of maize, wheat and rice are reported in Table 4.1 to 4.3.

4.1.1: Compound growth rates of area, production and productivity of maize in India

The absolute change in area, production, productivity and export of annual compound growth rates in area of maize was 0.95, 2.93, 1.22 and 1.98 per cent per annum during periods I, period II, period III and overall period at national level, respectively indicated in Table 4.1 and Fig. 4.1. It was statistically significant at 1 per cent level of significance. Ayalew *et al.,* (2016) find out growth rate of area,

production and productivity for period (1990-2012) in India have increased at the rate 1.88 per cent, 4.20 per cent and 2.28 per cent per annum.

Table 4.1: Compound growth rates of area, production and productivity of maize in India

Sr. No.	Period	Area (000 ha)		Production (000 tones)		Productivity (Kg/ha)	
		CAGR	t value	CAGR	t value	CAGR	t value
1	Period I	0.95***	6.27	3.29***	4.66	2.32***	3.42
2	Period II	2.93***	10.87	5.29***	4.72	2.29**	2.33
3	Period III	1.22***	3.71	3.74***	6.72	2.48***	5.17
4	Overall	1.98***	26.77	4.64***	27.45	2.61***	18.30

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
*, ** and *** are significant at 10, 5 and 1 per cent level of significance
CAGR = Compound Annual Growth Rate (per cent per annum)

The results revealed that, growth in area of maize was highest during period second but growth in area of maize was slightly decreased during period third. Yield of maize has shown positive and significant trend in entire study periods but maximum yield growth (2.48 per cent) was observed during period third. The production of maize was significantly increased by 5.29 per cent due to complementary effect of area expansion by 2.93 per cent and significant positive growth in yield of maize (2.29 per cent) in period second.

Thus, at overall level, increase in production (4.64 per cent) was due to improvement in yield (2.61 per cent) and area expansion (1.98 per cent). The performance of maize in terms of area, production and yield revealed an expansion in these parameters at national level. Similar result found in CACP report, that the production of maize, which after touching a high of 10.0 million tonnes during 1992-93 had declined to 9.6 million tonnes during 1993-94 and further to 9.1 million tonnes during 1994-95, is expected to recover during 1995-96 and even surpass the level achieved during 1992-93. (Commission for agricultural costs and prices policy for rabi crops of 1998-99). Pangayar *et al.* (2015) reported the growth rate was found to

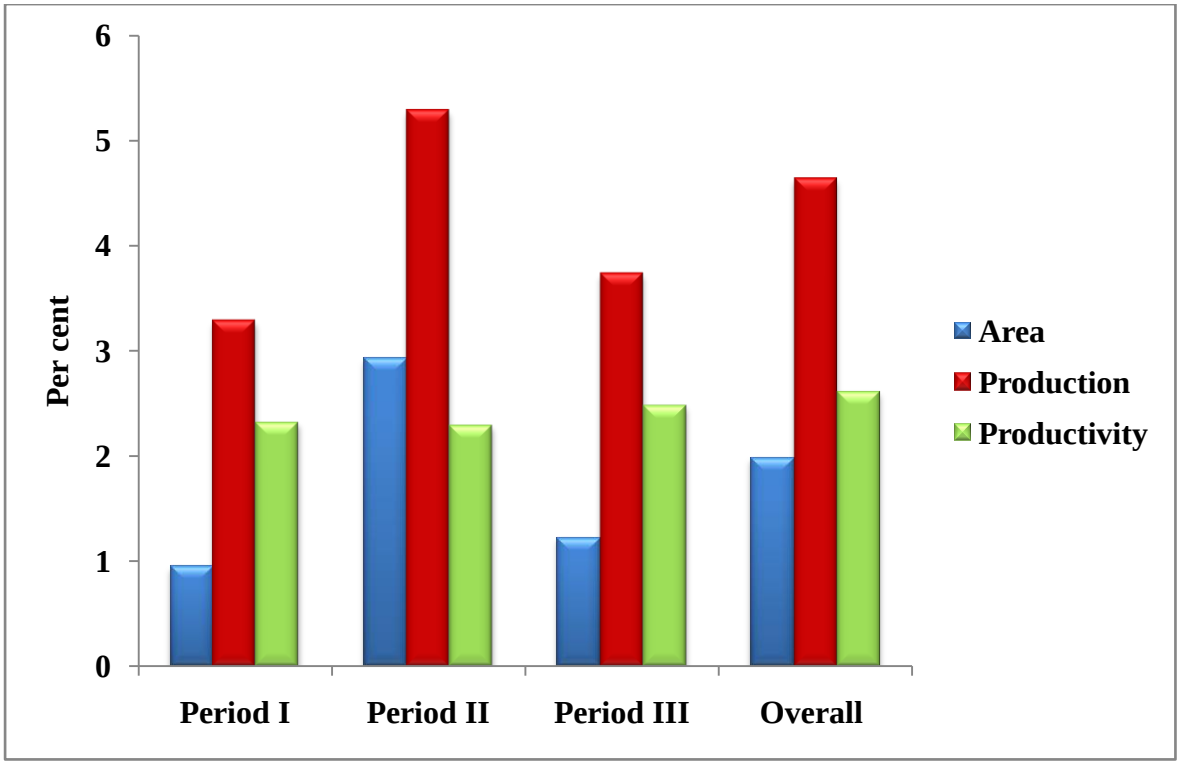

Figure 4.1: Compound growth rates of area, production and productivity of maize

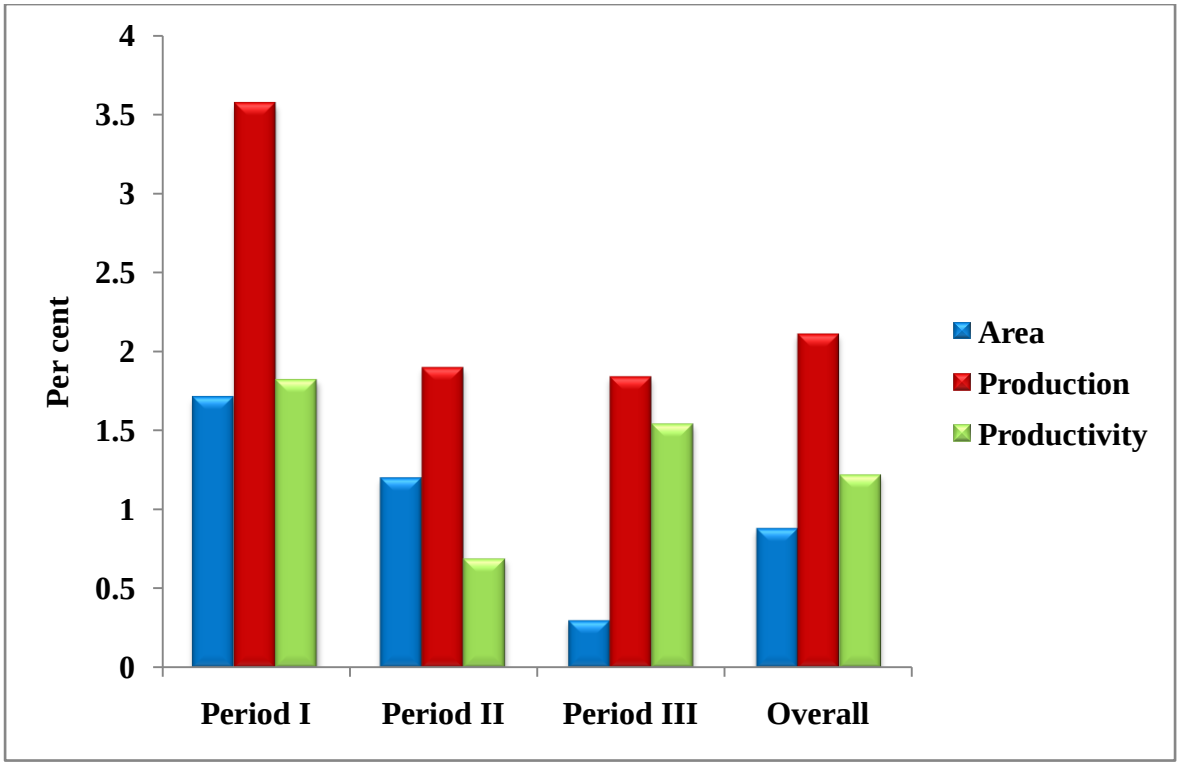

Figure 4.2: Compound growth rate of area, production and productivity of wheat in India

be high in terms of maize production, area and then productivity in India. Anjum and Madulika (2018) found the compound growth rate of maize production was increased and then declined for period (1991-to 2017).

4.1.2 Compound growth rates of area, production and productivity of wheat in India

The trends in area, production and productivity of wheat in the country are presented in Table 4.2 and Fig. 4.2. The results indicated that, wheat area expansion growth by 1.71, 1.20 and 0.30 and 0.88 per cent per annum in period I, period II, period III and overall period. In period third, the area under wheat crop increased at a non-significant rate.

Table 4.2: Compound growth rates of area, production and productivity of wheat in India

Sr. No.	Period	Area (000 ha)		Production (000 tones)		Productivity (kg/ha)	
		CAGR	t value	CAGR	t value	CAGR	t value
1	Period I	1.71***	7.72	3.57***	9.51	1.82***	4.99
2	Period II	1.20***	5.40	1.90***	3.66	0.69*	1.92
3	Period III	0.30NS	1.01	1.84***	3.65	1.54**	2.33
4	Overall	0.88***	12.94	2.11***	17.74	1.22***	12.69

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
*, ** and *** are significant at 10, 5 and 1 per cent level of significance
CAGR= Compound Annual Growth Rate (per cent per annum)

The production growth of wheat was much faster than area growth in India. The production of wheat was significantly increased at the rate of 3.57, 1.90 and 1.84 per cent per annum in periods I, II, III and overall period. As the yield is concerned, it was highly significant in period first (1.82 %). The yield growth of wheat crop was positive and significant in entire study period but it was improved at slower rate in subsequent periods. The positive and significant growth in production (1.84 %) was mainly due to yield improvement (1.54 %) as area (0.30 %) was non-significantly changed during third period. Thus, increased production of wheat crop was mainly due to yield improvement and slightly due to area expansion during overall period.

With limited scope for expansion of area, increase in the growth of production of wheat in future would depend on further improvements in yield per hectare, particularly in the areas where the yields continue to be far below the potential. In this context, recent release of new dwarf wheat varieties with high yield potential, particularly for cultivation in central parts of India. Apart from multiplication and supply of certified seeds of these and other better varieties to the farmers, it would also be important to increase the investment for better utilization of water resources and motivate

The production of wheat, which had been on an upswing during 1990-96 mainly on account of a decline in the average yield due to unfavorable weather conditions at the time of maturity. During the nineties area of wheat increased. The rate of yield growth has recorded a sharp deceleration. Wheat production was increased due to timely/early sowing of wheat, no attack of pests and diseases, more area under hybrid varieties and exceptionally favorable weather conditions i.e. as against a expansion of area, the increase in output of wheat was rather sluggish. During TE 1990-91, it increased by 17.4 million tonnes to 70.5 million tonnes during TE 1999-2000. (CACP report 2000-2001)

Oladele and Kenamara (2015) found same result that in spite of a remarkable growth rate in wheat production in India during their research study period. Limbore and Khilare (2015) in their research reported that production of wheat steadily increased with maximum productivity. Sendhil *et al.* (2012) Anjum and Madulika (2018) reprobated that the growth rate of area under wheat has shown continuous decline throughout the entire period. Dey (2020) observed that the wheat area was increased significant growth in area production also increased. India has shown a tremendous growth in wheat production especially after the Green revolution in 1960s.

4.1.3 Compound growth rates of area, production and productivity of rice in India

The area of rice in India was increased by 0.08 per cent per annum during overall period. In period first, area of rice was increased at 0.67 per cent per annum, whereas the area of rice was non-significantly changed in second (-0.02 %) and third (0.19 %) period Table 4.3 and Fig 4.3

Table 4.3: Compound growth rates of area, production and productivity of rice in India

Sr. No.	Period	Area (000 ha)		Production (000 tones)		Productivity (kg/ha)	
		CAGR	t value	CAGR	t value	CAGR	t value
1	Period I	0.67***	4.56	2.00***	5.68	1.32***	4.49
2	Period II	-0.02NS	-0.05	1.67*	1.85	1.69**	2.91
3	Period III	0.19 NS	1.54	5.93***	3.69	5.73***	3.55
4	Overall	0.08 *	1.64	2.07***	8.22	1.98***	8.30

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
*, ** and *** are significant at 10, 5 and 1 per cent level of significance
CAGR = Compound Annual Growth Rate (per cent per annum)

The production of rice was increased at the rate of 2.07 per cent per annum and it was possible due to yield improvement by 1.98 per cent per annum in overall period. The production of rice was increased by 2.00, 1.67 and 5.93 per cent per annum during period I, II, and III, respectively. It was mainly due to yield improvement in entire study period. The yield of rice increased by 1.32, 1.69, 5.73 and 1.98 per cent per annum during period I, II, III and overall period. Thus, it showed that, yield improvement was main reason for increase in production of rice.

As rice is grown under diverse agro-climatic conditions, the location specificity of the technology assumes more importance for improving the yield. Seed being a crucial input, its multiplication and distribution of seeds of location-specific high-yielding varieties need priority attention. In this connection, the efforts to evolve and release rice hybrids are a welcome development. It has been brought to the notice of the Commission that in Tamil Nadu; a programme of production of seeds of hybrid rice has already been taken up. Such efforts need to be encouraged so that seeds of varieties capable of improving the yield become available to the rice growers at a reasonable price. The Commission, therefore, recommends that efforts to develop

hybrid varieties of rice be stepped up and suitable incentives be given for production/ multiplication and distribution of seeds of these and other improved high yielding varieties of rice. (CACP report 1995-96), Thanh and Sing, (2006) conclude that the increased rice yield on usage of high yielding and quality varieties along with suitable rice production technologies. (Satishkumar *et al.,* 2016) found that the production and productivity of rice was increased positively growth rate during study period (1995-2015) but area was decreased during study period. (Bala and sudhakar, 2017) also reported that production of rice expanded at annual growth rate of 2.0 it was due to the yield in their research period (2003-04 to 2012-13). (Dey, 2020) also reported that the growth trend of area under rice grew. Rice production and productivity of the country increased.

Growth rates in exports of cereal crops

The export growth trends of maize, wheat and rice in terms of its quantity, value and price was estimated and presented for three sub-periods and overall period in Table 4.4 to 4.6.

4.1.4: Compound growth rates of maize exported from India

The compound growth rate of exported quantity, value and price of maize are shown in Table 4.4 and Fig 4.4. The export performance in terms of quantity showed that, there was positive and highly significant growths in the quantity of maize export are 78.57 per cent per annum in period I.

Table 4.4: Compound growth rates of maize exported from India

Sr. No.	Period	Export Quantity		Export Value		Export Unit Price	
		CAGR	t value	CAGR	t value	CAGR	t value
1	Period I	78.57***	2.32	58.59 NS	1.64	12.33**	2.26
2	Period II	67.38***	7.68	54.12***	5.41	8.61 NS	1.63
3	Period III	-22.01***	-4.42	-23.76***	-4.72	2.29 NS	1.66
4	Overall	40.66***	8.22	13.16***	7.33	1.99**	2.23

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
*, ** and *** are significant at 10, 5 and 1 per cent level of significance
CAGR= Compound Annual Growth Rate (per cent per annum)
Export Quantity = (tones**), Export Value= (**1000 US$), **Export Unit Price= (**US$/ tones)

In contrast, the export value of maize showed non-significant change while, the export unit price registered a positive growth of 12.33 per cent per annum in this

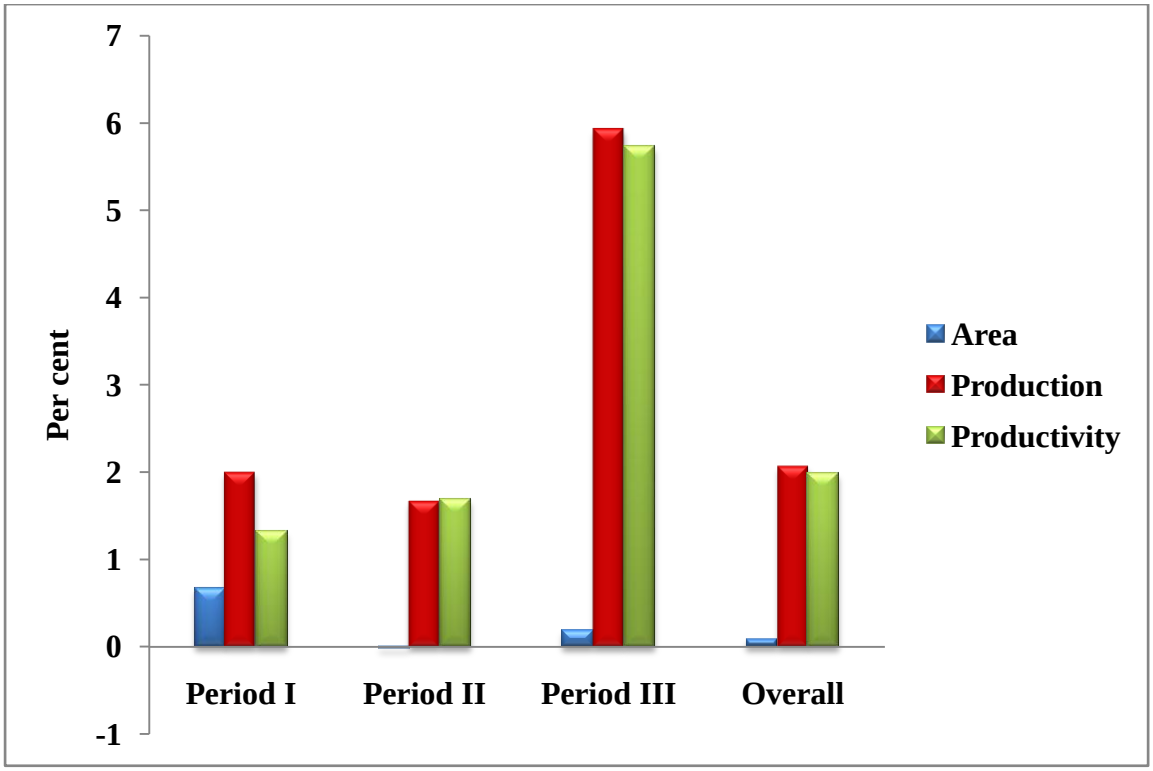

Figure 4.3: Compound growth rate of area, production and productivity of rice in India

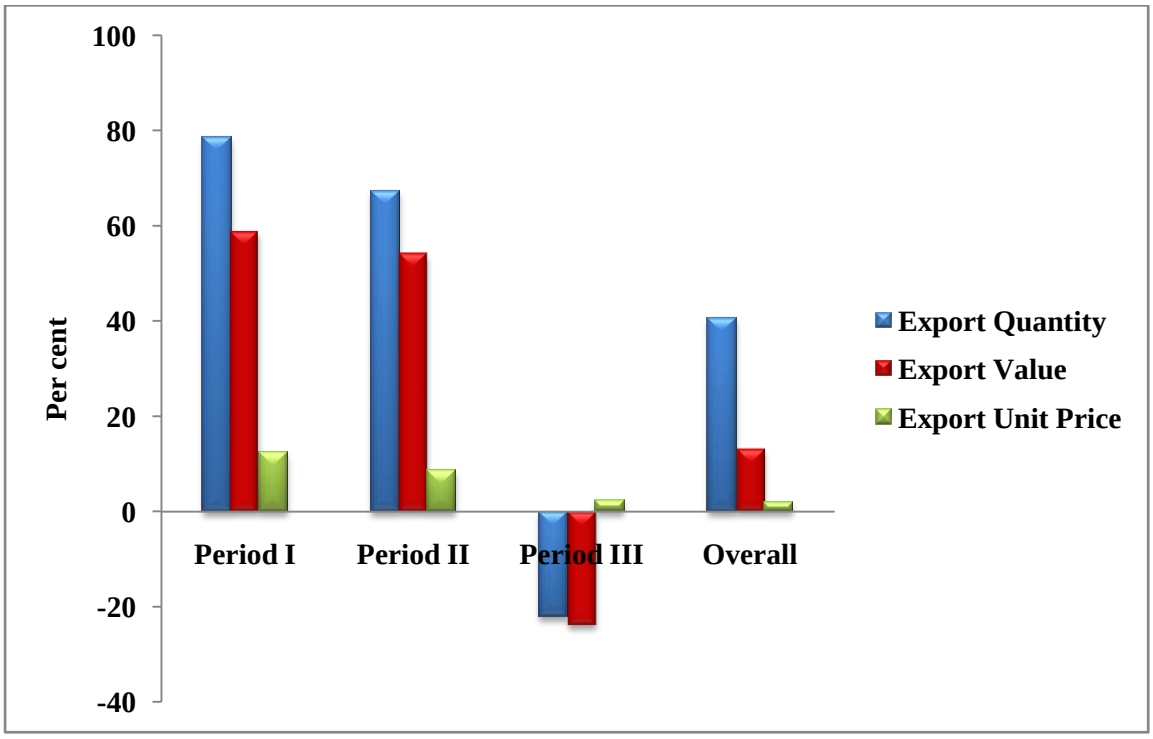

Figure 4.4: Compound growth rate of maize export from India

period. The export of maize in terms of quantity grew by 67.38 per cent per annum during the period II. At the same time, the value of maize exported also increased at a compound growth rate of 54.12 per cent per annum. The export performance of maize (8.61%) in terms of unit price showed positive but non-significant growth in second period.

The quantity and value of maize exported was found to be declined at (-22.01 %) and (-23.76%) per cent per annum in period III. However, export unit price of maize was non-significantly increased in this period. Thus, the maize export in terms of quantity, value and unit price grew at a positive and significant growth rate 40.66 per cent, 13.16 per cent and 1.99 per cent per annum during the overall period. It revealed that, export growth in terms of quantity and value was much higher than unit price in entire period. (Geetha and Srivastava 2019) also revealed the same result the quantity and value found significant growth during post WTO period (1996- 2016) (Bansal and Sing, 2020) examined from the trend line that there is upward trend observed in the export performance during the study period (1992-93 to 2018-19) with positive intercept and increasing slope. The volume of export increased due to increased at production of maize crop in the country. (Suresh and Mathur, 2016) viewed that the export of maize value increased at annual average growth rate of 44.6 per cent especially due to productivity increase during period of study.

4.1.5: Compound growth rates of wheat exported from India

Table 4.5 and Fig. 4.5 show that, the quantity of wheat export and export value declined at a non-significant rate whereas, the export unit price (13.76 %) recorded positive but non-significant growth in period I.

Table 4.5: Compound growth rates of wheat exported from India

Sr. No.	Period	Export Quantity		Export Value		Export Unit Price	
		CAGR	t value	CAGR	t value	CAGR	t value
1	Period I	-46.62 ^{NS}	-1.52	-39.27 ^{NS}	-1.11	13.76 ^{NS}	1.47
2	Period II	-71.10***	-4.83	-67.47***	-4.47	12.54***	8.13
3	Period III	14.87 ^{NS}	0.44	12.29 ^{NS}	0.38	-2.25*	-1.87
4	Overall	6.65***	-4.83	9.32***	-4.47	2.51***	8.13

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
*, ** and *** are significant at 10, 5 and 1 per cent level of significance
CAGR= Compound Annual Growth Rate (per cent per annum)
Export Quantity = (tones**), Export Value= (**1000 US$), **Export Unit Price= (**US$/ tones)

The export of wheat in terms of quantity and export value was declined by (-71.10 %) and (-67.47 %) per cent during period II respectively. The export unit price of wheat grew significantly at the rate of 12.54 per cent per annum in the same period. The quantity as well as export value of wheat showed positive but non-significant growth in period III. However, the export unit price of wheat was declined at (- 2.25 %) in period III. Thus, wheat export recorded a growth of 6.65 per cent in terms of quantity, 9.32 per cent in terms of value and -2.51 per cent in terms of unit price in the overall period.

Rajkumar and Dadhaicha (2013) evaluated the growth performance of Indian's agricultural export. Wheat export from 2000 to 2004 showed the increasing trend 27.50 per cent and decreasing trend from 2005 to 2006 but start incereasing from 2009 till 2010 but again declined.

Parihar (2019) found similar result on export value, quantity of wheat export showed postive compound growth rate (2009 to 2019) during period of the study. (Limbore and Khilare, 2015) revealed that compared to export quantity, value earned was relatively low that bring to conclusion that India must strengthen its export stratagies and increased the export of wheat to effectively utilize its export potential. (Suresh and Mathur, 2016) reported India's export of wheat has not registered significant growth rate.

4.1. 6: Compound growth rates of rice exported from India

The period wise analysis of rice export is reported in Table 4.6 and Fig 4.6 showed that, the export of rice in quantity grew at the rate of 52.51 per cent per annum during period I. It was also accompanied by positive and highly significant growth in export value 48.79 per cent per annum but the export unit price of wheat (-2.44 %) was non-significantly declined in period I. In period II, the export of rice in terms of quantity (-15.92 %) and value (0.42 %) showed non-significant changes but its unit price was significantly grew by 19.42 per cent per annum. The period III witnessed a significant growth in rice export 27.9 per cent in terms of quantity and 25.52 per cent in terms of value. But the unit price of Rice export was declined at the rate of (-1.86 %) in periods III.

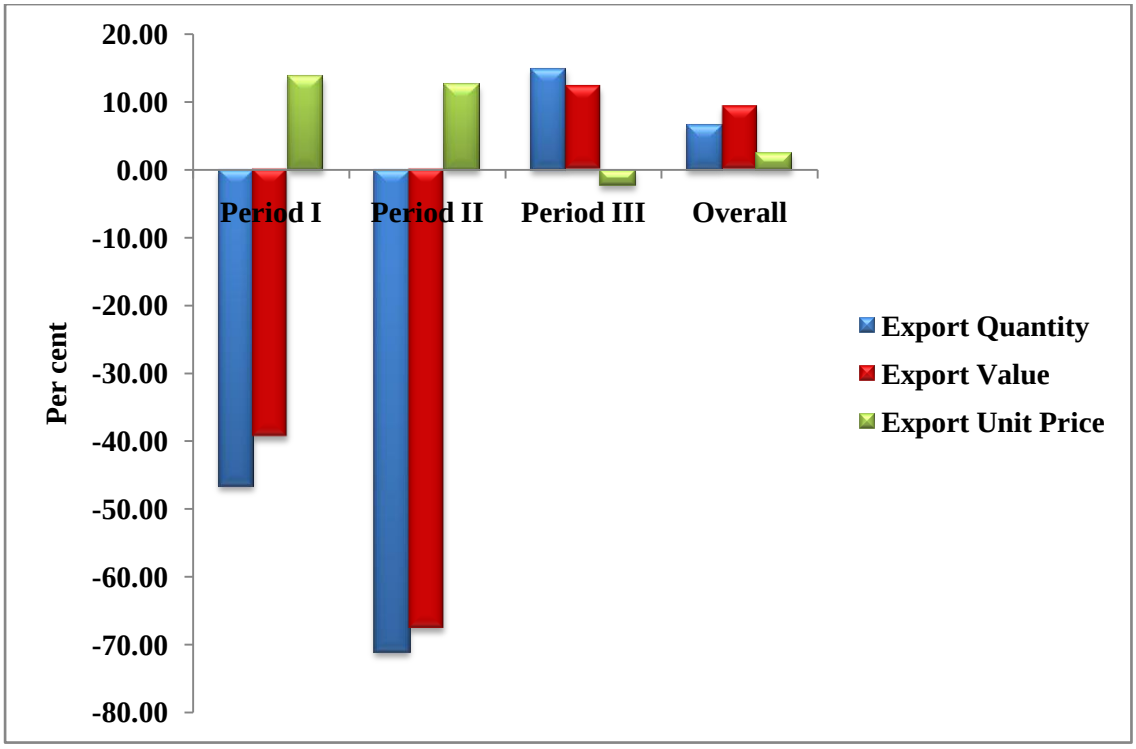

Figure 4.5: Compound growth rate of wheat export from India

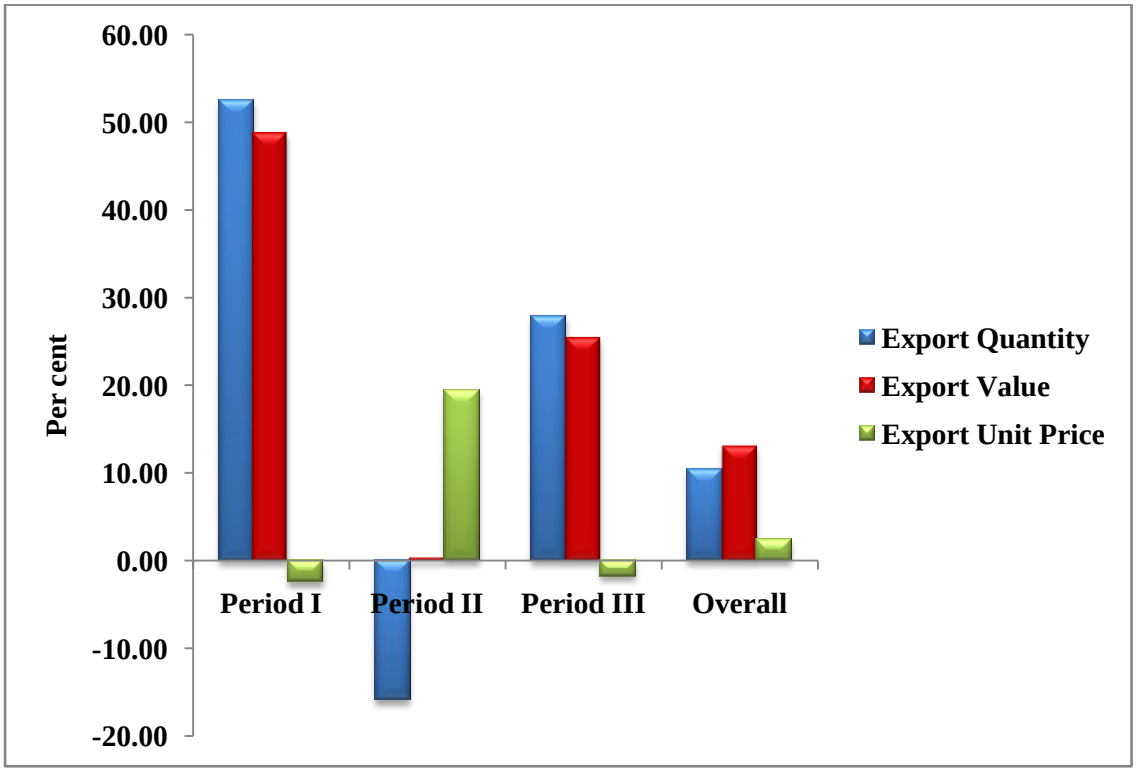

Figure 4.6: Compound growth rate of rice export from India

Table 4.6: Compound growth rates of rice exported from India

Sr. No.	Period	Export Quantity		Export Value		Export Unit Price	
		CAGR	t value	CAGR	t value	CAGR	t value
1	Period I	52.51***	3.61	48.79***	3.69	-2.44 NS	-1.63
2	Period II	-15.92 NS	-1.56	0.42 NS	0.04	19.42***	4.13
3	Period III	27.9*	1.89	25.52*	1.83	-1.86*	-2.23
4	Overall	10.41***	3.69	13.16***	5.29	2.46***	2.85

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
*, ** and *** are significant at 10, 5 and 1 per cent level of significance
CAGR= Compound Annual Growth Rate (per cent per annum)
Export Quantity = (tones**), Export Value= (**1000 US$), **Export Unit Price= (**US$/ tones)

During the overall period, the rice export in terms of quantity, value and unit price displayed positive and highly significant growth of 10.41 per cent, 13.16 per cent and 2.46 per cent per annum, respectively. It was due to a strong demand for basmati rice in the international markets and comfortable production in the country. The increased value of export of basmati rice was also a reason behind this significant growth in rice export as reported by Adhikari *et al.*, (2016). In addition to this, consistent policies for export of basmati rice, higher international price and increased domestic production of rice in the central pool were some of the reasons. (Gangwar and Rai, 1995).

Apart from the effective implementation of the price support policy, it would also be prudent to increase the access of the farm sector to the world market. In this connection, decisions such as abolition of minimum export price, relaxation of stock limits, and suspension of levy on superfine non-basmati rice meant for export, (CACP. 1996-97)

Adhikari *et al.* (2016) reported that the global export of rice increased from 11.70 Mt in 1990 to 38.66 Mt in 2013. Although, China and India together accounts for half of the world rice production, Thailand was a major player till 2011 on rice export front. When the Government of India removed ban on export of non-basmati rice in September, 2011, India emerged as a leading exporter of rice with market share of 25.73 per cent, followed by Vietnam (19.38 %) and Thailand (17.45 %) in 2012.

India's share in world export of rice has increased from 25.73 per cent in 2012 to 27.16 per cent in 2013.

Udhayakumar and Karunakaran (2020) found similar results that export quantity and value of rice showed a significant growth rate of 5.92 and 10.11 per cent per annum. The export unit value showed insignificant compound growth rate of 3.95 per cent per annum. During period I (1995-2010) and period II (2011-2018). (Devi and Kalabarani, 2016) reported that compound growth rate of export of rice increased during study period Shailza *et al.* (2020)

Country wise export performance of cereal crops

The country-wise growth performance of cereal crops export in terms of quantity, value and unit price was reported in terms of top seven export destinations For three sub periods and overall period.

4.1.7 Country-wise compound growth rates of maize exported from India

The country-wise growth performance of maize export is presented in Table 4.7 and Fig. 4.7, 4.8, and 4.9 the major importing countries of maize were selected on the basis of share of the particular country to the total maize exported globally during the period I (1990-91 to 1999-2000). Based on the export quantity to different countries, the trend analysis was carried out for the top importing countries. The top countries are Indonesia, UAE, Sri Lanka, Bangladesh, South Africa, Malaysia and Iran.

The result showed that, the highest growth rate in exported quantity of maize was observed in Sri Lanka with compound growth rate of 76.81 per cent followed by UAE 71.83 per cent which was significant at 1 per cent level of significance in period I. Highest growth in case of export value of maize was observed in UAE 65.31 per cent whereas, lowest export value was found in Iran -14.78 per cent. In case of export unit price, the highest growth was noticed in Sri Lanka and Bangladesh having CGR 92.96 and 75.53 per cent per annum, respectively. While, the lowest growth in export unit price was recorded in Indonesia -20.16 per cent but it was non-significant.

Vietnam and Malaysia reported the highest growth of 280.10 per cent and 212.04 per cent in terms of exported quantity of maize during period II. However, Bangladesh exhibited lower growth of 24.64 per cent. In case of export value, Taiwan recorded highest growth with 299.97 per cent per annum and lowest growth was noticed in Bangladesh 32.59 per cent per annum. The significantly highest growth in

export unit price was realized in Taiwan which was significant at 1 per cent level of significance. It was followed by countries *viz*., Korea 68.56 per cent and Malaysia 62.28 per cent and lowest unit price was found in Indonesia -14.98 per cent per annum in period II of study.

In period III, the exported quantity of maize showed positive and significant growth only in Nepal having CGR 20.76 per cent per annum; whereas, all other countries *viz*., Indonesia -63.68 per cent, Malaysia -60.73 per cent, Taiwan -60.60 per cent and Bangladesh -27.30 per cent revealed significant negative growth in quantity of maize exported from India. On the other hand, the countries such as Nepal 23.05 per cent and Bangladesh 18.26 per cent recorded significant positive growth in maize export value but the remaining countries showed declining growth in export value. The highest export unit price was realized in Indonesia 41.54 per cent which was significant too. In contrary, the lowest unit price was noticed in Malaysia -1.13 per cent per annum which was non-significant growth rate during period III.

Table 4.7: Country-wise Compound growth rates of maize exported from India

Sr. No.	Particulars		Indonesia	UAE	Sri Lanka	Bangladesh	South Africa	Malaysia	Iran	Other	Total
	Period-I										
1	Export Quantity	**CAGR**	14.42^{NS}	71.83***	76.81^{NS}	62.67^{NS}	-4.71^{NS}	2.25^{NS}	-18.98^{NS}	104.98**	58.96^{NS}
		t value	0.35	3.26	1.46	1.56	-0.16	0.04	-0.49	2.69	1.64
2	Export Value	**CAGR**	33.17^{NS}	65.31***	41.63^{NS}	59.72^{NS}	-3.47^{NS}	3.24^{NS}	-14.78^{NS}	113.58**	78.57**
		t value	0.89	3.79	1.06	1.78	-0.16	0.08	-0.48	3.06	2.32
3	Export Unit Price	**CAGR**	-20.16^{NS}	18.61^{NS}	92.96***	75.53***	-2.85^{NS}	-10.85^{NS}	-11.03^{NS}	98.18***	12.33**
		t value	-0.64	0.89	3.94	3.54	-0.16	-0.50	-0.50	4.51	2.26
	Period-II		**Bangladesh**	**Vietnam**	**Malaysia**	**Indonesia**	**Taiwan**	**UAE**	**Korea**	**other**	**Total**
1	Export Quantity	**CAGR**	24.64**	280.10***	212.04***	62.97***	153.45**	92.79***	140.58*	72.24***	54.12***
		t value	2.84	9.26	3.53	3.46	2.74	5.71	2.07	6.33	5.41
2	Export Value	**CAGR**	32.59***	276.65***	242.80***	38.66***	299.97***	95.71***	107.54*	61.93***	68.38***
		t value	3.97	9.19	3.74	3.37	6.93	6.25	2.02	8.12	7.68
3	Export Unit Price	**CAGR**	6.38***	54.88^{NS}	62.28**	-14.98***	99.64***	1.51^{NS}	68.56**	-5.99^{NS}	8.61^{NS}
		t value	5.89	1.75	2.61	-2.62	3.90	0.85	2.35	-1.42	1.63
	Period-III		**Nepal**	**Bangladesh**	**Vietnam**	**Indonesia**	**Malaysia**	**Taiwan**	**Sri Lanka**	**Other**	**Total**
1	Export Quantity	**CAGR**	20.76***	-27.30**	-50.55**	-63.68***	-60.73***	-60.60***	13.28^{NS}	-22.36***	-27.11***
		t value	5.68	-2.88	-2.78	-6.61	-5.60	-5.23	0.26	-5.03	-4.92
2	Export Value	**CAGR**	23.05***	18.26**	-46.89***	-62.75***	-56.06***	-52.07***	-3.15^{NS}	-13.69***	-22.01***
		t value	9.29	-3.05	-3.53	-6.46	-5.60	-4.33	-0.08	-3.46	-4.42
3	Export Unit Price	**CAGR**	1.88^{NS}	12.44*	7.40^{NS}	41.54***	-1.13	1.17^{NS}	6.28^{NS}	7.77***	2.29^{NS}
		t value	1.21	2.18	0.91	4.49	-1.42	0.74	1.19	4.34	1.66

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20 *, ** and *** are significant at 10, 5 and 1 per cent level of significance

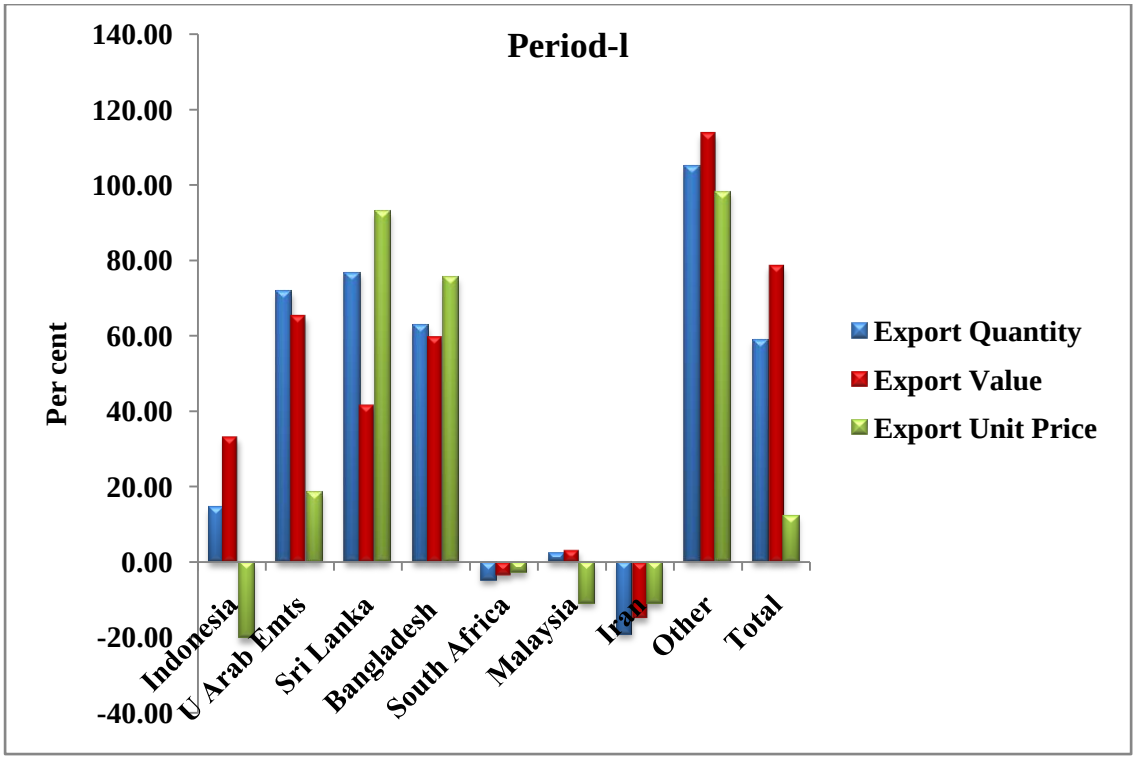

Figure 4.7: Country wise compound growth rate of maize export from India for period-I

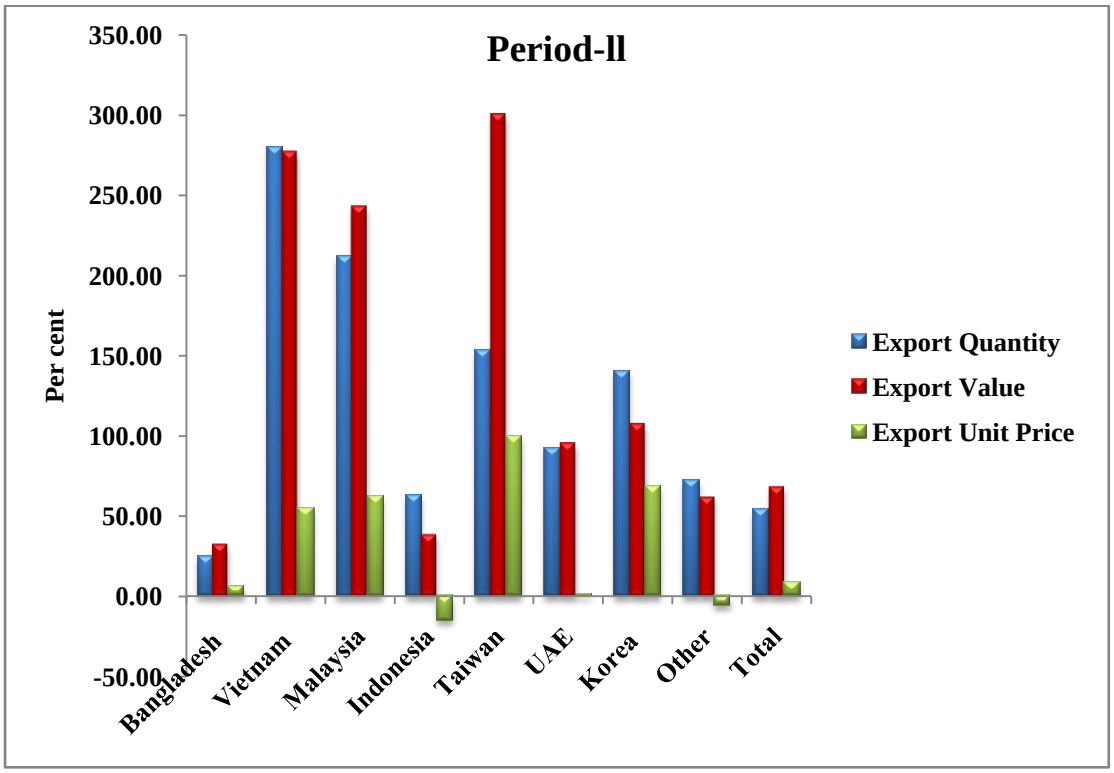

Figure 4.8: Country wise compound growth rate of maize export from India for period-II

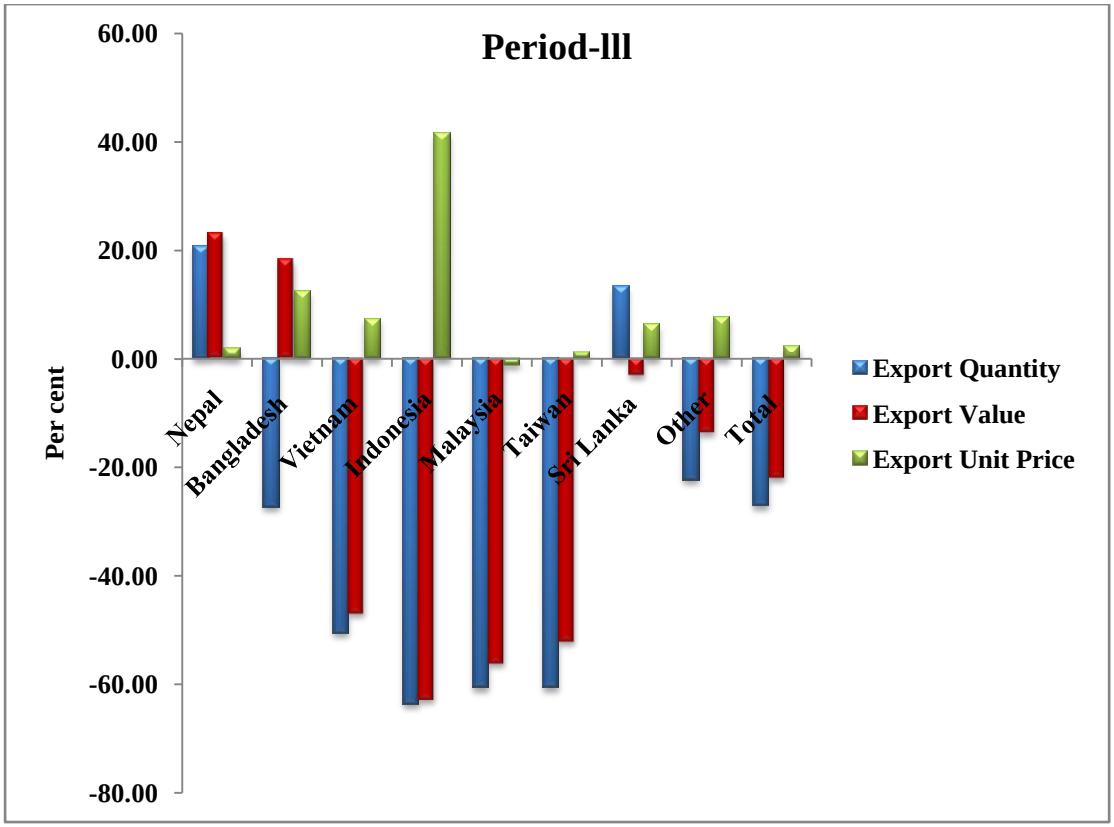

Figure 4.9: Country wise compound growth rate of maize export from India for period III

4.1. 8: Compound growth rates of wheat exported from India

The export performance of wheat in terms of quantity, value and unit price is reported in Table 4.8 and Fig.4.10, 4.11, and 4.12. The wheat export in terms of quantity showed positive but non-significant growth in top seven export destinations except Jordan, where it was negatively non-significant during period I. In a similar manner, there was non-significant growth in export value of wheat. In case of unit price of wheat, UAE was the single country which recorded positive and significant growth (28.13 %); whereas, it was significantly declined in Netherland (-39.47 %). The rest of countries realized non-significant growth in export unit price of wheat in period I.

In period II, the quantity of wheat export registered a positive and significant growth of 96.04 per cent and 91.79 per cent in Philippines and Korea, respectively. Indonesia and Yemen registered positive growth in export value of wheat but it was non significant while remaining countries displayed negative growth trend in export value. The export unit price of wheat registered negative growth in top seven export destinations in period II.

The export of wheat quantity was significantly increased at the rate of 92.96 per cent during third period. In contrast, the countries *viz*., Bangladesh, Indonesia, Djibouti, and Korea showed declined growth in exported quantity of wheat in the same period. The significant growth in export earning was recorded in Nepal 90.84 per cent and lowest growth was noticed in Korea -94.46 per cent per annum it was showed significant at 1 per cent of level of significance. In case of export unit price Bangladesh recorded positive but non-significant growth in the export.

In case of Unit price of wheat was the rest of countries realized negative and non-significant growth in export unit price except Yemen showed the lowest export unit price that is -41.30 per cent but which is significant at 10 percent of level of significance of wheat in period III .

Table 4.8: Country wise compound growth rates of wheat exported from India

Sr. No.	Particulars		UAE	Netherland	Yemen	Jordan	Korea	Bangladesh	Turkey	Other	Total
	Period-I										
1	Export Quantity	**CAGR**	83.06^{NS}	90.53^{NS}	61.20^{NS}	**-39**^{NS}	73.26^{NS}	152.61^{NS}	26.02^{NS}	-54.31^{NS}	-58.1*
		t value	0.83	0.48	0.36	-0.99	0.66	1.81	0.21	-1.80	-1.83
2	Export Value	**CAGR**	-35.00^{NS}	24.14^{NS}	6.87^{NS}	-13.51^{NS}	68.16^{NS}	233.26^{NS}	45.45^{NS}	-51.15^{NS}	-58.83*
		t value	-0.41	0.38	0.13	-0.37	1.37	1.38	0.54	-1.77	-1.94
3	Export Unit Price	**CAGR**	28.13**	-39.47**	-6.43^{NS}	-30.73^{NS}	-31.24^{NS}	-30.73^{NS}	13.30^{NS}	6.83***	7.47***
		t value	2.46	-2.75	-0.26	-1.25	-1.54	-1.25	0.50	3.98	3.86
	Period-II		**Sri Lanka**	**UAE**	**Indonesia**	**Philippines**	**Bangladesh**	**Korea**	**Yemen**	**Other**	**total**
1	Export Quantity	**CAGR**	-11.72^{NS}	-67.01***	55.32^{NS}	96.04*	-58.59**	91.79**	12.87^{NS}	-64.60***	-71.10***
		t value	-0.16	-3.74	0.30	-2.02	-2.31	-2.29	0.47	-5.05	-4.83
2	Export Value	**CAGR**	-67.47**	-62.54***	27.49^{NS}	**-71***	-52.9*	-85.8**	28.76^{NS}	-60.49***	-67.47***
		t value	-2.68	-3.52	0.20	-2.04	-2.04	-2.33	1.01	-4.62	-4.47
3	Export Unit Price	**CAGR**	-14.61^{NS}	-16.67^{NS}	-34.55^{NS}	-44.11**	-29.53^{NS}	-48.17**	-50.84***	11.76***	12.54***
		t value	-0.56	-1.01	-1.61	-3.09	-1.63	-3.15	-4.55	7.36	8.13
	Period-III		**Nepal**	**Bangladesh**	**U A E**	**Indonesia**	**Djibouti**	**Yemen**	**Korea**	**Other**	**Total**
1	Export Quantity	**CAGR**	92.96***	-45.98***	20.32^{NS}	-77.62*	-85.55***	160.82^{NS}	-95.13**	-5.85^{NS}	14.87^{NS}
		t value	4.58	-3.47	0.40	-2.28	-4.38	0.95	-3.07	-0.18	0.44
2	Export Value	**CAGR**	90.84***	-41.87***	12.74^{NS}	-75.16*	-84.38***	159.38^{NS}	-94.46***	-5.20^{NS}	12.29^{NS}
		t value	4.74	-3.60	0.30	-2.22	-5.74	0.93	-3.27	-0.17	0.38
3	Export Unit Price	**CAGR**	-1.1^{NS}	34.32^{NS}	-6.3^{NS}	-4.84^{NS}	-20.75^{NS}	-41.30*	-23.87^{NS}	0.7^{NS}	-2.25*
		t value	-0.89	1.66	-1.16	-0.15	-0.75	-1.93	-0.81	0.38	-1.87*

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
*, ** and *** are significant at 10, 5 and 1 per cent level of significance

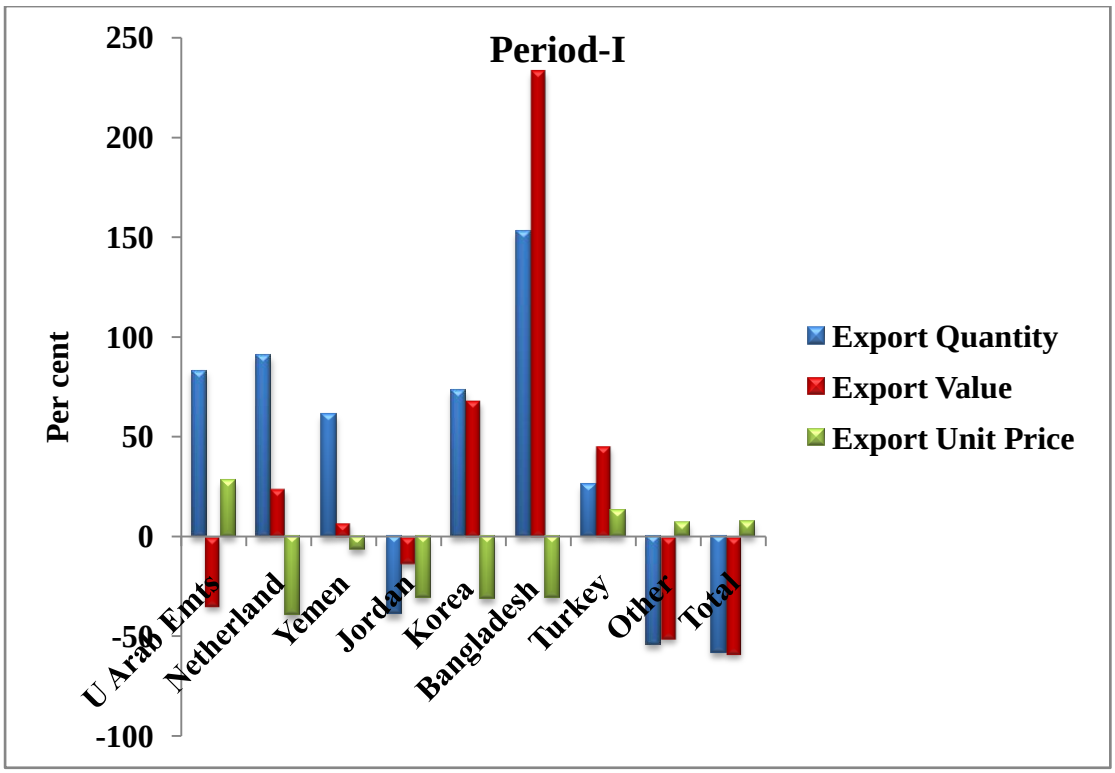

Figure 4.10: country wise compound growth rate of wheat export from India for period -I

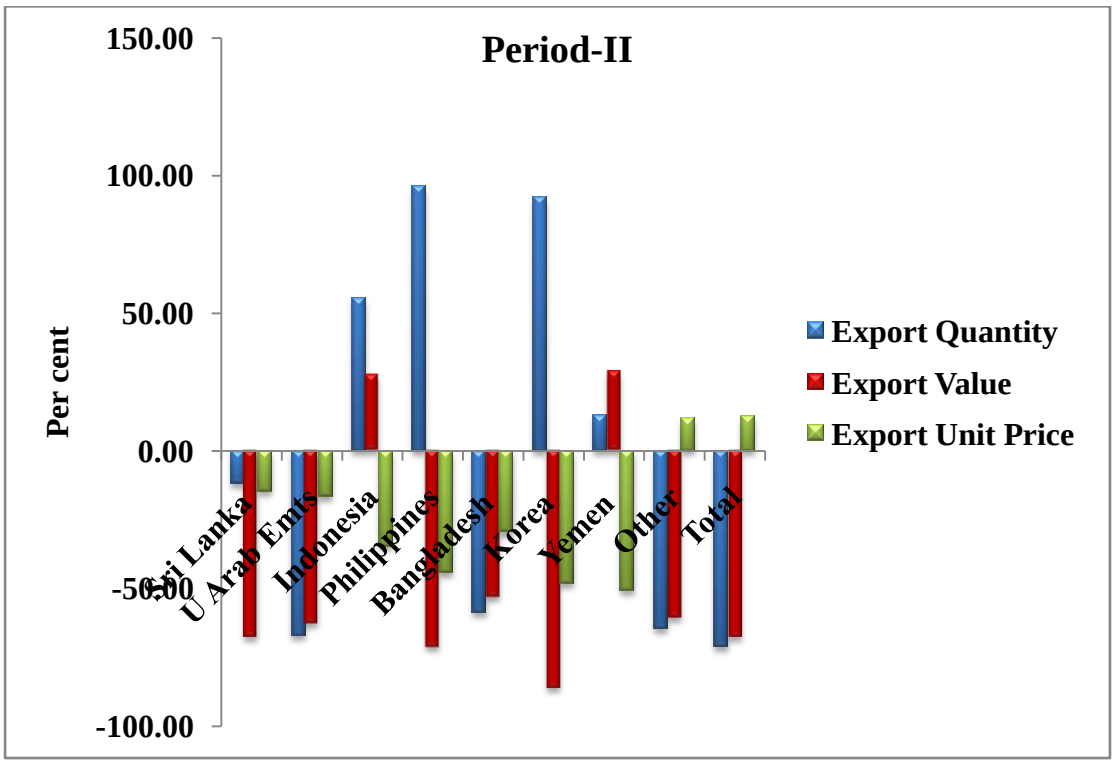

Figure 4.11: Country wise compound growth rate of wheat export from India for period-II

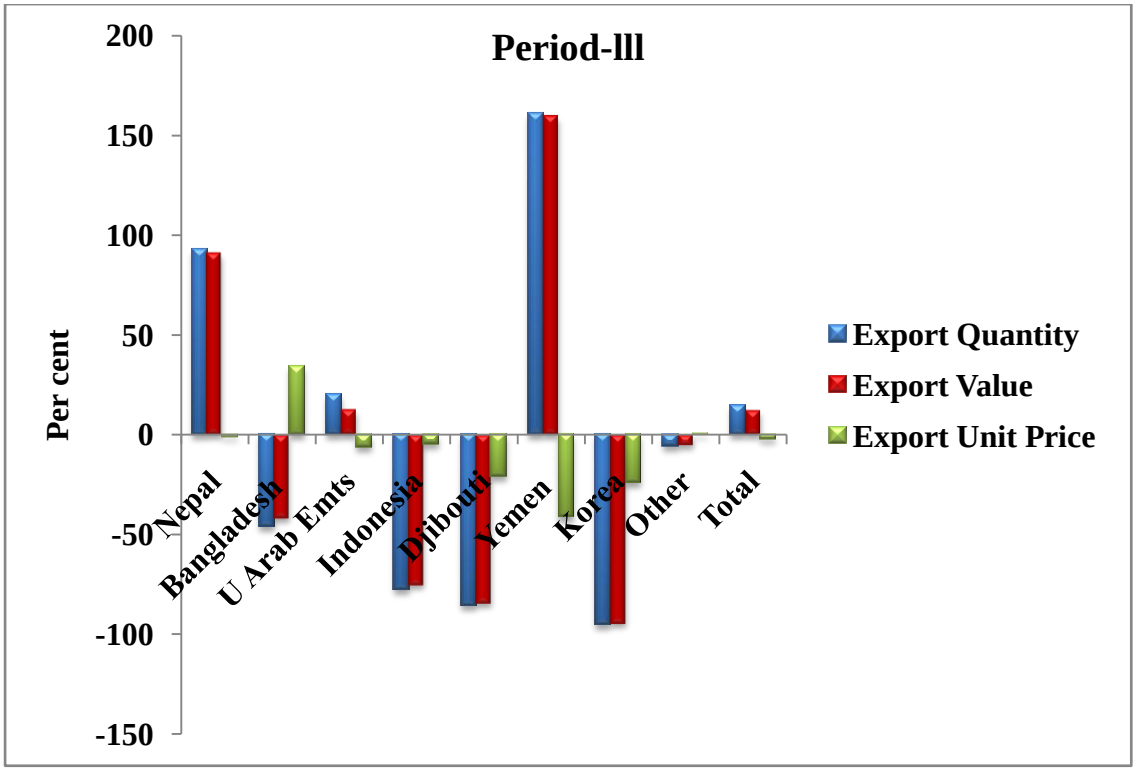

Figure 4.12: Country wise compound growth of wheat export from India for period –III

4.1.9: Compound growth rates of rice exported from India

Increasing demand for rice as well as the capacity of producing rice in India, which is supported by export policy, have created scope for the export of rice from India.

The country-wise growth performance of rice exports in terms of quantity, value and unit price reported in Table 4.9 and Fig. 4.13, 4.14 and 4.15. On pursuing this table, it was noticed that, the highest growth in exported quantity of rice was observed in South Africa with compound growth rate of 219.19 per cent, which was significant at 5 per cent level of significance during period I. Likewise, the significant growth in export earning was recorded in South Africa (217.53 %) and lowest growth was noticed in Indonesia -58.57 per cent per annum but the growth was non-significant. The export unit price grew at the rate of 125.51 per cent and 120.05 per cent in Russia and Bangladesh, respectively during period I.

Nigeria was the one and only the country which recorded significant positive growth of 61.52 per cent per annum in terms of exported quantity of rice during period II. On the other hand, South Africa (-56.52 %) showed significant but negative growth trend and the rest of countries registered non-significant growth in the exported quantity of rice. The export value of rice was non-significantly increased in Cote D Ivoire, Nepal and UAE while significantly declined in Nigeria by (-56.56 %) per cent. Cote D Ivoire reported the highest growth of 52.92 per cent in rice export unit price. However, Nepal exhibited lowest growth (7.78 %) in export unit price but it was non-significant in period II. In period III, the export of rice quantity and export value was significantly increased at the rate of 138.69 per cent and 124.45 per cent in Guinea at 5 per cent level of significance. However, Nepal showed the positive export unit price grew significantly at growth rate of 2.48 per cent per annum in the period III. The growth in export quantity was higher than export value and unit price in period III.

Liberalization policies adopted in early 1990s, subsequently followed by formation of WTO in 1995 helped to boost rice exports from India.

The growth in export quantity was higher than export value and unit price in three sub-periods. Along with the measures taken for promoting the exports of these grains, it was the Shortfall in the output of rice in countries like Indonesia,

Table 4.9: Compound growth rates of rice exported from India

Sr. No.	Particulars		Bangladesh	Saudi Arab	South Africa	Russia	Sri Lanka	Kenya	Indonesia	Other	Total
	Period-I										
1	Export Quantity	**CAGR**	26.58 NS	31.09***	219.19**	102.47 NS	26.76 NS	38.93 NS	-61.04 NS	37.25**	52.51***
		t value	0.85	4.94	2.70	1.65	0.59	0.60	-0.82	2.48	3.61
2	Export Value	**CAGR**	26.29 NS	30.07***	217.53**	83.46 NS	21.96 NS	28.54 NS	-58.57 NS	34.67**	48.79***
		t value	0.84	5.16	2.71	1.50	0.47	0.48	-0.95	2.53	3.69
3	Export Unit Price	**CAGR**	120.05***	-0.78 NS	101.51***	125.51***	65.83**	94.74***	90.21**	26.65*	-11.70***
		t value	4.61	-0.92	3.72	4.21	2.55	3.36	2.60	2.04	-3.79
	Period-II		**Saudi Arab**	**UAE**	**Nepal**	**Cote D Ivoire**	**South Africa**	**Bangladesh**	**Nigeria**	**Other**	**Total**
1	Export Quantity	**CAGR**	-25.70 NS	-6.58 NS	13.53 NS	58.21 NS	-56.52**	-34.52 NS	61.52*	-14.87 NS	-15.92 NS
		t value	-1.63	-0.57	0.94	1.05	-2.32	-1.31	-1.94	-1.58	-1.56
2	Export Value	**CAGR**	-16.88 NS	17.96 NS	22.03 NS	65.98 NS	-48.62 NS	-24.52 NS	-56.56*	4.48 NS	0.42 NS
		t value	-1.15	1.44	1.68	1.41	-1.73	-0.89	-1.83	0.41	0.04
3	Export Unit Price	**CAGR**	11.86 NS	26.26	7.48 NS	52.92**	18.17*	14.8 NS	12.94 NS	22.72**	19.42***
		t value	1.26	5.89	0.59	2.72	2.23	1.32	1.73	2.43	4.13
	Period-III		**Nepal**	**Benin**	**Guinea**	**Cote D Ivoire**	**Senegal**	**South Africa**	**Bangladesh**	**Other**	**Total**
1	Export Quantity	**CAGR**	30.61***	42.83*	138.69**	34.64 NS	102.18 NS	5.33 NS	19.28 NS	27.58 NS	27.9*
		t value	3.58	2.01	2.39	1.75	1.65	0.80	0.80	1.78	1.89
2	Export Value	**CAGR**	33.85***	41.53*	124.45**	32.67 NS	87.94 NS	3.02 NS	24.45 NS	23.8 NS	25.52*
		t value	4.20	1.89	2.42	1.70	1.61	0.30	1.10	1.71	1.83
3	Export Unit Price	**CAGR**	2.48**	-0.91 NS	37.09 NS	-1.96*	35.49 NS	-2.9***	4.34 NS	-2.96**	-1.86*
		t value	2.45	-0.97	1.68	-1.95	1.67	-3.28	1.49	-2.30	-2.23

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20 ***, **** and *** are significant at 10, 5 and 1 per cent level of significance

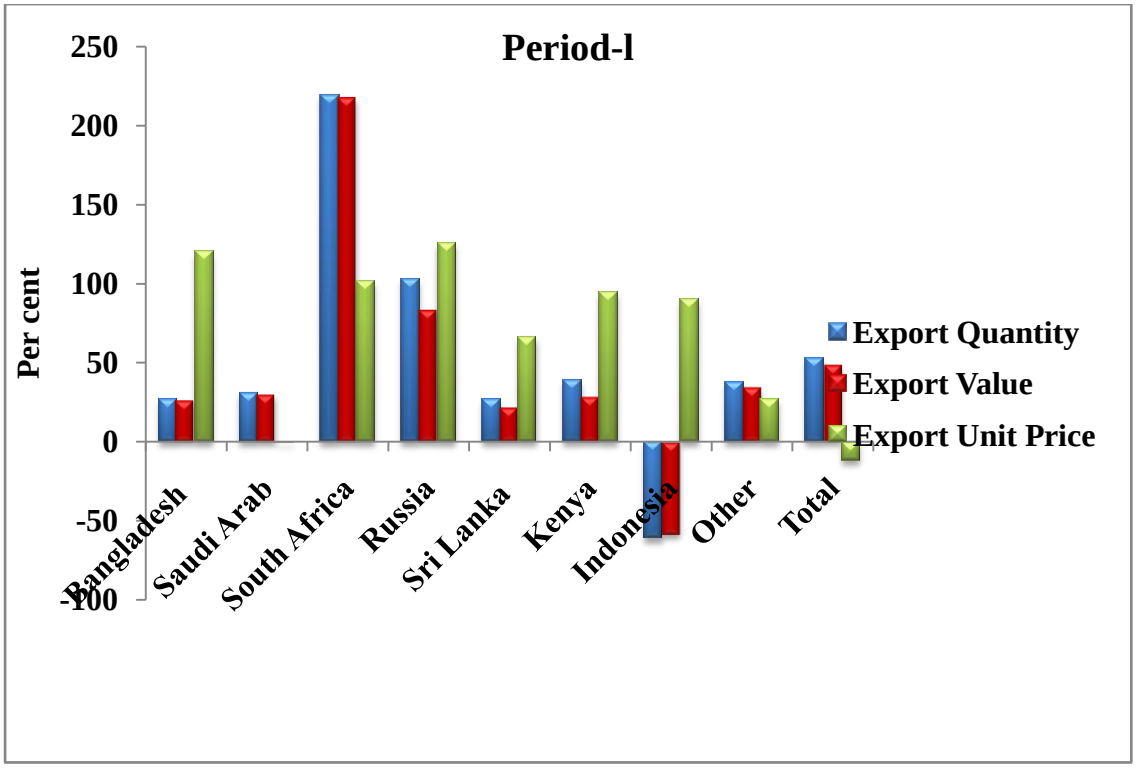

Figure 4.13: Country wise compound growth rate of rice export from India for period –I

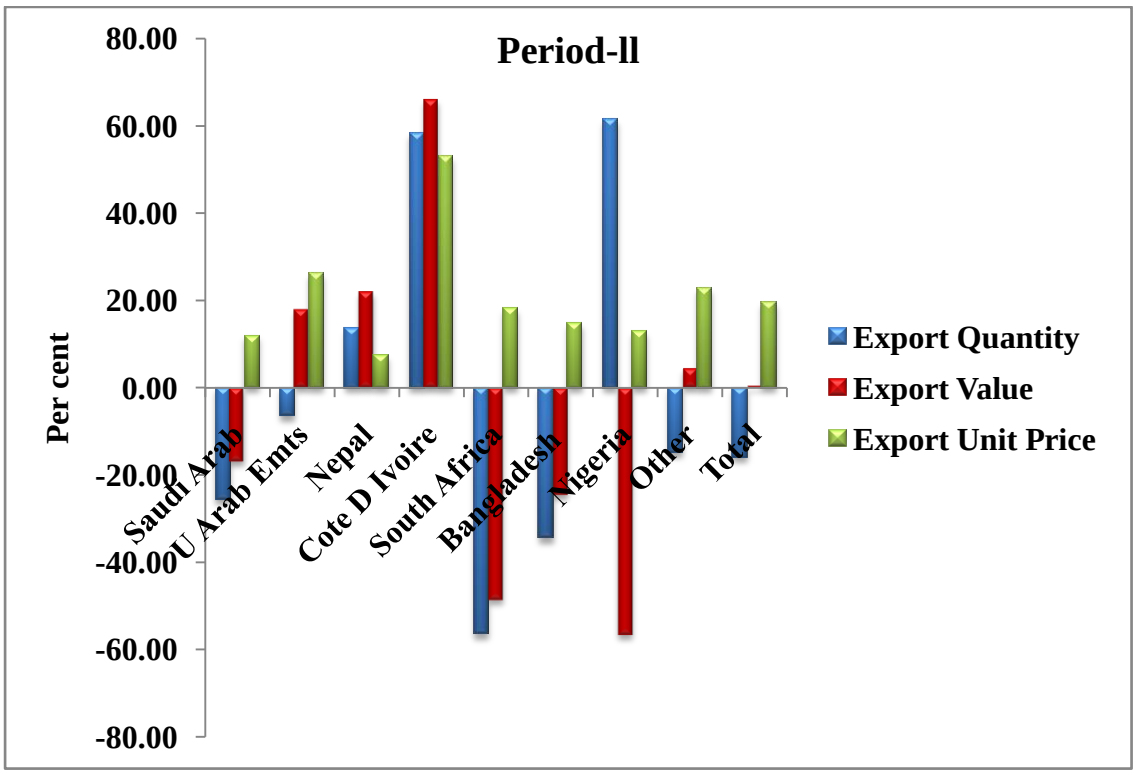

Figure 4.14: Country wise compound growth rate of rice export from India for period-II

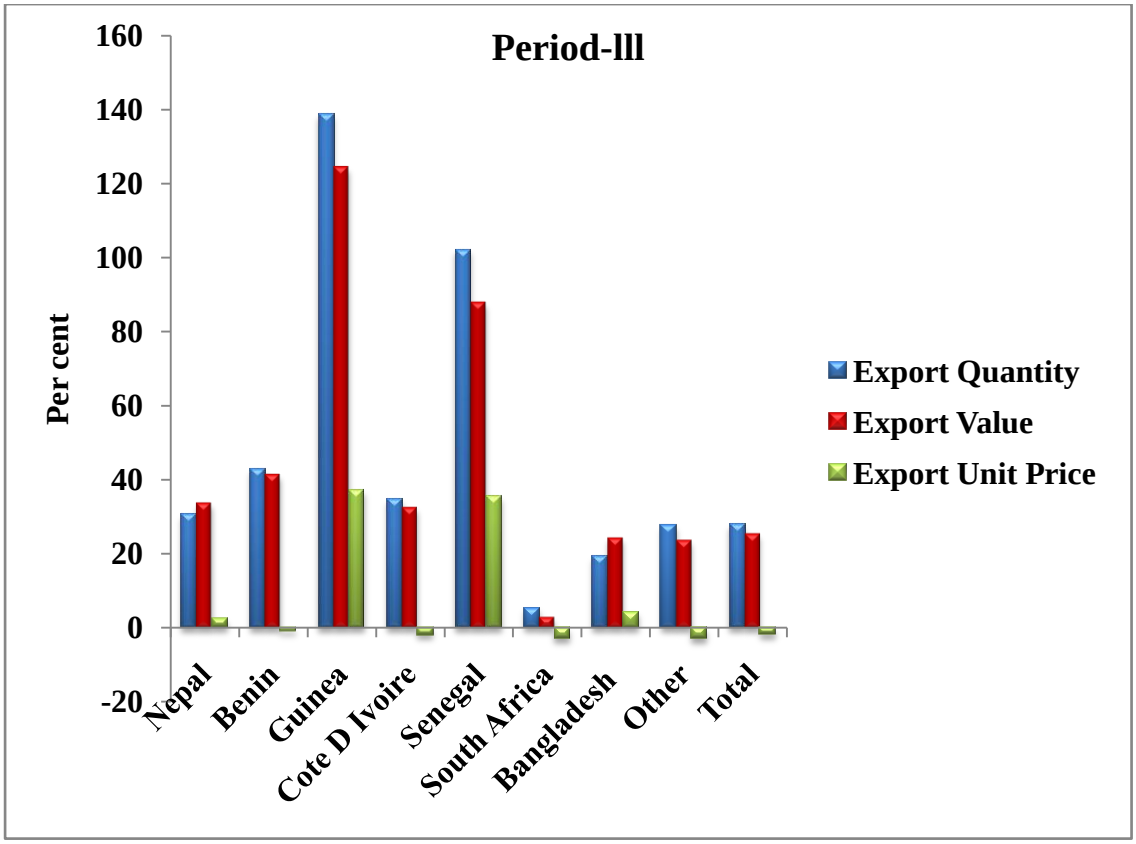

Figure 4.15: Country wise compound growth rate of rice export from India for period-III

Bangladesh and China and reduced supplies from Thailand and Vietnam and consequent firming up of the prices in the world market that helped in increasing

The exports of Indian rice in the case of wheat also, a lower global output coupled with the depleted stocks increased the demand for the Indian grain. These apart, changes in the structure of world market also helped in increasing the exports of rice and wheat from India. Though this augurs well for the exports of Indian rice and wheat, it would be important to establish the country as a reliable supplier in the international market.

Udhayakumar and Karunakaran (2020) found that the Owing to price competitiveness, nowadays, African countries have also changed to Indian non-basmati rice. India is the leading exporter of the rice as there is a strong demand for Indian rice in the international markets. The Indian rice export value has increased from 33.70 billion to 503.07 billion between 1997-98 to 2017-18, mainly to China, Benin, USA, UK, France, Malaysia and Japan. During 2017-18 the country has exported globally about 40.56 Lakh tonnes of Basmati rice and 86.48 Lakh tonnes for Non-Basmati rice, the worth of 268.70 billion and 229.68 billion respectively. Nethrayini *et al.* (2012) reported that the instability analysis in case of basmati rice Saudi Arabia and Kuwait are the relatively stable importers where as in case of non-basmati rice all are unstable importers. Agrawal (2021) reported that rice export from India she stated the India exports rice to various countries like Saudi Arab, Iran, Kuwait, United Arab Emirates, and U.K. etc. The time series data on export of rice from India for the period 2008-09 to 2017-18 was taken for the study rice export from India to UAE increased from 2008 to 2010, and in 2011 a downfall of export of rice from India, from 2011 to 2012 again a rise in rice export from India to UAE was observed, from 2012 to 2014 again a downfall of export of rice from India to UAE was observed, during 2014 to 2017 increment can be seen in the export of rice from India due to bumper yield of cereal, in 2018 downfall of export was observed.

4.2 Instability in area, production, productivity and Export of cereal crops

In this section, we have focused to examine and explain the fluctuations in area, production, productivity and export changes from one period to the other period for selected cereal crops.

4.2.10: Instability indices of area, production and productivity of maize in India

The fluctuations in area, production and productivity of maize crop, the instability index was estimated and reported in Table 4.10 and Fig. 4.16, at national level, the instability in area of maize crop was increased as the measures *viz*., standard deviation, coefficient of variation and Cuddy-Della Valley Index (CDVI) showed increasing trend in study period.

Table 4.10: Instability indices of area, production and productivity of maize in India

Period	Area (000 ha)			
	Mean	**SD**	**CV**	**CDVI**
Period I	6.10	0.19	3.15	1.30
Period II	7.46	0.66	8.90	2.08
Period III	9.10	0.43	4.68	2.85
Overall	7.56	1.32	17.52	3.60
	Production (000 tones)			
Period I	9.93	1.12	11.28	5.64
Period II	15.07	2.76	18.32	9.64
Period III	24.93	3.07	12.31	4.90
Overall	16.64	6.76	40.64	10.59
	Productivity (kg/ha)			
Period I	1.62	0.14	8.81	5.48
Period II	2.01	0.22	11.01	8.51
Period III	2.73	0.24	8.66	4.21
Overall	2.12	0.51	23.95	7.30

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
SD = Standard Deviation, CV =Coefficient of Variation (per cent per annum),
CDVI = Cuddy Della Valle's Instability Index (per cent per annum)

The results revealed that, instability index i.e. CDVI of maize area increased from 1.30 to 2.08 and 2.85 per cent during periods I, II, III of the study. In these sub-periods, the magnitude of area instability was below 5 per cent which was considered as low level of instability. The instability in area of maize crop was 3.60 per cent in overall period.At national level, yield of maize crop was more unstable compared to area, which increased variability in production of maize during entire study period.

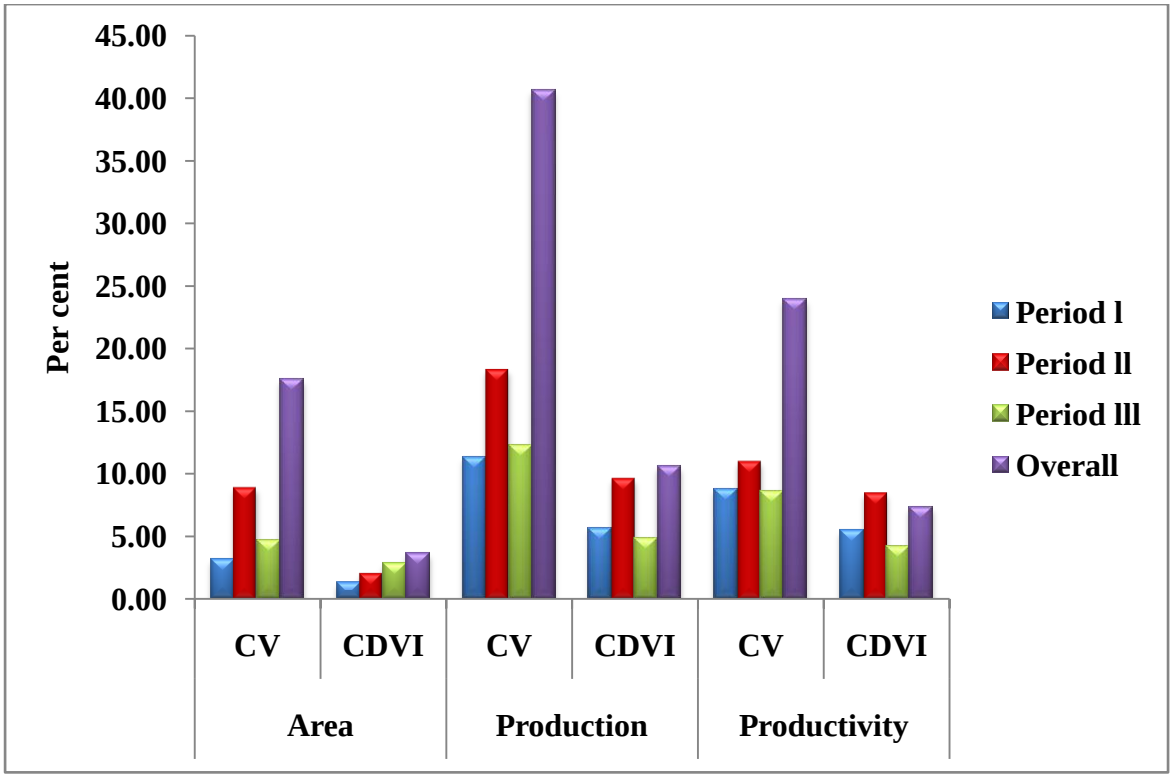

Figure 4.16: Instability indices of maize in area, production and productivity in India

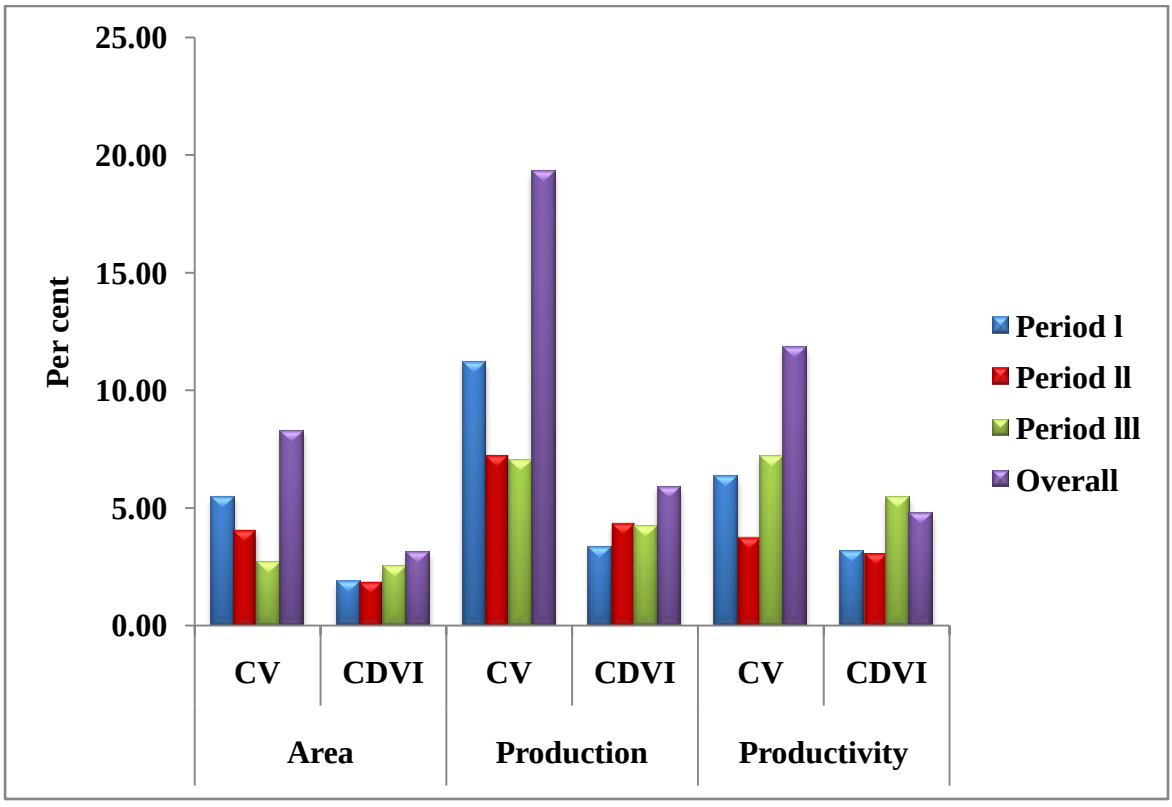

Figure 4.17: Instability indices of Wheat in area, production and Productivity in India

Sudden rise in production variability of maize crop from 5.64 to 9.64 per cent was observed from period I to period II. It was due to increased yield variability from 5.48 to 8.51 per cent during same period. The area of maize crop was also unstable in period II (2.08 %) as compared to period I (1.30 %) in this region. However, the production instability of maize was declined to 4.90 per cent due to declined instability in yield (4.21 %) and area (2.85 %) in period III.

Thus, maize crop showed low level of instability in area (3.60 %), as compared to production (10.59 %) and yield (7.30 %) during entire period. Similar result found on Anjum and Madhulika (2018) viewed the instability in area for maize increased continuously throughout the study period (1990-91 to 2009-10 to 2016 to 2017) but instability in production of maize was increased in first period (1990-91 to 2000-01) then decreased in third period (2009-10 to 2016-17). In case of productivity has increased in second period (2000-01 to 2009-10) and then declined in the third period.

4.2.11: Instability indices of area, production and productivity of wheat in India

The estimates of area, production and yield instability in wheat crop at national level were presented in Table 4.11 and Fig.4.17.

Table 4.11: Instability indices of area, production and productivity of wheat in India

Period	Area (000 ha)			
	Mean	**SD**	**CV**	**CDVI**
Period I	25.55	1.40	5.48	1.85
Period II	26.90	1.09	4.07	1.87
Period III	30.24	0.81	2.68	2.52
Overall	27.56	2.28	8.28	3.14
	Production (000 tones)			
Period I	63.91	7.13	11.16	3.35
Period II	73.42	5.31	7.23	4.34
Period III	95.95	6.73	7.01	4.22
Overall	77.76	15.01	19.30	5.86
	Productivity (kg/ha)			
Period I	2.50	0.16	6.34	3.17
Period II	2.73	0.10	3.75	3.09
Period III	3.17	0.23	7.21	5.44
Overall	2.80	0.33	11.82	4.76

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
SD = Standard Deviation, **CV** =Coefficient of Variation (per cent per annum),
CDVI = Cuddy Della Valle's Instability Index (per cent per annum)

In India, area under wheat crop was found relatively stable as CDVI was 1.85, 1.87 and 2.52 per cent in consecutive periods. Fluctuations in area of wheat were slightly increased over the period of time. Instability in production of wheat was increased in period III (4.22 %) as compared to period I (3.35 %) due to rise in yield instability of wheat from 3.17 per cent to 5.44 per cent in this period. Similar result found in Anjum and Madhulika (2018) reported that the instability in the area for, wheat increased in second period (2000-01 to 2009-10) of study but declined in third period, but production of wheat has declined in the second period but again increased in the third period (2009-10 to 2016-17) The area of wheat crop was more stable as compared to production and yield in India. The area of wheat crop was more stable as compared to production and yield in India. The instability indices for wheat area, production and productivity were 3.14 per cent, 5.86 per cent and 4.76 per cent in overall period

4.2. 12: Instability indices of area, production and productivity of rice in India

The estimates of area, production and yield instability in rice at national level are reported in Table 4.12 and Fig.4.18. A perusal of table revealed that, instability in production and productivity of rice at national level was increased during period III of study compared to period I. It was increased from 7.39 per cent to 29.68 per cent per annum in production. With regard to yield, instability was increased from 2.49 to 15.86 per cent per annum.

In case of area, it fluctuated from 1.28 per cent to 3.35 per cent from I to II period. Further, the area of rice crop became stable as instability index was declined to 1.04 per cent in period III. During overall study period, instability in area, production and productivity of rice was 2.33, 30.34 and 15.77 per cent per annum, respectively. It revealed that, instability in rice production was maximum compared to yield and area at national level. Similar findings were noticed in the study of Anjum and Madhulika (2018) who observed that the instability in area, production and productivity of rice was increased during second period (2001-02 to 2009-10) but declined in third period (2009-10 to 2016-17).

Table 4.12: Instability indices of area, production and productivity of rice in India

Period	Area (000 ha)			
	Mean	**SD**	**CV**	**CDVI**
Period I	43.22	1.04	2.42	1.28
Period II	43.41	1.46	3.35	3.35
Period III	43.71	0.52	1.18	1.04
Overall	43.45	1.06	2.44	2.33
	Production (000 tones)			
Period I	80.00	5.40	6.75	7.39
Period II	89.01	7.76	8.72	11.31
Period III	119.79	30.03	25.07	29.68
Overall	96.26	24.66	25.61	30.34
	Productivity (kg/ha)			
Period I	1.85	0.09	4.67	2.49
Period II	2.05	0.14	6.82	4.65
Period III	2.74	0.67	24.63	15.86
Overall	2.21	0.55	24.75	15.77

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
SD = Standard Deviation, **CV** =Coefficient of Variation (per cent per annum),
CDVI = Cuddy Della Valle's Instability Index (per cent per annum)

Satishkumar (2016) viewed that the instability in area, production found more stable than productivity, the yield effect has contributed majorly to rice production. Day (2020) reported that the instability during the entire period, highest variation was noticed for production in comparison to area and yield. It may be due to launch of various development schemes in that decade by the government to improve Indian agriculture.

4.2.13: Instability indices of maize exported from India

The instability index of maize export in terms of quantity, value and unit price is presented in Table 4.13 and Fig.4.19. The export instability in terms of quantity of maize was higher in period I, as CV and CDVI was 144.21 and 143.18 per cent which was further declined to 108.12 and 68.52 per cent in period II and 76.95 and 42.77 per cent in period III.

The export value registered instability of 144.72 per cent, 64.48 per cent and 45.16 per cent during I, II and III periods which showed that, in export value were declined over the period of time. The estimated CV also displayed similar declining trend. The unit price realization was more stable (15.42 and 13.25 %) during period III as compared to period I and period II.

Table 4.13: Instability indices of maize exported from India (Per cent)

Period	Export Quantity (Metric Tons)		
	Mean	**CV**	**CDVI**
Period I	12509	144.21	143.18
Period II	917031	108.12	68.52
Period III	2182606	76.95	42.77
Overall	1037381	136.33	113.52
	Export Value (Thousand US$)		
Period I	2155	148.24	144.72
Period II	233711	119.09	64.48
Period III	572392	77.38	45.16
Overall	269419	139.70	115.92
	Export Unit Price (US$/Tons)		
Period I	253	89.28	72.42
Period II	241	83.96	74.82
Period III	273	15.42	13.25
Overall	255	66.93	65.60

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
CV =Coefficient of Variation (per cent per annum), **CDVI** = Cuddy Della Valle's Instability Index (per cent per annum), **Export Quantity = (**tones**), Export Value= (**1000 US$), **Export Unit Price= (**US$/ tones)

The instability index of maize export indicated that, the fluctuations in export quantity and export value were quite higher as compared to export unit price in entire study period. Also Similar result were found in Gaatha and Shrivastava (2019) observed that the instability indices reveals that quantity and export value remained highly instable in both the periods, (1981-1995 to 1996 -2016) whereas unit value is having medium instability across the study period The export quantity is found more unstable in pre-WTO period than post-WTO period and it may be due to variability in quantum exported. The other cause may be due to somewhat inconsistent domestic production, international demand and exports policy for maize during post-WTO period. Similarly, variability in export quantity along with unit price was the major cause of the variability in export earnings during pre-WTO period.

4.2.14: Instability indices of wheat exported from India

The instability indices of wheat export presented in Table 4.14 Fig. 4.20 revealed that, the exported quantity of wheat registered instability (CDVI) of 126.49, 84.87, 128.17 and 151.49 per cent per annum, for period I, II, III and overall period respectively. The estimated values of CV also showed instability of 127.01 per cent, 113.50 per cent, 138.85 per cent and 155.07 per cent during three sub-periods and

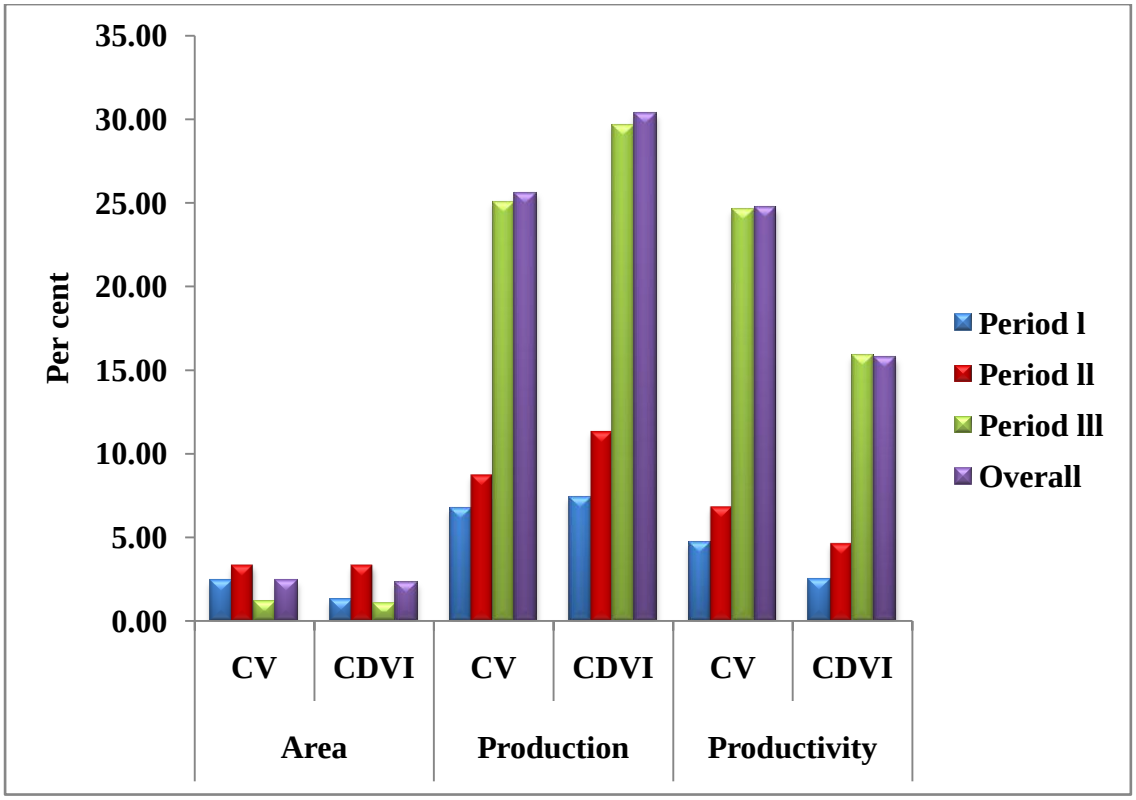

Figure 4.18: Instability indices of rice in area, production and productivity in India

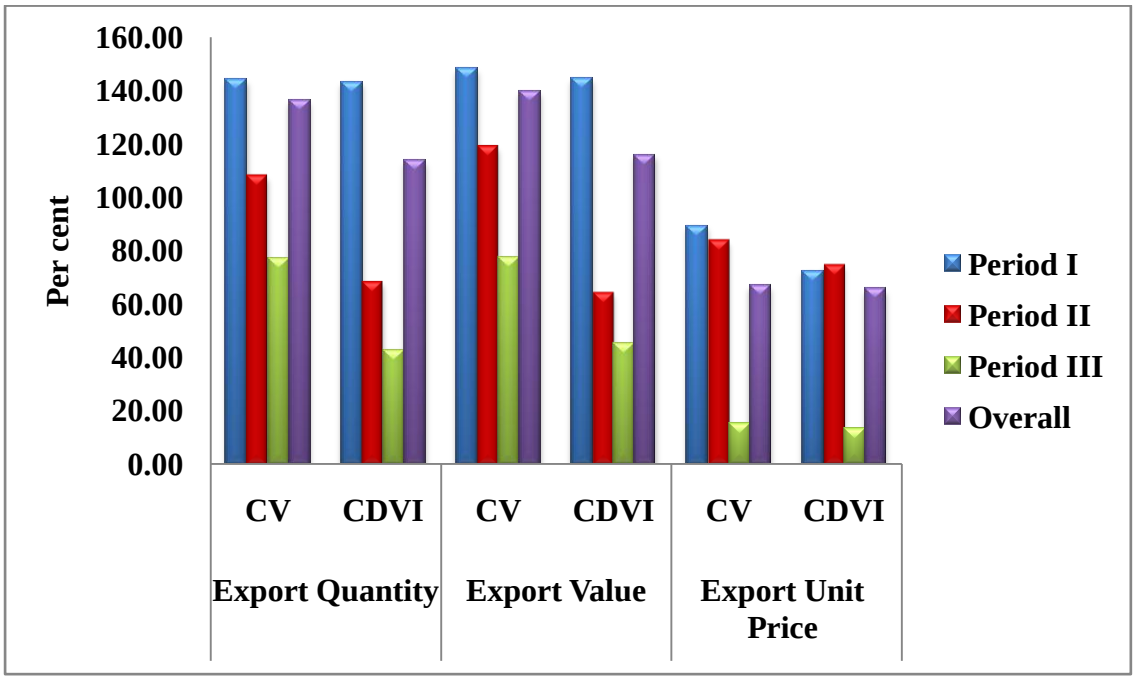

Figure 4.19: Instability indices of maize in export quantity, value and unit price from India

overall period. It suggested the fact that, the variations in exported quantity of wheat were high in period III.

However, the fluctuations in the export value revealed mixed trend i.e. variations in export value were higher (134.20 and 131.56 %) in period I, but declined in period II (110.10 and 86.77 %) and again it increased in period III (141.32 and 130.34 %).

Table 4.14: Instability indices of wheat exported from India (Per cent)

Period	Export Quantity (Metric Tones)		
	Mean	**CV**	**CDVI**
Period I	239615.45	127.01	126.49
Period II	1403076.15	113.50	84.87
Period III	1744104.11	138.85	128.17
Overall	1128931.90	155.07	151.49
	Export Value (Thousand US$)		
Period I	61355.12	134.20	131.56
Period II	172781.19	110.10	86.77
Period III	499363.08	141.32	130.34
Overall	244499.79	184.56	176.48
	Export Unit Price (US$/Tones)		
Period I	326.69	158.75	150.71
Period II	172.77	38.29	14.26
Period III	289.04	13.58	11.27
Overall	262.83	113.98	113.97

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
CV =Coefficient of Variation (per cent per annum), **CDVI** = Cuddy Della Valle's Instability Index (per cent per annum), **Export Quantity = (**tones**), Export Value= (**1000 US$), **Export Unit Price= (**US$/ tones)

The unit price of wheat registered higher fluctuations (158.75 and 150.71 %) in period I but it became more stable during period III as compared to period I and period II. Instability indices of wheat revealed that, the export unit price was more stable as compared to export quantity and export value in three sub-sequent periods and overall period. Oladele and Kenamara (2015) observed that instability index in the export of wheat was very high, which signified that India could not meet up in the world wheat market despite volume of production of wheat. (Parihar, 2019) stated that the instability of wheat export in terms of quantity, value showed highest instability in wheat export in the entire study period.

4.2.15: Instability indices of rice exported from India

The instability index of rice export in terms of quantity, value and unit price is presented in Table 4.15 and Fig. 21. The export instability in terms of quantity of rice was higher in period I, as CDVI was 86.23 per cent which was further declined 53.59 per cent in period II and 34.38 per cent in period III. The instability in quantity of rice exported during entire study period was 52.73 per cent which was quite high.

Table 4.15: Instability indices of rice exported from India (Per cent)

Period	Export Quantity (Metric Tones)		
	Mean	**CV**	**CDVI**
Period I	1546186	108.11	86.23
Period II	2881742	55.43	53.59
Period III	6071787	41.44	34.38
Overall	3499905	77.48	52.73
	Export Value (Thousand US$)		
Period I	384833	105.53	83.65
Period II	653991	78.27	76.33
Period III	2428814	41.20	34.98
Overall	1155879	98.41	60.67
	Export Unit Price (US$/Tones)		
Period I	266	16.99	14.57
Period II	265	55.46	29.66
Period III	411.75	9.64	7.50
Overall	314.33	35.90	29.33

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10
Period III: 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
CV =Coefficient of Variation (per cent per annum), **CDVI** = Cuddy Della Valle's Instability Index (per cent per annum), **Export Quantity = (**tones**), Export Value=(**1000 US$), **Export Unit Price= (**US$/ tones)

The export value registered instability of 83.65, 76.33 and 34.98 per cent during I, II and III periods which showed that, instability in export value of rice was declined over the period of time and it became more stable in period III. The estimated CV also displayed similar declining trend. The unit price realization was more stable (7.50 %) during third period as compared to period I and period II. The instability index of rice export indicated that, the fluctuations in export quantity and export value were quite higher as compared to export unit price in entire study period.

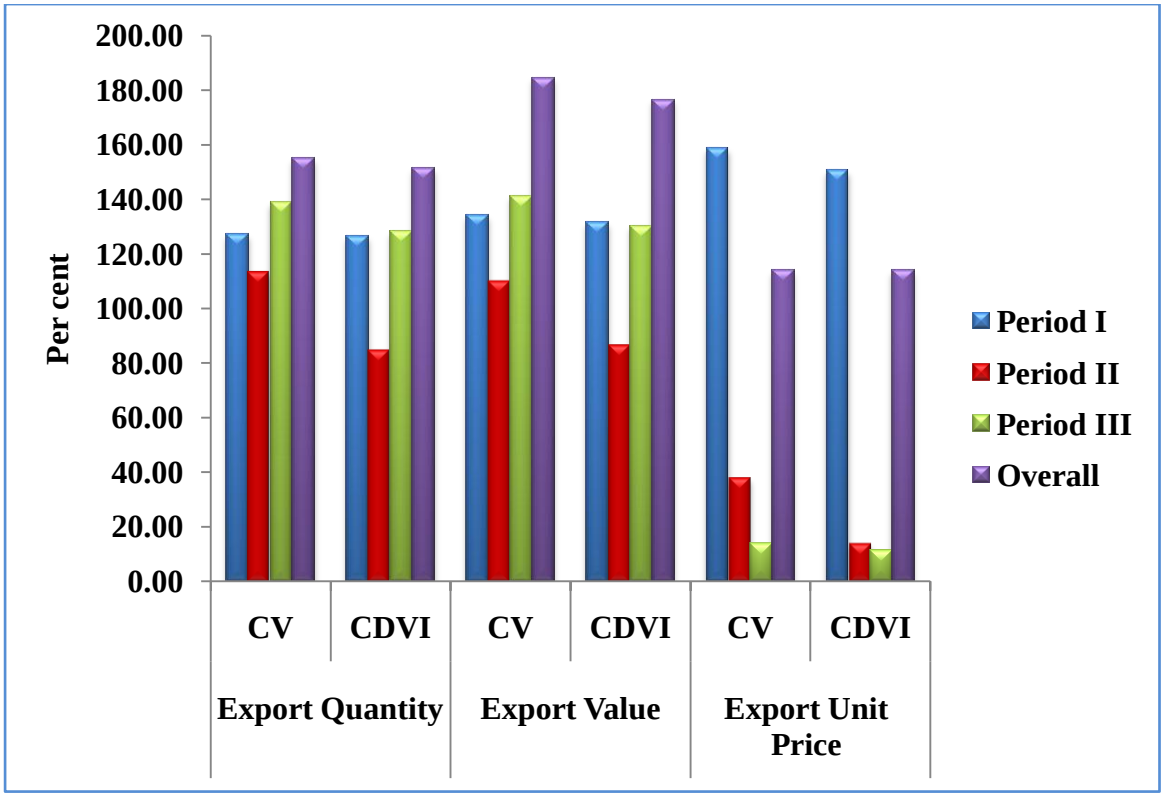

Figure 4.20: Instability indices of wheat in export quantity, value and unit price from India

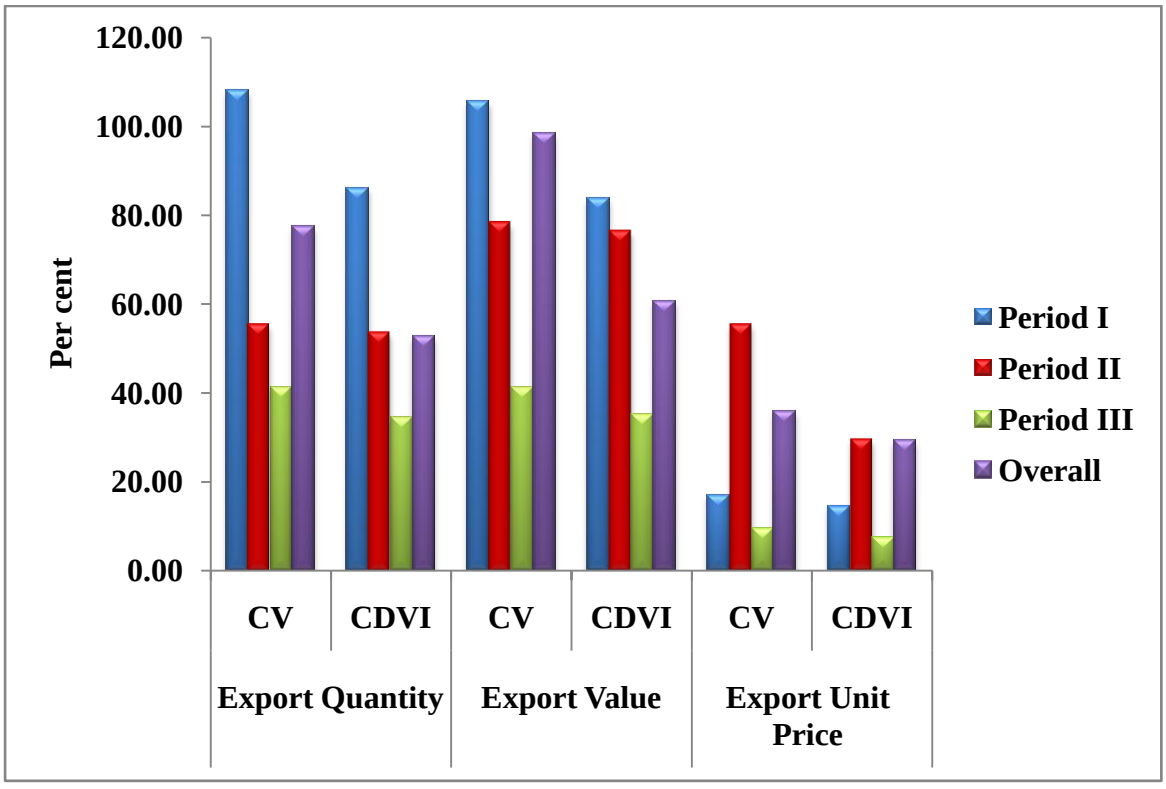

Figure 4.21: Instability indices of rice in export quantity, value and unit price from India

Country wise instability indices of cereal crops

The country-wise variations in exports of selected cereal crops i.e. maize, wheat and rice from India were estimated for the period from 1990-91 to 2019-20.

4 .2.16: Country wise Instability indices of maize exported from India

The results of instability indices of maize in terms of quantity, value and unit price were reported in Table 4.16 and Fig. 4.22, 4.23, and 4.24. The results revealed that, among the top destinations of Indian maize exports in terms of quantity, South Africa was the most unstable market having the highest instability index i.e. 315.69 per cent per annum in period I. Countries *viz*., Indonesia (246.80 %), Iran (220.89 %) and Malaysia (207.76 %) were also unstable markets followed by South Africa having higher fluctuations in this period. In terms of export value, South Africa (315.69 %), Iran (227.54 %) and Malaysia (222.91 %) were most unstable markets having the higher instability indices in period I. UAE was the most stable market in terms of unit price by showing the lowest instability i.e. 44.63 per cent, whereas South Africa was found to be unstable market. It clearly indicated that, South Africa was the most unstable market in maize export in terms of quantity, value and unit price in the period I**.**

There was a steep decline in the instability indices of all the countries during period II. The highest instability in terms of export quantity (171.01 %) and export value (186.93 %) was observed in Korea while lowest instability was observed in Bangladesh (33.48 %) and Vietnam (51.31 %), respectively. Bangladesh was the most stable market in terms of unit price having the lowest instability (9.15 %) followed by UAE (14.53 %), respectively. However, Vietnam registered higher fluctuations i.e. 115.33 per cent in unit price realized in this period.

In period III, Sri Lanka recorded highest variability in terms of export quantity (136.10 %) and export value (137.57 %) while lowest instability was observed in Nepal (23.25 % and 15.43 %), respectively. Malaysia was the most stable market in terms of unit price of maize by registering the lowest instability (6.82 %) followed by Nepal (13.75 %) and Taiwan (14.76 %), respectively. In contrast, Indonesia registered higher fluctuations i.e. 98.92 per cent in unit price realized in this period.

Table 4 .16: Country wise Instability indices of maize exported from India **(Per cent)**

Sr. No.	Particulars		Indonesia	U A E	Sri Lanka	Bangladesh	South Africa	Malaysia	Iran	Other	Total
	Period-I										
1	Export Quantity	**Mean**	596.22	292.14	2396.30	1299.78	287.20	5364.99	1473.70	799.15	12509.50
		CV	248.72	222.72	158.89	135.96	316.23	207.78	224.18	103.88	144.21
		CDVI	246.80	146.08	141.19	119.02	315.69	207.76	220.89	75.31	124.74
2	Export Value	**Mean**	195.94	64.30	406.35	207.20	34.15	806.23	197.17	243.60	2154.91
		CV	202.07	220.21	169.38	135.98	316.23	222.99	230.83	111.17	148.24
		CDVI	192.80	131.80	158.68	115.04	315.69	222.91	227.54	75.40	114.64
3	Export Unit Price	**Mean**	201.17	201.40	112.48	143.85	11.89	23.08	26.03	266.36	252.72
		CV	161.85	46.82	74.99	75.06	316.23	211.00	211.80	93.10	89.28
		CDVI	154.42	44.63	74.10	71.80	315.69	209.50	210.08	82.95	87.16
	Period-II		**Bangladesh**	**Vietnam**	**Malaysia**	**Indonesia**	**Taiwan**	**U A E**	**Korea**	**Other**	**Total**
1	Export Quantity	**Mean**	218155.70	126862.36	358046.03	37837.46	94719.07	44766.35	44388.99	255716.66	917030.52
		CV	75.45	173.05	143.47	113.54	193.83	138.16	211.98	114.41	108.12
		CDVI	33.48	104.36	89.73	71.88	122.67	61.29	171.01	46.65	50.09
2	Export Value	**Mean**	36768.11	23748.36	72779.58	7696.27	20880.13	9195.12	9063.30	53580.51	233711.36
		CV	90.80	174.43	151.96	102.28	196.41	148.06	229.66	120.53	119.09
		CDVI	52.73	51.31	91.65	65.74	74.27	61.05	186.93	39.65	41.16
3	Export Unit Price	**Mean**	157.93	340.49	135.28	420.81	150.14	188.22	292.27	262.08	240.94
		CV	21.23	116.17	58.45	78.87	77.13	15.25	95.68	51.60	83.96
		CDVI	9.15	115.33	29.35	53.09	50.18	14.53	94.44	45.08	74.82
	Period-III		**Nepal**	**Bangladesh**	**Vietnam**	**Indonesia**	**Malaysia**	**Taiwan**	**Sri Lanka**	**Other**	**Total**
1	Export Quantity	**Mean**	267391.31	281620.75	396906.62	506828.12	386469.31	89091.61	24691.20	229606.61	2182605.53
		CV	52.16	85.37	114.39	116.23	106.49	148.14	136.73	63.54	76.95
		CDVI	23.25	59.77	81.56	45.70	45.46	66.88	136.10	29.58	36.43
2	Export Value	**Mean**	62069.59	75527.30	101720.92	131712.27	98996.53	25321.18	5966.34	71077.45	572391.58
		CV	53.00	72.02	116.78	118.12	108.67	153.03	138.58	52.45	77.38
		CDVI	15.43	48.98	73.05	47.35	48.97	83.66	137.57	33.17	41.73
3	Export Unit Price	**Mean**	232.27	435.01	492.19	1359.09	248.79	279.94	339.21	352.12	272.51
		CV	14.96	91.57	92.59	140.50	7.64	15.46	80.14	32.99	15.42
		CDVI	13.75	74.37	89.41	98.92	6.82	14.76	70.99	20.55	13.25

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10**Period III:** 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
CV =Coefficient of Variation (per cent per annum), **CDVI** = Cuddy Della Valle's Instability Index (per cent per annum),
Export Quantity = (tones**), Export Value= (**1000 US$), **Export Unit Price= (**US$/ tones)

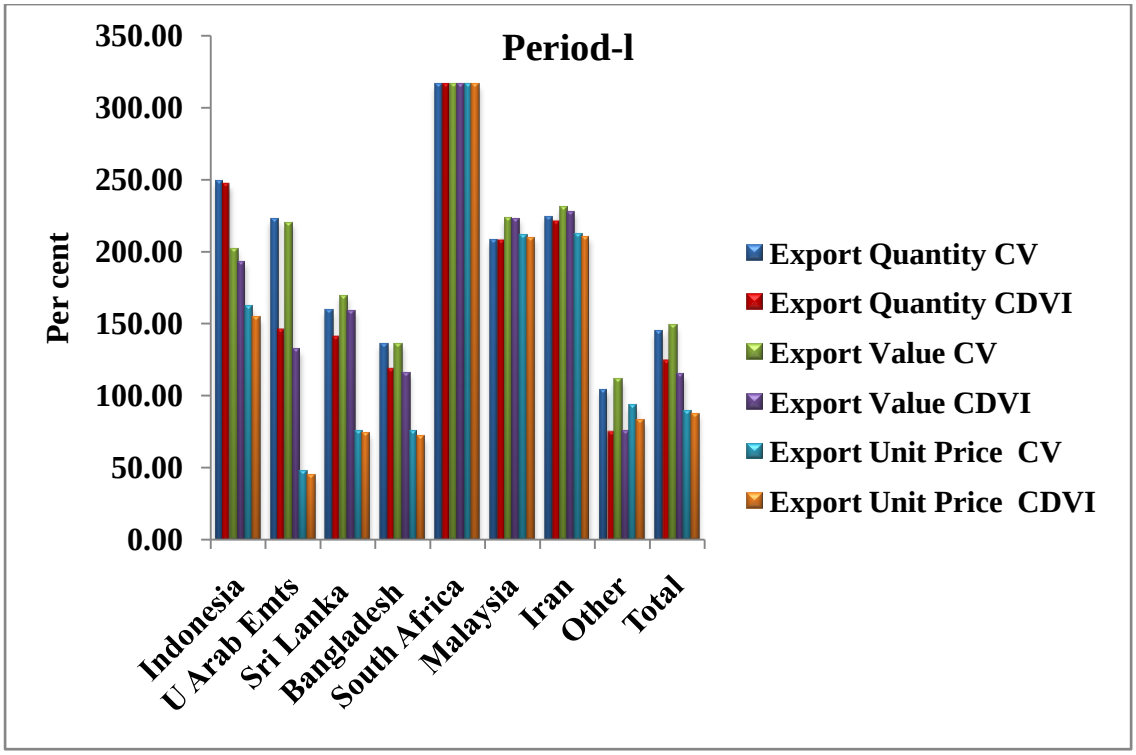

Figure 4.22: Country wise instability indices of maize export from India for period-I

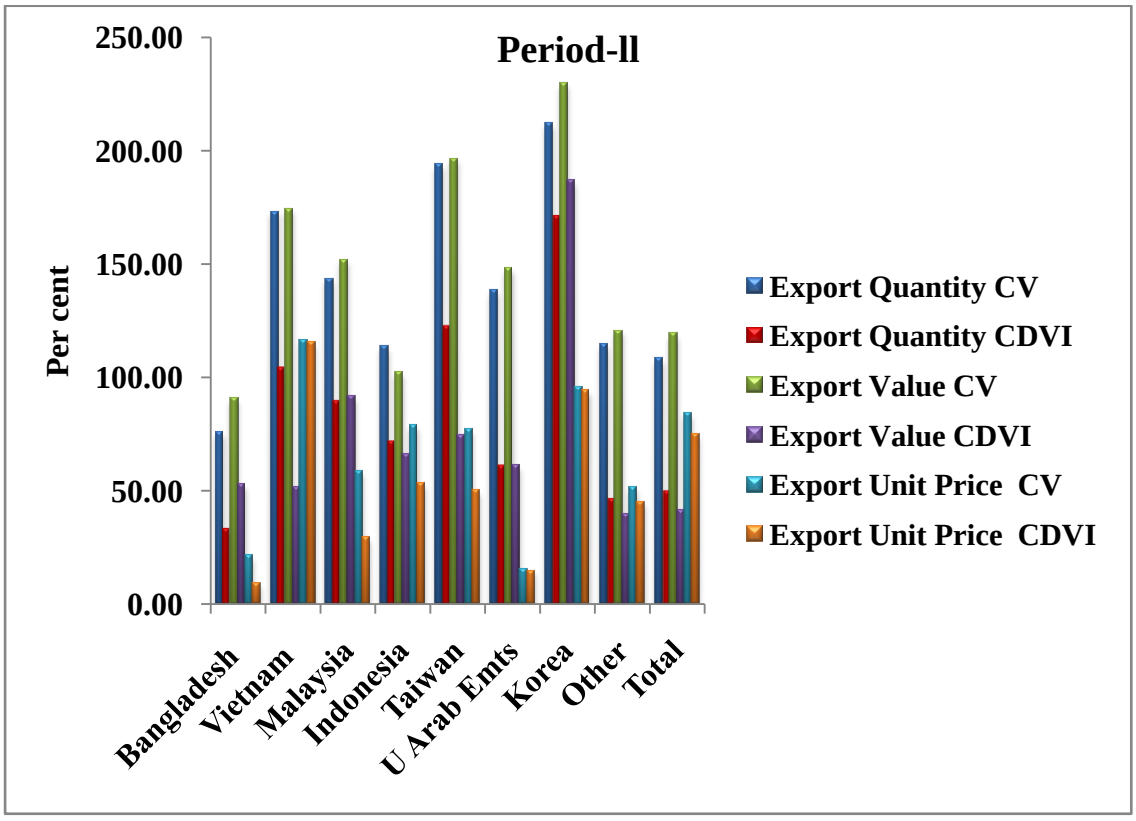

Figure 4.23: Country wise instability indices of maize export from India for period-II

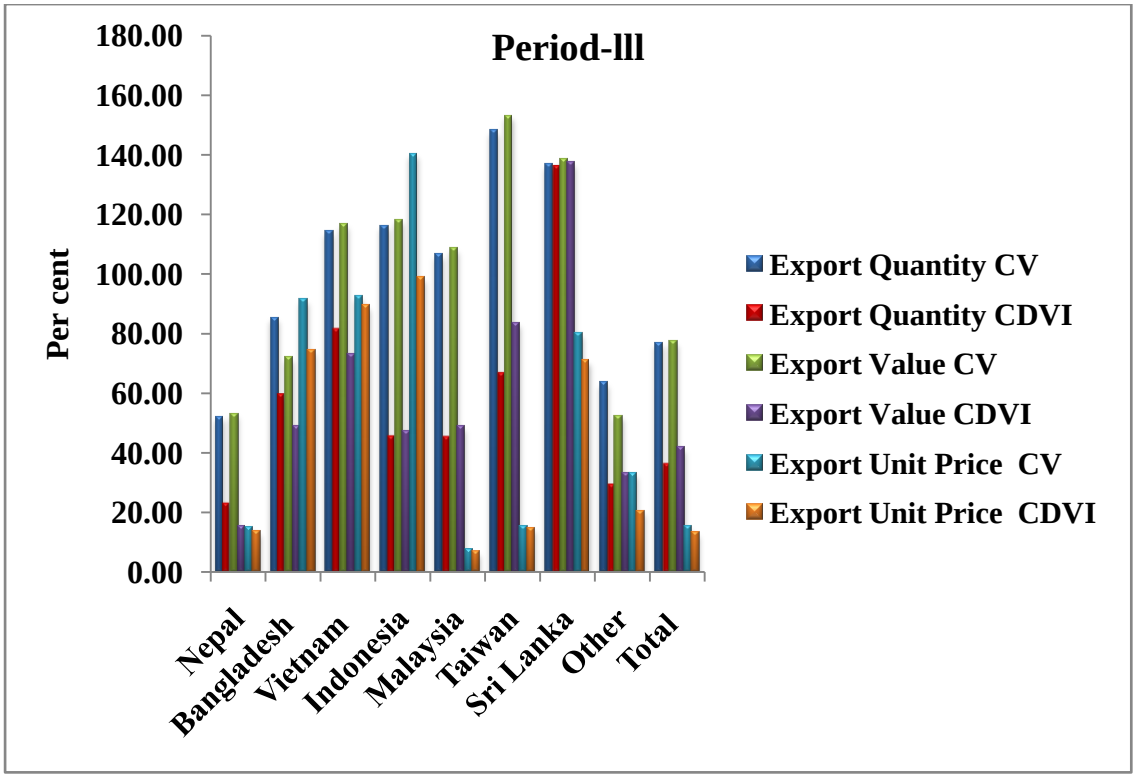

Figure 4.24: Country wise instability indices of maize export from India for period-III

4.2.17 Country wise Instability indices of wheat exported from India

The mean, Coefficient of Variation (CV) and instability indices of wheat in terms of quantity, value and unit price were reported in Table 4.17 and Fig. 4.25, 4.26, 4.27. The results showed that, Netherland was the most unstable market in terms of export quantity having the highest instability index i.e. 215.56 per cent followed by Yemen (209.76 %) and Turkey (196.53 %) in period I. But in case of export value, the higher fluctuations were registered by Turkey (211.52 %) and Bangladesh (196.53 %) in the same period. Yemen and Netherland were the most stable market in terms of unit price having the lowest instability i.e. 1.24 per cent and 3.95 per cent in period I.

The instability indices of all countries showed declining trend in period II as compared to the period I. Indonesia emerged as a most unstable market as it recorded the highest instability in terms of export quantity (190.23 %) and export value (191.39 %) in period II. But in case of export unit price, Korea showed higher variations i.e. 188.01 per cent followed by Indonesia (107.40 %) in the same period.

Yemen was the most unstable market in terms of export quantity (158.38 %) and export value (161.69 %); however, Nepal recorded lowest fluctuations having instability indices 39.45 per cent and 38.39 per cent per annum, respectively during period III. Korea registered higher fluctuations i.e. 131.97 per cent in unit price realized whereas; Nepal was the most stable market having the lowest instability i.e. 11.46 per cent in period III.

Table 4 .17: Country wise Instability indices of wheat exported from India **(Per cent)**

Sr. No.	Particulars		UAE	Netherland	Yemen	Jordan	Korea	Bangladesh	Turkey	Other	Total
	Period-I										
1	**Export Quantity**	**Mean**	26856.17	20320.99	36164.37	42158.89	26329.10	23896.34	13880.63	91338.51	280945.01
		CV	129.81	238.83	223.29	187.21	210.43	181.23	200.75	144.01	140.26
		CDVI	119.83	215.56	209.76	162.34	176.02	134.45	196.53	121.46	117.68
2	**Export Value**	**Mean**	3870.20	5061.59	9617.38	4716.44	2911.76	3719.33	2263.40	13820.92	40553.24
		CV	153.54	182.08	175.26	164.50	179.65	198.44	215.29	163.87	162.23
		CDVI	150.34	170.41	173.89	159.16	169.21	197.56	211.52	162.58	133.84
3	**Export Unit Price**	**Mean**	133.32	176.55	169.13	141.51	42.45	211.64	176.43	155.73	153.73
		CV	124.78	5.52	1.72	34.81	172.23	60.60	42.21	21.61	23.67
		CDVI	116.99	3.95	1.24	24.13	113.72	36.27	30.18	10.94	11.98
	Period-II		**Sri Lanka**	**UAE**	**Indonesia**	**Philippines**	**Bangladesh**	**Korea**	**Yemen**	**Other**	**Total**
1	**Export Quantity**	**Mean**	60207.52	118012.02	132741.41	161807.68	538835.53	63610.74	72803.93	255057.33	1403076.15
		CV	174.45	119.81	192.41	170.53	107.56	132.72	152.33	116.63	113.50
		CDVI	174.09	69.14	190.23	126.55	78.21	87.31	147.07	56.98	57.35
2	**Export Value**	**Mean**	7864.44	14814.84	14961.36	17114.69	70248.08	6325.86	9189.83	32262.10	172781.19
		CV	183.28	121.00	192.29	160.61	111.10	133.60	163.08	113.07	110.10
		CDVI	117.39	72.67	191.39	118.77	85.43	86.96	140.96	59.06	58.89
3	**Export Unit Price**	**Mean**	116.69	151.01	70.28	102.59	122.56	143.51	61.70	179.62	172.77
		CV	**87.28**	**61.81**	**114.88**	**95.86**	**66.76**	**189.15**	**110.75**	**35.54**	**38.29**
		CDVI	86.92	60.07	107.40	90.82	63.25	188.01	75.05	12.75	14.26
	Period-III		**Nepal**	**Bangladesh**	**UAE**	**Indonesia**	**Djibouti**	**Yemen**	**Korea**	**Other**	**Total**
1	**Export Quantity**	**Mean**	104444.12	567334.54	181596.05	105541.00	80027.52	91825.39	187498.54	425836.95	1744104.11
		CV	74.94	137.13	135.74	160.40	205.36	193.27	206.62	146.91	141.32
		CDVI	39.45	82.56	133.20	111.97	92.79	158.38	85.90	134.42	137.22
2	**Export Value**	**Mean**	26725.01	155864.10	52458.22	30839.49	23687.24	26927.28	55595.09	127266.65	499363.08
		CV	74.94	137.13	135.74	160.40	205.36	193.27	206.62	146.91	141.32
		CDVI	38.39	84.74	134.99	113.92	80.59	161.69	82.06	146.65	140.10
3	**Export Unit Price**	**Mean**	263.63	238.98	424.45	246.90	212.97	114.88	133.62	331.05	289.04
		CV	12.16	35.75	89.91	90.86	70.67	128.74	135.32	16.48	13.58
		CDVI	11.46	32.38	79.72	87.33	65.32	105.78	131.97	16.41	13.52

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10 **Period III:** 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
CV =Coefficient of Variation (per cent per annum), **CDVI** = Cuddy Della Valle's Instability Index (per cent per annum),
Export Quantity = (tones**), Export Value= (**1000 US$), **Export Unit Price= (**US$/ tones)

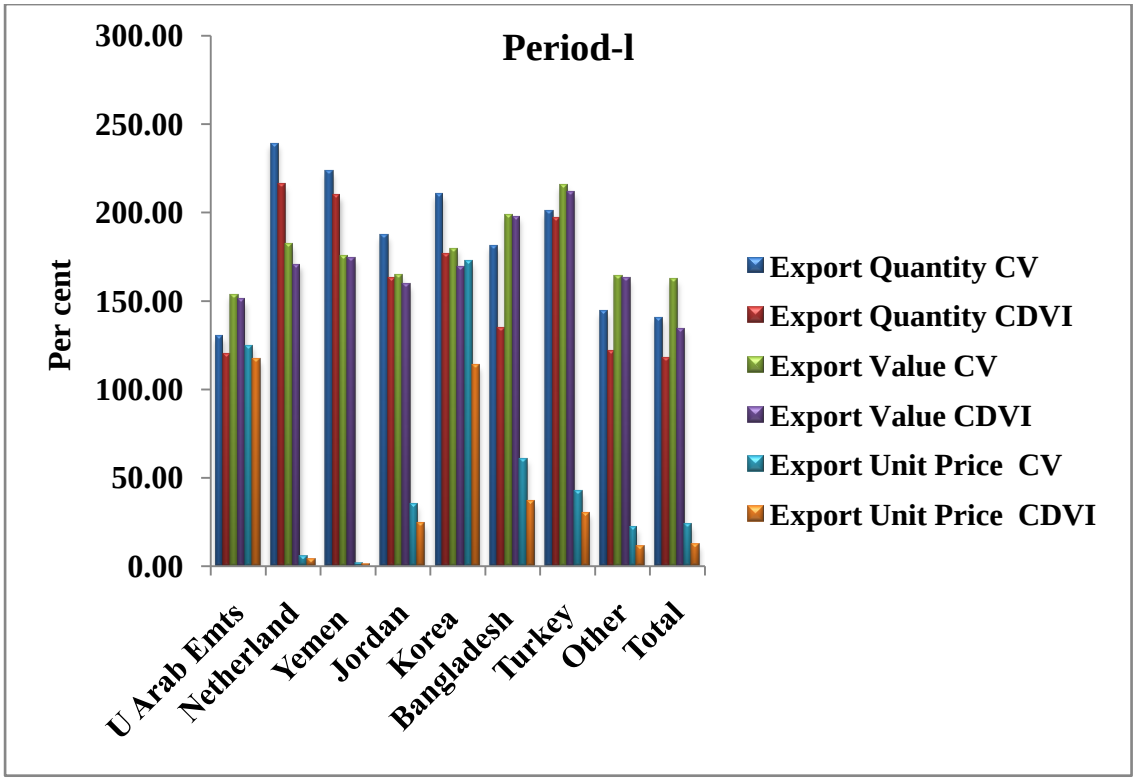

Figure 4.25: Country wise instability indices wheat export from India for Period- I

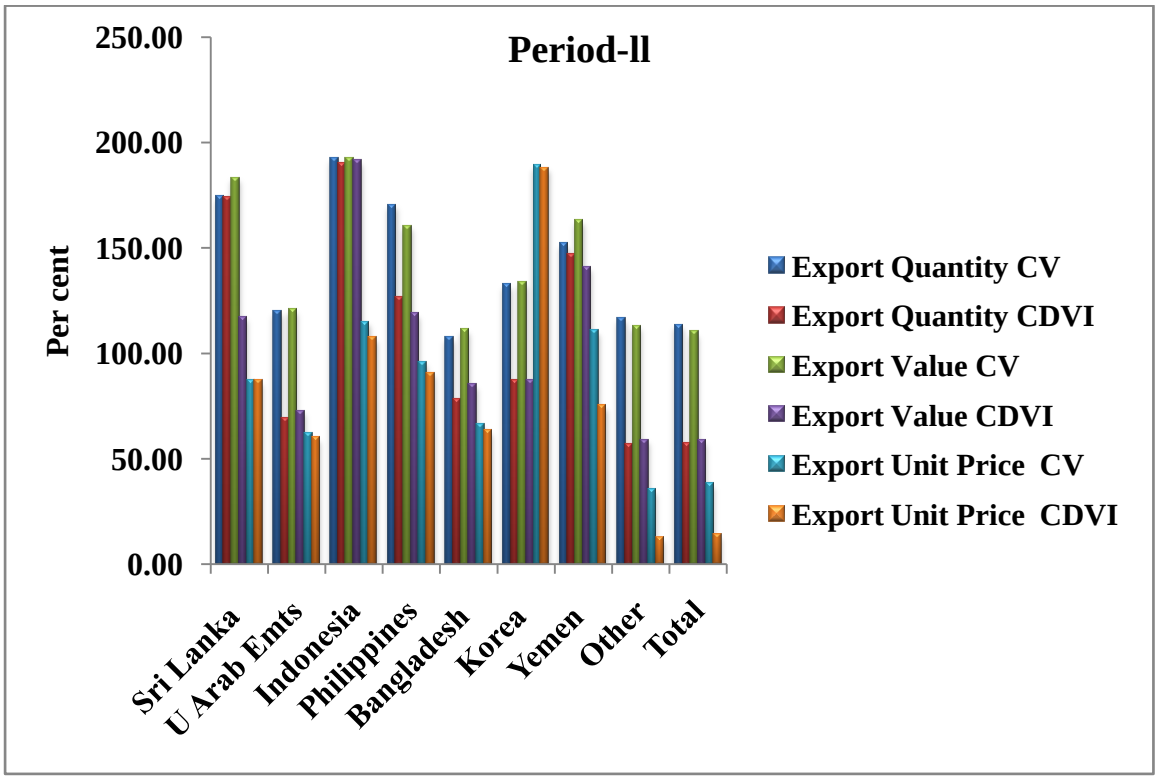

Figure 4.26: Country wise instability indices wheat export from India for Period- II

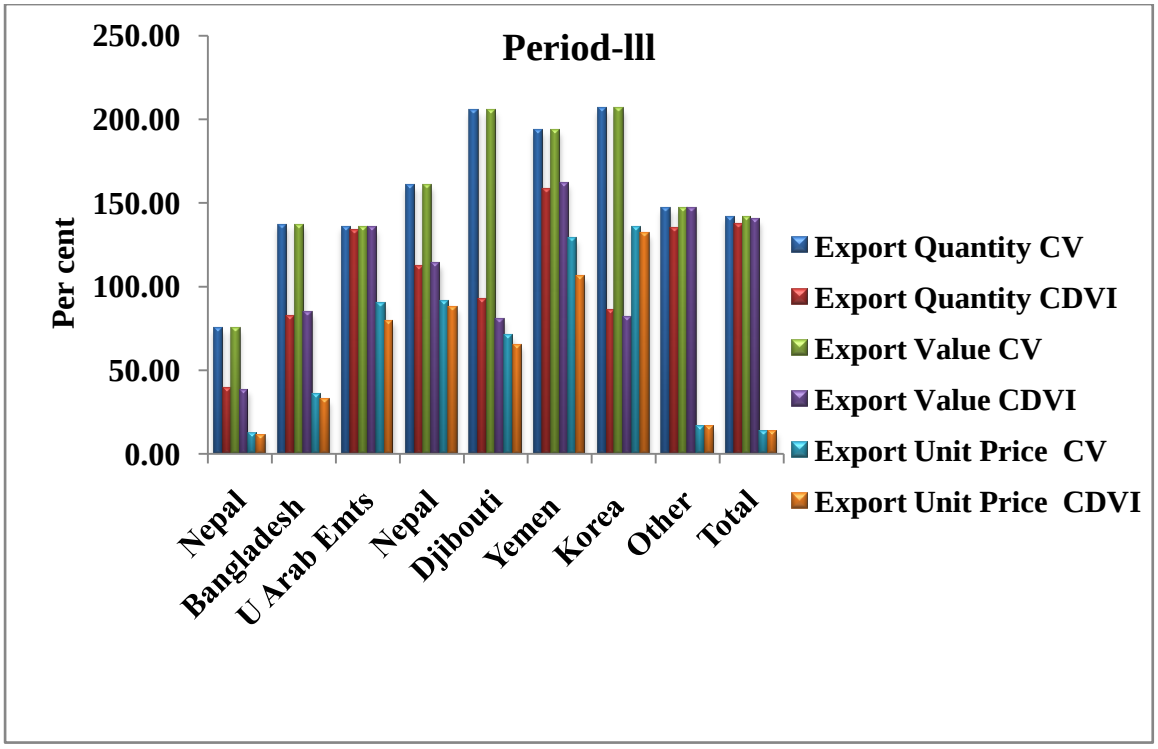

Figure 4.27: Country wise instability indices wheat export from India for Period- III

4.2.18: Country wise Instability indices of rice exported from India

The country wise instability indices of rice are reported in Table 4.18, Fig. 4.28, 4.29 and 4.30. The results showed that, Indonesia registered the highest variations in terms of export quantity and unit price with CDVI, 280.13 per cent and 123.51 per cent in period I, respectively. On the other hand less variations in unit price of rice were realized in Bangladesh (30.94 %) followed by Russia (40.04 %) in this period.

The instability indices in terms of export quantity and export value for Cote D Ivoire were 103.67 per cent and 128.48 per cent per annum, respectively in period II. It showed that, highest fluctuations in these two variables were highest among the top destinations of Indian rice exports in period II. Whereas, Nepal was most unstable market in terms of unit price with highest instability i.e. 76.09 per cent in the same period.

Nepal became more stable market in period III in terms of quantity, value and unit price as the instability indices were 30.94, 30.72 and 6.03, respectively. In contrary, Bangladesh registered the highest instability indices i.e. 123.51, 118.70 and 33.56 per cent, respectively in the same period.

Table 4.18: Country wise Instability indices of rice exported from India **(Per cent)**

Sr. No.	Particulars		Bangladesh	Saudi Arab	South Africa	Russia	Sri Lanka	Kenya	Indonesia	Other	Total
	Period-I										
1	Export Quantity	Mean	468853.343	97092.579	152963.874	79117.62	53254.511	58999.57	107695.564	528209.276	1546186.33
		CV	161.85	71.37	123.11	122.34	140.99	204.36	302.87	83.97	108.11
		CDVI	148.83	35.48	78.45	94.37	137.14	197.40	280.13	63.16	66.72
2	Export Value	Mean	124227.16	112377.50	94386.12	187167.02	294083.83	735458.48	295156.47	1034592.94	2881741.94
		CV	66.47	80.60	95.96	110.62	61.43	75.69	73.18	70.54	55.43
		CDVI	57.62	79.01	91.10	103.67	47.52	68.64	60.38	61.58	48.50
3	Export Unit Price	Mean	478863.20	589593.99	311098.27	335654.68	596702.15	233471.40	487208.97	3039194.34	6071787.01
		CV	49.86	53.17	59.53	47.05	51.35	54.53	128.34	37.48	41.44
		CDVI	30.94	43.34	45.47	40.04	44.37	53.61	123.51	31.73	34.46
	Period-II		Saudi Arab	UAE	Nepal	Cote D Ivoire	South Africa	Bangladesh	Nigeria	Other	Total
1	Export Quantity	Mean	124227.16	112377.50	94386.12	187167.02	294083.83	735458.48	295156.47	1034592.94	2881741.94
		CV	74.14	131.42	116.82	143.54	77.94	109.42	82.21	76.79	78.27
		CDVI	57.62	79.01	91.10	103.67	47.52	68.64	60.38	61.58	48.50
2	Export Value	Mean	40422.03	45085.15	16808.67	38390.31	61524.57	169157.96	64916.54	223569.18	653990.80
		CV	74.14	131.42	116.82	143.54	77.94	109.42	82.21	76.79	78.27
		CDVI	68.71	117.14	100.51	128.48	66.54	104.11	68.97	76.27	76.33
3	Export Unit Price	Mean	477.34	436.30	252.33	201.75	259.65	283.59	314.99	302.61	265.00
		CV	69.02	78.25	76.21	65.89	63.78	60.42	81.36	76.91	55.46
		CDVI	66.97	41.41	76.09	38.51	57.03	59.61	67.39	69.60	29.66
	Period-III		Nepal	Benin	Guinea	Cote D Ivoire	Senegal	South Africa	Bangladesh	Other	Total
1	Export Quantity	Mean	478863.20	589593.99	311098.27	335654.68	596702.15	233471.40	487208.97	3039194.34	6071787.01
		CV	49.86	53.17	59.53	47.05	51.35	54.53	128.34	37.48	41.44
		CDVI	30.94	43.34	45.47	40.04	44.37	53.61	123.51	31.73	34.46
2	Export Value	Mean	166306.98	230938.60	113811.53	122438.71	180093.61	89132.23	193150.38	1332942.23	2428814.27
		CV	55.00	55.28	58.25	45.73	49.49	57.21	127.35	37.40	41.20
		CDVI	30.72	45.96	44.29	39.21	43.01	56.88	118.70	32.01	34.59
3	Export Unit Price	Mean	338.86	389.00	334.79	373.51	276.08	381.92	460.79	462.11	411.75
		CV	10.79	8.50	35.71	7.89	36.39	8.88	36.01	16.73	9.64
		CDVI	6.03	7.07	27.15	6.77	31.62	8.83	33.56	14.32	8.09

Note: **Period I:** 1990-91 to 1999-00; **Period II:** 2000-01 to 2009-10**Period III:** 2010-11 to 2019-20; **Overall:** 1990-91 to 2019-20
CV =Coefficient of Variation (per cent per annum), **CDVI** = Cuddy Della Valle's Instability Index (per cent per annum), **Export Quantity = (**tones**),**
Export Value= (1000 US$), **Export Unit Price= (**US$/ tones)

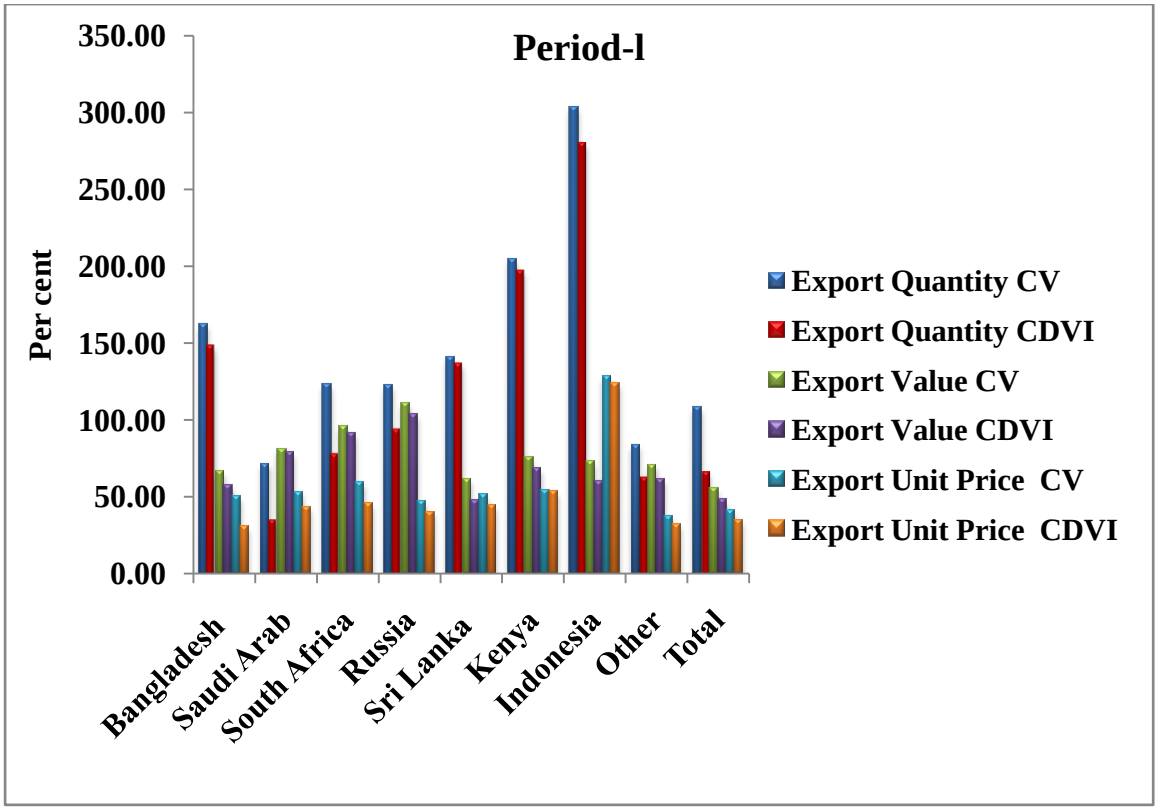

Figure 4.28: Country wise instability indices rice export from India for period – l

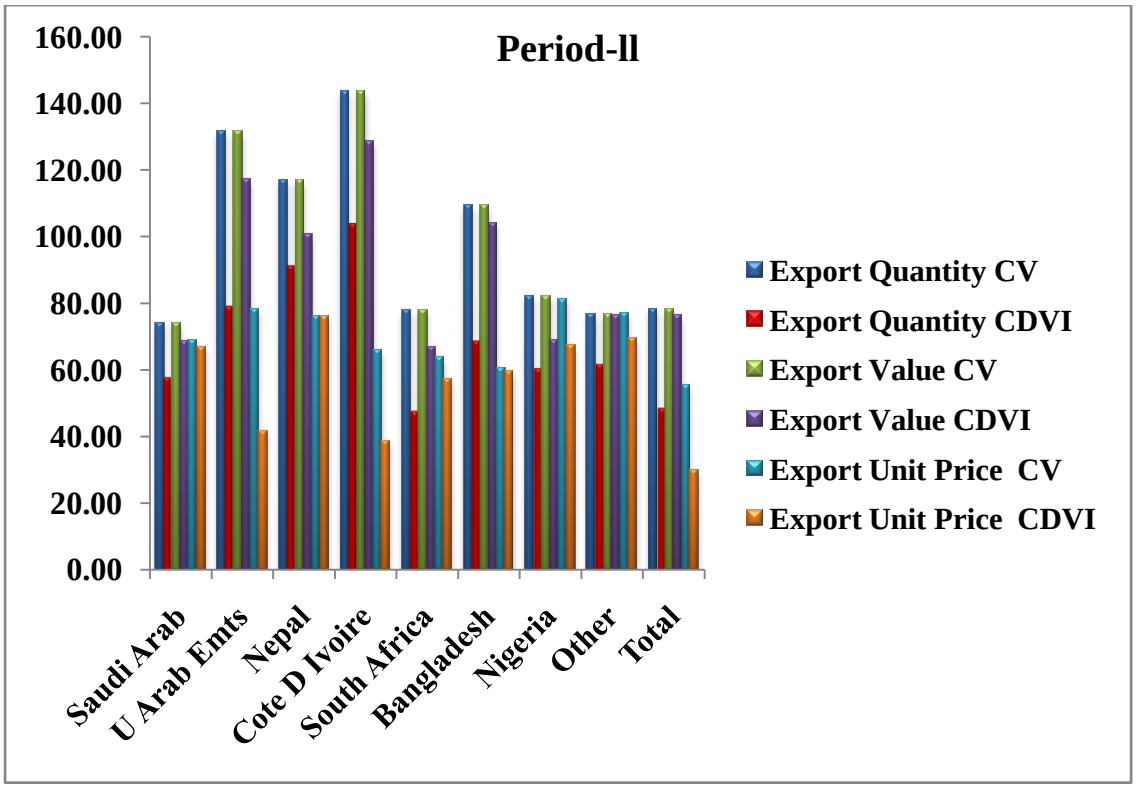

Fig 4.29: Country wise instability indices rice export from India for period – ll

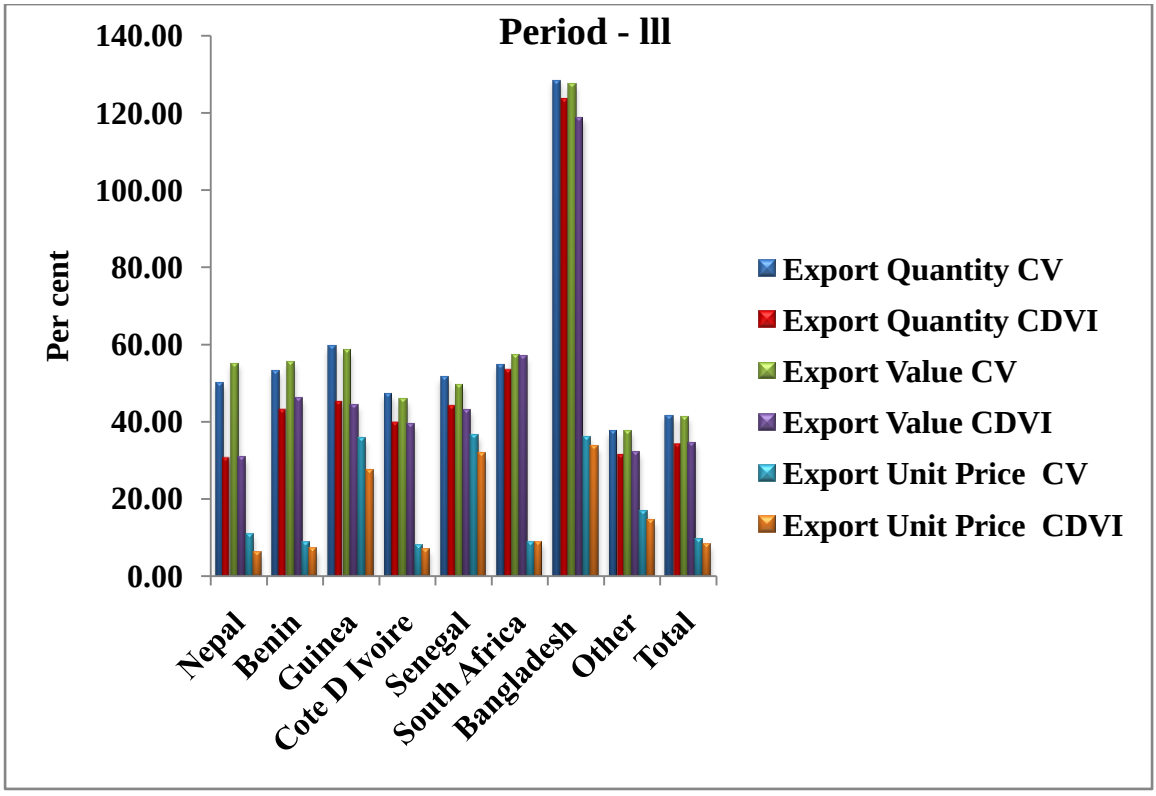

Figure 4.30: Country wise instability indices rice export from India for period – lll

4.3 Export Performance Ratio of maize

The Export Performance Ratio (EPR) was estimated to examine the comparative advantage of India using the method suggested by Balassa (1965). Since Export Performance Ratio is based on observed pattern of trade flows, it is also called Revealed Comparative Advantage (RCA). If EPR/RCA is greater than unity, the country has the comparative advantage in export of the concerned commodity and vice versa. As suggested by Laursen (1998), RCA was made symmetric by obtaining the index as (RCA-1/RCA+1). This index is known as Revealed Symmetric Comparative Advantage (RSCA) and varies from -1 to +1.

4.3.19: Export Performance of Maize in India

The Export Performance Ratio (EPR) for export of maize was estimated to compare the export comparative advantage and disadvantage of India and is presented in Table 4.19. It can be viewed from table that, the RCA values were 0.07, 0.80, 0.76 and 0.55 during periods I, II, III and overall period, respectively. The estimated RCAs were less than unity. In addition to this, the negative values of RSCA (-0.46) gave a clear indication of comparative disadvantage of Indian maize, which was increased over the period of time. The decreasing trend of RCAs in recent years indicated declined export comparative advantage of maize in India over the period of time. It revealed the fact that, India was not comparatively disadvantage in maize export throughout the study period.

The Indian maize export was less comparative advantages due to the low production and less productivity of seed variety over last three decade. Indian maize became non-competitive in the international market due to relatively weak international prices. The global prices fell down in which led to fall in subsequent external demand and it pushed local prices lower than MSP. Malhotra (2017) reported that, Indian poultry sector has been growing around 8 to 10 percent annually over last decade and cattle feed which accounts 63 per cent of total maize consumption and nearly 8 per cent of maize for human consumption in India. Foreign manufacturers in India have largely focused on the domestic market, instead of treating it as a low-cost, high-quality manufacturing base for exports. This was the main reason behind the failure (ANGRAU Crop Outlook Reports of Andhra Pradesh MAIZE – January to December 2021).

India has witnessed a jump in maize exports from 2007 and found comparative advantage up to 2014. The global prices had come down in 2014-15 which lead to fall

in subsequent external demand having pushed local prices to lower than MSP, while in 2015-16 the Shortage in domestic production pushed prices above international markets, thus making maize exports unviable in 2015 and 2016.

Table 4.19: Export Performance of Maize in India

Period	Year	RCA	RSCA
Period I	1990-91	0.50	-0.33
	1991-92	0.00	-1.00
	1992-93	0.00	-1.00
	1993-94	0.04	-0.93
	1994-95	0.04	-0.93
	1995-96	0.03	-0.95
	1996-97	0.06	-0.88
	1997-98	0.00	-0.99
	1998-99	0.00	-0.99
	1999-00	0.01	-0.98
Average(Period I)		**0.07**	**-0.90**
Period-II	2000-01	0.06	-0.89
	2001-02	0.18	-0.69
	2002-03	0.11	-0.80
	2003-04	0.57	-0.27
	2004-05	1.19	0.09
	2005-06	0.46	-0.37
	2006-07	0.53	-0.30
	2007-08	1.53	0.21
	2008-09	1.69	0.26
	2009-10	1.65	0.25
Average (Period II)		**0.80**	**-0.25**
Period-III	2010-11	1.76	0.27
	2011-12	1.39	0.16
	2012-13	1.30	0.13
	2013-14	0.94	-0.03
	2014-15	0.80	-0.11
	2015-16	0.28	-0.56
	2016-17	0.26	-0.59
	2017-18	0.29	-0.55
	2018-19	0.37	-0.46
	2019-20	0.20	-0.66
Average(Period III)		**0.76**	**-0.24**
Overall Period		**0.55**	**-0.46**

The significant increase in domestic production of the maize crop is the major option for improvement of maize export trade. Also the export price of maize must compete with the global prices. The domestic consumption and exchange rate found to be non-significant in affecting the maize exports from India. The reason for this may be slight fluctuations in consumption of maize and exchange rate over the years (Geetha and Srivastava, 2019).

4.3.20 Export Performance Ratio of wheat

Indian wheat had a comparative disadvantage as the estimated RCAs were less than unity during entire study period **(**Table 4.20). The RCA values were 0.21, 0.86, 0.37 and 0.48 during periods I, II, III and overall period, respectively. The estimated RCAs were less than unity. The average values of RSCA were -0.73, -0.34, -0.59 and -0.55 in first, second, third and overall period, respectively.

Table 4.20: Export Performance of Wheat in India

Period	Year	RCA	RSCA
Period I	1990-91	0.12	-0.79
	1991-92	0.49	-0.34
	1992-93	0.03	-0.95
	1993-94	0.00	-1.00
	1994-95	0.12	-0.79
	1995-96	0.54	-0.30
	1996-97	0.78	-0.12
	1997-98	0.00	-1.00
	1998-99	0.00	-1.00
	1999-00	0.00	-1.00
Average(Period I)		**0.21**	**-0.73**
Period-II	2000-01	0.54	-0.30
	2001-02	1.61	0.23
	2002-03	1.90	0.31
	2003-04	2.60	0.44
	2004-05	1.44	0.18
	2005-06	0.52	-0.31
	2006-07	0.02	-0.95
	2007-08	0.00	-1.00
	2008-09	0.00	-1.00
	2009-10	0.00	-1.00
Average(Period II)		**0.86**	**-0.34**
Period-III	2010-11	0.00	-1.00
	2011-12	0.14	-0.76
	2012-13	0.97	-0.02
	2013-14	1.27	0.12
	2014-15	0.91	-0.05
	2015-16	0.18	-0.70
	2016-17	0.07	-0.88
	2017-18	0.07	-0.88
	2018-19	0.05	-0.90
	2019-20	0.07	-0.87
Average(Period III)		**0.37**	**-0.59**
Overall Period		**0.48**	**-0.55**

The negative values of RSCA gave a clear indication of comparative disadvantage of Indian wheat, which was increased over the period of time. The decreasing trend of RCAs in recent years indicated declined export. Wheat was

comparatively disadvantages in India over the period of time. It revealed the fact that, India was not comparatively advantage in wheat export throughout the study period.

4.3.21 Export Performance Ratio of rice

The Export Performance Ratio (EPR) for export of rice was estimated to compare the export comparatively advantages or disadvantages of India presented in Table 4.21.

Table 4.21: Export Performance of Rice in India

Period	Year	RCA	RSCA
Period-I	1990-91	8.11	0.78
	1991-92	10.02	0.82
	1992-93	9.95	0.82
	1993-94	9.85	0.82
	1994-95	9.29	0.81
	1995-96	17.83	0.89
	1996-97	11.13	0.84
	1997-98	11.21	0.84
	1998-99	15.76	0.88
	1999-00	9.86	0.82
Average(Period I)		**11.30**	**0.83**
Period-II	2000-01	9.76	0.81
	2001-02	10.65	0.83
	2002-03	16.97	0.89
	2003-04	12.03	0.85
	2004-05	16.44	0.89
	2005-06	12.04	0.85
	2006-07	10.57	0.83
	2007-08	12.32	0.85
	2008-09	9.12	0.80
	2009-10	8.41	0.79
Average (Period II)		**11.83**	**0.84**
Period-III	2010-11	7.18	0.76
	2011-12	8.37	0.79
	2012-13	9.95	0.82
	2013-14	12.55	0.85
	2014-15	13.58	0.86
	2015-16	14.18	0.87
	2016-17	14.79	0.87
	2017-18	15.75	0.88
	2018-19	15.33	0.88
	2019-20	16.71	0.89
Average (Period III)		**12.84**	**0.85**
Overall Period		**11.99**	**0.84**

It can be viewed from table that, the RCA values were 11.30, 11.83, 12.84 and 11.99 during periods I, Period II, period III and overall period, respectively.

The estimated RCAs were higher than unity revealed that, the Indian rice had a comparative advantage during entire study period.

The average values of RSCA were 0.83, 0.84, 0.85 and 0.84 in period I, II, III and overall period, respectively. The positive values of RSCA gave a clear indication of comparative advantage of Indian rice, which was increased over the period of time. It highlighted the fact that, India was comparatively advantage in rice export throughout the study period and India had great potential in rice export globally. Batra and Khan (2005) revealed that India enjoyed comparative advantage in case of rice in the world market. The ban on the exports of non-basmati rice while permitting the export of basmati rice in the recent past might also have contributed to expansion of area under basmati rice.

Agrawal (2021) found that India has a competitive advantage in rice export and Indian prices are very economic which makes massive export of rice possible. The rice commodity is larger export cereal of India from 2008 to 2014-15 it was seen that rice export increased due to bumper crops of good quality and domestic production. During 2016 to 2018 a down fall in the export of rice was observed in India due to tight supplies and growing domestic demand.

The technologies developed through new researches and strategies would help in enhancing the production and quality of rice which will in turn help in maintaining global standards and demand for rice export. Still there is a need to develop technology to help farmer yield better quality of rice in large quantities to eliminate the dependency on imports of rice. Indian rice showed strong export performance during the past years (1990-91 to 2019-2020)

The Study concludes that the rice export performance achieved in recent past years by India is significant and it has proved by facts and figures that India has the potential to become a biggest rice exporter in global market in years to come. India can improve its current export performance by implementing new steps and initiatives, like developing the varieties, revered for the drought-tolerance so that domestic production does not suffer and thus exports.

4.4 Export competitiveness of maize

The export competitiveness of maize was analyzed using Nominal Protection Coefficient (NPC). The NPC basically helps in measuring the divergence of domestic price from international price and thus determines the degree of export competitiveness of a commodity (Kumar, 2008). The underlying rationale is that such divergence represents the presence of market interventions such as taxes, subsidies and other policy instruments. If NPC is less than 0.5, it is highly competitive and if it ranged between 0.5 and 1.0, it can be judged as moderately competitive. The commodity is not competitive for export if it exceeds unity (Srikalaa *et al.,* 2017). If NPC is greater than one, then the commodity is protected, compared to the situation that what would prevail under free trade and if NPC is less than one the commodity is not protected.

4.4.22: Nominal Protection Coefficient (NPC) of Maize

The estimates nominal protection coefficient (NPC) of maize was estimated for the periods I, II, III and overall period and results of the analysis are presented in Table 4.22. The results indicated that, the NPC values of maize was observed to be 0.76 during the overall period which implied that, maize was moderately competitive in global market as farmers received less price in domestic market (867.14 Rs/Qtl) than the global price (1135.37 Rs/Qtl). It indicated that, Indian maize trade was advantageous. Hence, the hypothesis i.e. Indian maize have better competitiveness in International market has been proved. The result were in line with the findings of Kolhe *e. al.*, (2021) in which estimated value of NPC of maize export was 0.86 which implied that, maize experienced moderately export competitiveness in international market.

The period wise analysis showed that, the value of NPC for maize in period I was 0.38 which indicated that, maize was highly competitive in global market as the domestic price (349.92 Rs/Qtl) was quite less than the global price (924.14 Rs/Qtl). But the situation was changed in second period; as NPC of maize export was 1.02 which showed that, Indian maize has non-competitive market and it was protected from the distorted world prices. The NPC values witnessed an increasing trend, especially during 2000-01 to 2006-07 due to the increasing average domestic price and declining international price which resulted in an erosion of competitiveness. In period III, the NPC of maize export was 0.85 which showed that, market was moderately competitive as international price (1663.73 Rs/Qtl) was greater than

domestic price (1416.70 Rs/Qtl). In this period, the domestic prices of maize were consistently lower than the international prices proved that, Indian maize trade was advantageous except in the year 2018-19.

Table 4.22: Nominal Protection Coefficient (NPC) of Maize (Rs/Qtl)

Period	Year	Domestic Price	International Price	NPC
Period I	1990-91	190	314.41	0.60
	1991-92	268.33	589.89	0.45
	1992-93	357.8	547.06	0.65
	1993-94	230	362.13	0.64
	1994-95	361	439.21	0.82
	1995-96	386	585.94	0.66
	1996-97	417	670.58	0.62
	1997-98	422.66	1009.50	0.42
	1998-99	383	901.25	0.42
	1999-00	483.41	3821.39	0.13
Average (Period-I)		**349.92**	**924.14**	**0.38**
Period II	2000-01	583.33	840.53	0.69
	2001-02	716.67	802.81	0.89
	2002-03	628	866.45	0.72
	2003-04	740	652.44	1.13
	2004-05	800	665.21	1.20
	2005-06	1100	752.48	1.46
	2006-07	1200	782.63	1.53
	2007-08	758	895.78	0.85
	2008-09	906	954.11	0.95
	2009-10	916	969.95	0.94
Average (Period-II)		**834.80**	**818.24**	**1.02**
Period III	2010-11	1031	1115.94	0.92
	2011-12	1208	1337.63	0.90
	2012-13	1341	1482.01	0.90
	2013-14	1285	1513.23	0.85
	2014-15	1267	1428.90	0.89
	2015-16	1398	1664.90	0.84
	2016-17	1260	1818.89	0.69
	2017-18	1267	1741.23	0.73
	2018-19	2204	1780.19	1.24
	2019-20	1906	2754.37	0.69
Average (Period-III)		**1416.70**	**1663.73**	**0.85**
Overall Period		**867.14**	**1135.37**	**0.76**

4.4 Export competitiveness of wheat

The results of nominal protection coefficient (NPC) for wheat are presented in Table 4.23. On pursuing the table, Indian wheat was found to be not competitive in global market as NPC value of wheat was 1.05 (exceeds unity) during the overall period. This implied that wheat was possibly protected in entire period.

4.4.23: Nominal Protection Coefficient (NPC) of wheat

The NPC for wheat was 1.00 and 0.96 during period I and period III which showed that, wheat was moderately competitive.

Table 4.23: Nominal Protection Coefficient (NPC) of wheat (Price in Rs/Qtl)

Period	Year	Domestic Price	International Price	NPC
Period I	1990-91	299.58	223.20	1.34
	1991-92	322.33	240.15	1.34
	1992-93	382	277.82	1.37
	1993-94	466.66	529.43	0.88
	1994-95	446.66	488.76	0.91
	1995-96	475	579.89	0.82
	1996-97	548	609.53	0.90
	1997-98	563.88	825.40	0.68
	1998-99	608	771.04	0.79
	1999-00	365	825.40	0.44
Average (Period-I)		**456.90**	**456.90**	**1.00**
Period II	2000-01	796	510.25	1.56
	2001-02	735.5	502.08	1.46
	2002-03	752	479.36	1.57
	2003-04	741	584.19	1.27
	2004-05	752	726.52	1.04
	2005-06	779	747.18	1.04
	2006-07	1078	758.06	1.42
	2007-08	1050	1009.86	1.04
	2008-09	1173	1300.39	0.90
	2009-10	1310	1181.82	1.11
Average (Period-II)		**916.65**	**779.97**	**1.18**
Period III	2010-11	1449	1773.73	0.82
	2011-12	1367	1381.40	0.99
	2012-13	1363	1616.16	0.84
	2013-14	1672	1665.05	1.00
	2014-15	1825	1707.15	1.07
	2015-16	1630	1592.65	1.02
	2016-17	1676	1686.14	0.99
	2017-18	1782	1934.30	0.92
	2018-19	1780	1878.43	0.95
	2019-20	1936	2020.38	0.96
Average (Period-III)		**1648**	**1725.54**	**0.96**
Overall Period		**1004.12**	**1014.19**	**1.05**

During second period, the NPC was 1.18. In this period, the domestic prices of wheat were consistently higher than international prices and thus, Indian wheat was found to be disadvantageous except in the year 2008-09.

Export of wheat during period-I (1990-91 to 1999-00) subjected to quantitative restrictions (OR) and are permitted against a license. Exports of wheat were banned in the latter half of 1996-97 following sharp rises in domestic prices. Though the ban was lifted and a quantitative ceiling of 1 million tones each during 1998-99 and 1999-2000, 1998-99 Indian wheat has been totally priced out in the global market. That's why in period first Indian wheat was moderately competitive. (CACP report 2000-2001)

Skriner, (2009). Given this, it seems reasonable to propose that there is some correlation between world export growth, world wheat export growth and other international factors and India's export growth that create its impact on export competitiveness of wheat in India. Similar results were reported by Madan and Sharma (2018) where they stated that, wheat was a non-competitive crop as an export commodity. The domestic prices were continuously higher than International prices and estimated values of NPCs were greater than unity i.e. 1.01 during the period 1991-2016.

Export competitiveness of rice

The export competitiveness of rice analyzed by using Nominal Protection Coefficient (NPC) and presented in Table 4.24.

4.4.24: Nominal Protection Coefficient (NPC) of rice

The value of NPC for rice in first period was 0.82 which indicated that, rice was moderately competitive in global market as the domestic price (696.89 Rs/Qtl) was quiet less than the global price (851.20 Rs/Qtl). The NPC of rice rise to 0.91 and 0.92 in period II and period III, respectively. But still Indian rice has moderate competitiveness in global market. During overall period, the NPC values of rice was 0.90 which implied that, rice was moderately competitive in global market as farmers received less price in domestic market (1379.11 Rs/Qtl) than the global price (1538.18 Rs/Qtl). It was not protected in the domestic market as farmers received fewer prices than the global price. Thus, It indicated that, Indian rice have better competitiveness in International market.

Exports of rice were subjected to canalization, minimum export price, and export quota. Erratic domestic production and large consumption of rice also attributed to non-significant growth rate in 1991. Also, frequent ban in exports of non rice due to food security issue reduced the quantity of non- basmati rice exports. India would have to take effective steps to enhance domestic production through expansion of area as well as increased productivity India should launch various export promotion policies. WTO had removed export barriers on non-basmati rice; major boost in export of rice was occurred

Table 4.24: Nominal Protection Coefficient (NPC) of rice (Price in Rs/Qtl)

Period	Year	Domestic Price	International Price	NPC
Period I	1990-91	558	687.07	0.81
	1991-92	536.4	608.74	0.88
	1992-93	580.9	716.03	0.81
	1993-94	623.3	937.57	0.66
	1994-95	693.3	759.06	0.91
	1995-96	670	818.69	0.82
	1996-97	710	967.76	0.73
	1997-98	757	938.59	0.81
	1998-99	974	1008.70	0.97
	1999-00	866	1069.84	0.81
Average (Period-I)		**696.89**	**851.20**	**0.82**
Period II	2000-01	758	1138.74	0.67
	2001-02	852	863.69	0.99
	2002-03	897	882.20	1.02
	2003-04	937	823.65	1.14
	2004-05	966.25	1091.26	0.89
	2005-06	1120	1087.82	1.03
	2006-07	1274	1146.10	1.11
	2007-08	1274	1401.80	0.91
	2008-09	1744	1810.72	0.96
	2009-10	1867	2617.84	0.71
Average (Period-II)		**1168.925**	**1286.38**	**0.91**
Period III	2010-11	2081	2297.13	0.91
	2011-12	2111	2166.02	0.97
	2012-13	2342	2160.41	1.08
	2013-14	2084	2488.36	0.84
	2014-15	2137	2468.99	0.87
	2015-16	2379	2395.12	0.99
	2016-17	1464	2500.42	0.59
	2017-18	2467	2655.70	0.93
	2018-19	2550	2787.66	0.91
	2019-20	3100	2849.73	1.09
Average (Period-III)		**2271.50**	**2476.95**	**0.92**
Overall Period		**1379.11**	**1538.18**	**0.90**

During the same period. Production shortfall, decreasing stock in government central pool and raising internal price forced the government to ban export of non-basmati rice in 2007. But, due to abundantly production of rice during 2011-12, government get rid of the exports ban on non-basmati rice, and India during 2012 became the leading exporter in global markets. And all these consequences from 1990 to 2020 India become moderately competitive in rice export in global market. The main constraint in expanding exports of rice is competitiveness, which in 2000-2001 has suffered erosion due to continuous increases in the costs of Indian rice, while the international prices have been witnessing declining trend.

Indian wholesale prices of rice are far above the currently ruling very low international prices. That was the main cause for period I (1990-91) and period II (2000-10) found moderately competitive. (CACP.2001)

The results were in close agreement with the findings of Goverdan *et al.*, (2014). They stated that, the average NPC of rice was 0.96 during the period 1990-91 to 2009-10 implied its moderate export competitiveness. Yogesh B. (2010) found that rice was fairly competitive in international market under exportable hypothesis for the period of 1993- 94 to 1997-98 and then it became non-competitive upto 2002-2003. He also stated that, as India signed the WTO, it reduces its support in form of subsidies to small and marginal farmers and the market prices in India increased sharply. As a result, Indian price of rice rose sharply and become noncompetitive in market due to artificially lower world prices of U.S. in the rest of the years. Makama *et al.* (2016), Agrawal (2021).

4.5 Direction of Trade of Cereal crops in India

It is important to know the changing export trade across its destinations dynamics of export trend plays an important role to sustain or enhance the current export trend. The dynamics of changes in export trend for annual export data of Cereal crops was studied through estimation of transitional probability matrix for a period of 30 years (1990-91 to 2019-20). These analyses were carried out separately for three sub periods, period I (1990-91 to 1999-00), period II (2000-01 to 2009-10) and period III (2010-11 to 2019-20).

4.5.25 Transitional probability matrix of maize export (Period I: 1990-91 to 1999-00)

The transitional probability matrix for Indian maize importing countries of period I (1990-91 to 1999-00) is presented in Table 4.25 reveals that, during the study period, Sri Lanka remained as the most stable market among the major importers of Indian maize as reflected by the higher probability retention at 0.2882 i.e. the probability that Sri Lank retained its export share over the study period was 28.82 per cent. Sri Lanka lost 71.18 per cent share to Malaysia. Whereas it gained 80.43 per cent share from Iran, 12.20 per cent share from Indonesia, 11.21 per cent share from others and 2.06 per cent share from Malaysia. Thus Nepal was the most reliable and loyal markets for Indian maize.

Table 4.25: Transitional probability matrix of maize export (Period I: 1990-91 to 1999- 00)

Countries	Indonesia	UAE	Sri Lanka	Bangladesh	South Africa	Malaysia	Iran	Other
Indonesia	**0.0000**	0.0000	0.1220	0.0168	0.0000	0.6405	0.1971	0.0236
UAE	1.0000	**0.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sri Lanka	0.0000	0.0000	**0.2882**	0.0000	0.0000	0.7118	0.0000	0.0000
Bangladesh	0.4875	0.1911	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.3213
South Africa	0.0000	0.0000	0.0000	1.0000	**0.0000**	0.0000	0.0000	0.0000
Malaysia	0.0000	0.1261	0.0206	0.1310	0.0000	**0.0000**	0.5889	0.1335
Iran	0.0000	0.0000	0.8043	0.0000	0.0000	0.1531	**0.0000**	0.0425
Other	0.0000	0.0000	0.1121	0.7961	0.0000	0.0000	0.0000	**0.0917**

The minor countries of maize importers, categorized as other countries was found to be the loyal markets after Sri Lanka with the higher probability retention at 0.0917 i.e. the probability that other countries retained its export share over the study

period was 9.17 per cent. Whereas it lost 79.61 per cent of market share to Bangladesh and 11.21 per cent of share to Sri Lanka. It gained 32.13, 13.35, 4.25 and 2.36 per cent share from Bangladesh, Malaysia, Iran and Indonesia, respectively.

Indonesia had retained zero probability of its own share of imports of Indian maize and lost its share to Malaysia, Iran, Sri Lanka, others and Bangladesh to the extent of 64.05, 19.71, 12.20, 2.36 and 1.68 per cent, respectively. It gained 100 per cent share from UAE and 48.75 per cent from Bangladesh.

Similarly, UAE, which also has a zero probability of retention of its own share of imports, lost its 100 per cent share to Indonesia. Whereas, it gained 19.11 per cent share from Bangladesh and 12.61 per cent share from Malaysia.

Bangladesh could not retain its previous market share and lost its major share to Indonesia, others and UAE to the extent of 48.75 per cent, 32.13 per cent and 19.11 per cent, respectively. It gained 100 per cent share from South Africa, 79.61 per cent share from others, 13.10 per cent share from Malaysia and 1.68 per cent share from Indonesia.

South Africa could not retain its previous market share, which has a zero probability of retention of its own share and lost its 100 per cent share to Bangladesh.

Malaysia was also another importer of maize, because it could not retain its original share and lost its major share to Iran, others, Bangladesh, UAE, and Sri Lanka to the extent of 58.89 per cent, 13.35 per cent, 13.10 per cent, 12.61 per cent and 2.06 per cent, respectively. It gained 71.18 per cent share from Sri Lanka, 64.05 per cent share from Indonesia and 15.31 per cent share from Iran.

Iran also could not retain its original share. It lost 80.43 per cent share to Sri Lanka, 15.31 per cent share to Malaysia and 4.25 per cent share to others. Iran gained 58.89 per cent share from Malaysia and 19.71 per cent share from Indonesia.

Therefore, it is clear from the analysis that, Sri Lank was the only country that was found to be the loyal market among the major importing countries of Indian maize during period I. Indonesia, UAE, Bangladesh, South Africa and Iran were the most unstable importers as they could not retain their original share.

4.4.26 Transitional probability matrix of maize export (Period II: 2000-01 to 2009-10)

The transitional probability matrix for Indian maize importing countries of period II (2000-01 to 2009-10) is presented in Table 4.26. The table clearly depicts that, Bangladesh, Vietnam and Malaysia were the loyal markets of Indian maize. Bangladesh was the most stable and loyal market as resembled by the highest probability retention of 0.7588 that interprets that Bangladesh retained its import share over the study period by 75.88 per cent followed by Malaysia and Vietnam which retained 56.36 per cent and 35.94 per cent of their shares over the study period.

Table 4.26: Transitional probability matrix of maize export (Period II: 2000-01 to 2009-10)

Countries	Bangladesh	Vietnam	Malaysia	Indonesia	Taiwan	UAE	Korea	other
Bangladesh	**0.7588**	0.0000	0.1052	0.0542	0.0000	0.0417	0.0000	0.0401
Vietnam	0.0000	**0.3594**	0.1061	0.0000	0.5035	0.0000	0.0310	0.0000
Malaysia	0.0915	0.0000	**0.5636**	0.0000	0.0000	0.0000	0.0000	0.3450
Indonesia	0.0000	0.0000	0.4323	**0.0000**	0.0000	0.0000	0.5677	0.0000
Taiwan	0.0000	0.0000	0.5744	0.0000	**0.0000**	0.4256	0.0000	0.0000
UAE	0.0000	0.0000	1.0000	0.0000	0.0000	**0.0000**	0.0000	0.0000
Korea	0.2368	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.7632
Other	0.0000	0.0536	0.2208	0.1014	0.0247	0.0378	0.0000	**0.5616**

Vietnam had retained 35.94 per cent share of imports of maize and lost share to Malaysia, Taiwan and Korea to the extent of 10.61, 50.35 and 3.10 per cent respectively. It gained very less share from per cent share from other country categories i.e.5.74 per cent.

Malaysia also one of the most loyal importer of maize it probability retention of 56.36 per cent and lost it share to other country categories (34.50 %) and Bangladesh (9.15 %). And gained major share to UAE (100 %), followed by Taiwan (57.44 %), Indonesia (43.23 %), Vietnam (10.61 %), Bangladesh (10.52 %) and other country (22.08 %).

Indonesia unable to import of Indian maize it has zero probability retention of its own share of import, lost it share to Malaysia (43.23 %) followed by Korea (56.77 %) share, it gained small share from Bangladesh (5.42 %) and 10.14 per cent share from other country.

Same condition observed in Taiwan has zero probability retention of its own share of import, lost it share to Malaysia (57.44 %) and UAE (42.56 %), it gained share from Vietnam 50.35 per cent share and from other country categories it share (2.47 %).

UAE could not retain its own share of import, lost 100 percent share to Malaysia. It gained 42.56 per cent share from Taiwan, 4.17 per cent from Bangladesh and 3.78 per cent from other country.

Korea also unable to import of Indian maize had retained zero probability of its own share of import and lost its major share to other country category (76.32 %) and too Korea (23.68 %).

The other countries retained 56.16 per cent of its export share over the study period. And it lost its share to Malaysia (22.08 %), Indonesia (10.14 %) very few lost to Vietnam (5.36 %), Taiwan (2.47 %) and UAE (3.78 %)

Therefore, it is clear from the analysis that, Bangladesh, Vietnam and Malaysia were the only countries that were found to be the loyal markets among the major importing countries of Indian maize during period II. Indonesia, Taiwan, UAE, and Korea were the most unstable importers as they could not retain their original share.

4.4.27 Transitional probability matrix of maize export (Period III: 2009-10 to 2019-20)

The transitional probability matrix for Indian maize importing countries of period III (2009-10 to 2019-20) is presented in Table 4.27.

Table 4.27: Transitional probability matrix of maize export (Period III: 2009-10 to 2019-20)

Countries	Nepal	Bangladesh	Vietnam	Indonesia	Malaysia	Taiwan	Sri Lanka	Other
Nepal	**0.8179**	0.0718	0.0000	0.0000	0.0000	0.0000	0.0000	0.1103
Bangladesh	0.9535	**0.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0465
Vietnam	0.0000	0.0000	**0.6827**	0.1942	0.0955	0.0276	0.0000	0.0000
Indonesia	0.0000	0.3119	0.0000	**0.0000**	0.4692	0.0560	0.0003	0.1626
Malaysia	0.0000	0.0000	0.0000	1.0000	**0.0000**	0.0000	0.0000	0.0000
Taiwan	0.0000	0.0000	0.2874	0.0000	0.5168	**0.1958**	0.0000	0.0000
Sri Lanka	0.0000	0.1537	0.0000	0.0000	0.0000	0.0000	**0.6002**	0.2460
Other	0.0000	0.3907	0.1607	0.0000	0.0788	0.0066	0.0000	**0.3633**

The table clearly depicts that, Nepal, Vietnam, Sri Lanka and Taiwan were the loyal markets of Indian maize. Nepal was the most stable and loyal market as resembled by the highest probability retention of 0.8179 that interprets that Nepal retained its import share over the study period by 81.79 per cent followed by Vietnam, Sri Lanka and Taiwan which retained 68.27 per cent, 60.02 per cent and 19.58 per cent of their shares over the study period. The other countries retained 36.33 per cent of its export share over the study period. Similar results found in Geetha and Srivastava, (2019) reported that the Nepal was the most stable market for maize export among the major countries as reflected by highest probability of retention at 74.39 per cent then followed by Bangladesh with 69.83 per cent, Malaysia, Vietnam Indonesia for the period from 2001 to 2016.

Nepal is the most loyal importer of Indian maize and it retained its original share of 81.79 per cent and lost its share to Bangladesh (7.18 %) and other country categories (11.03 %) and it gained share from Bangladesh 95.35 per cent.

Vietnam was the second most loyal importer which retains 68.27 per cent of its original share, while it lost to its share to Indonesia (19.42 %), Malaysia (9.55 %) and Taiwan (2.76 %). However, it was gain share from Vietnam (28.74 %) and other country categories (16.07 %)

Sri Lanka was the third most loyal importer of maize in period III it has retain 60.02 per cent its original share, it lost its share to Bangladesh (15.37 %) and other country categories (24.60 %) while it gained share from Sri Lanka (0.03 %).

Bangladesh had retained zero probability of its own share of import of Indian maize and lost its major share to Nepal i.e. 95.35 per cent and 4.65 per cent share from other country categories, it gained share from 31.19 per cent from Indonesia, 15.37 per cent from Sri Lanka, 39.07 per cent from other country categories and from Nepal (7.18 %).

Similarly Indonesia could not retain its share it lost its share to Bangladesh (31.16 %), Malaysia (46.92 %), Taiwan (5.60 %), Sri Lanka (0.03 %) and other country (16.26%).it gained major share from Malaysia (100 %) and Vietnam (19.42 %).

Malaysia was also unstable importer it cause zero probability of retention of its own share of importer of Indian maize and lost 100 per cent share to Indonesia and

gained it share from Taiwan (51.68 %) followed by Indonesia (46.92 %) also very few share from other country (7.88 %) and Vietnam (9.55 %)

Taiwan was the loyal importer of maize it was retain 19.58 per cent probability retention and lost its share to Malaysia (51.68 %) and Vietnam (28.74 %) and it gained very few share from Vietnam (2.76 %), Indonesia (5.60 %) and other country categories (0.06 %).

The other countries pooled under 'others' retained 36.33 per cent of its share original share, it lost its share Bangladesh (39.07 %), Vietnam (16.07 %), Malaysia (7.88 %) and Taiwan (0.66 %). However, it gained share from Sri Lanka (24.60 %), Indonesia (0.1626 %), Nepal (11.03 %) and 4.65 per cent share from Bangladesh.

4.5.28 Actual and predicted shares of maize export from India

The actual and estimated shares of maize exported from India to different countries (in percentage term) were shown in Table 28 and fig. 4.31, 4.32, 4.33, 4.34, 4.35, 4.36, 4.37, and 3.48. A comparison of this proportion during the study period revealed that he observed proportions of export shares were consistent with the estimated shares of export, which were derived from the Markov chain process. However, differences have been observed in some years, which could be due to limitation of the model that the present estimates depend only on the previous year.

Observations and the exports also depend on sudden policy changes, leading to a brut increase or decrease in exports to a country.

Table 4.28 presents the actual and predicted values of Indian maize exports to major importers from 2010-11 to 2019-20.

The actual share of Nepal in maize import from India had maximum fluctuation over the study period (2010-11 to 2019-20) on the whole it had increased from 3.40 per cent to 84.67 per cent. Prediction in export of maize share value also showed the same result where it was from 26.08 per cent to 71.82 per cent.

Bangladesh the actual and predicted export of share also showed decreased trend 24.43 per cent to 2.69 per cent and 9.96 per cent to 10.79 per cent, respectively from 2010-11 to 2019-20.

The actual proportion of Vietnam market share of maize export from India showed a decreased trend from 20.16 per cent to 0.51 per cent also the predicted import share had decreased from 16.03 per cent to 2.29 per cent from 2010-11 to 2019-20.

Indonesia imported 16.79 per cent of maize from India and it showed decreased in trend over the period of study 0.01 per cent per annum, the predicted proportion of maize import showed a decreasing trend i.e. decreased from 25.98 per cent to 0.15 per cent from 2010-11 to 2019-20

The actual proportion of Malaysia share of maize had a decreasing trend from 2010-11 to 2019-20i.e. 22.06 per cent to 11.50 per cent and similar trend was observed for predicted share with decrease share from 11.50 per cent to 1.01per cent.

The actual proportion of Taiwan market share of maize had a decreased in trend. The share found to have decreased from 1.56 per cent to 0.01 per cent in 2010-2011.The predicted proportion also had a fluctuating trend i.e. 1.88 to 0.10 per cent

With respect to Sri Lanka, the actual and predicted proportion showed decline in the shares from 0.27 to 0.001 and 0.17 to 0.009 per cent, respectively from 2010-11 to 2019-20.

The actual proportion of India's maize export to other countries showed a fluctuating trend during the overall study period. The actual proportion of share increased from 11.33 per cent during 2010-11 to 12.05 per cent during 2019-20. The predicted proportion had the opposite scene where 8.42 per cent share during 2010-11 increased to 13.84 per cent during 2019-20.

Table 4.28: Actual and predicted shares of Maize export from India (Quantity: Metric Tons)

Countries	Nepal		Bangladesh		Vietnam		Indonesia		Malaysia		Taiwan		Sri Lanka		Other	
Year	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
2010-11	102413.15 (3.40)	785112.61 (26.08)	735581.97 (24.43)	299453.16 (9.950)	606800.60 (20.16)	482542.13 (16.03)	505472.35 (16.79)	781970.65 (25.98)	664158.55 (22.06)	346259.21 (11.50)	47013.00 (1.56)	56523.02 (1.88)	8051.00 (0.27)	4986.81 (0.17)	340932.75 (11.33)	253575.80 (8.42)
2011-12	70205.99 (1.82)	518204.82 (13.44)	483274.28 (12.53)	530081.40 (13.75)	735603.18 (19.08)	645386.91 (16.74)	1060592.73 (27.51)	928984.37 (24.09)	786164.88 (20.39)	721128.50 (18.70)	220984.84 (5.73)	126252.94 (3.27)	2872.40 (0.07)	2047.79 (0.05)	496022.93 (12.86)	383634.53 (9.95)
2012-13	145191.05 (3.03)	227196.85 (4.74)	113735.96 (2.38)	625422.23 (13.06)	1277521.80 (26.68)	1037127.32 (21.66)	1569348.50 (32.77)	1214782.12 (25.37)	966747.56 (20.19)	1087495.21 (22.71)	394496.50 (8.24)	202545.87 (4.23)	15.03 (0.00)	487.92 (0.01)	321271.85 (6.71)	393270.75 (8.21)
2013-14	198217.59 (5.01)	654357.13 (16.55)	516258.80 (13.06)	450019.12 (11.38)	856660.10 (21.66)	683381.71 (17.28)	1003130.88 (25.37)	1064426.39 (26.92)	898103.35 (22.71)	663595.69 (16.78)	167112.00 (4.23)	114638.82 (2.90)	255.00 (0.01)	459.17 (0.01)	314498.88 (7.95)	323358.60 (8.18)
2014-15	243947.08 (8.63)	546540.42 (19.34)	363950.53 (12.88)	440188.98 (15.58)	385023.49 (13.63)	322233.96 (11.40)	917664.05 (32.48)	538912.24 (19.07)	464158.81 (16.43)	509720.33 (18.04)	35387.00 (1.25)	70970.59 (2.51)	109176.06 (3.86)	65812.27 (2.33)	306303.56 (10.84)	331231.82 (11.72)
2015-16	312629.18 (44.79)	432930.96 (62.03)	185877.02 (26.63)	78299.66 (11.22)	1498.28 (0.21)	21311.59 (3.05)	9871.21 (1.41)	33027.48 (4.73)	32736.58 (4.69)	15384.67 (2.20)	1772.00 (0.25)	1750.47 (0.25)	30463.40 (4.36)	18288.48 (2.62)	123099.50 (17.64)	96953.89 (13.89)
2016-17	376391.21 (66.46)	342503.52 (60.48)	36337.77 (6.42)	65075.30 (11.49)	403.05 (0.07)	17502.09 (3.09)	1484.04 (0.26)	12537.85 (2.21)	12459.60 (2.20)	15182.53 (2.68)	15970.00 (2.82)	3738.43 (0.66)	44655.00 (7.88)	26804.34 (4.73)	78651.56 (13.89)	83008.19 (14.66)
2017-18	426667.90 (60.48)	426241.02 (60.42)	81033.26 (11.49)	82214.15 (11.65)	21828.61 (3.09)	35257.83 (5.00)	641.53 (0.09)	23158.89 (3.28)	18920.80 (2.68)	14108.84 (2.00)	4642.80 (0.66)	2326.67 (0.33)	33396.13 (4.73)	20046.01 (2.84)	118382.81 (16.78)	102160.47 (14.48)
2018-19	484927.21 (46.10)	673320.07 (64.01)	290195.67 (27.59)	97095.01 (9.23)	81834.07 (7.78)	81341.46 (7.73)	27.91 (0.00)	36939.05 (3.51)	21050.73 (2.00)	21628.71 (2.06)	3490.00 (0.33)	3948.06 (0.38)	18027.00 (1.71)	10820.60 (1.03)	152303.33 (14.48)	126763.00 (12.05)
2019-20	313322.69 (84.67)	265770.65 (71.82)	9962.19 (2.69)	39930.01 (10.79)	1893.00 (0.51)	8472.24 (2.29)	47.99 (0.01)	559.80 (0.15)	192.27 (0.05)	3740.51 (1.01)	48.00 (0.01)	357.63 (0.10)	1.00 (0.009)	0.61 (0.009)	44598.97 (12.05)	51234.69 (13.84)

Note: Figure in parentheses indicates percentage to total export of maize (A =Actual, P=Predicted)

4.5.29 Projection of Indian Maize Export to Major Importing Countries

The export of Indian maize to different countries which was computed using the transitional probability matrix and presented in Table 4.29. and fig. 4.39, 4.40, 4.41, 4.42, 4.43, 4.44, 4.45, and 4.46. It was projected that during 2020-21, the major markets for Indian maize would be Nepal (69.03 %), Bangladesh (10.61 %) and others (13.48 %).

The projected exports to Nepal have exhibited a decreasing trend in both absolute value and percentage to total export. The projected market share is likely to decrease marginally from 69.03 per cent to 63.00 per cent from 2020-21 to 2023-24. The reason for showing decreasing trend by Nepal was that it had lost its market share to Bangladesh and other countries. Similarly, the projected export of maize to other countries have shown decreasing trend in both absolute value and percentage. The projected market share is likely to decrease from 13.48 per cent to 12.86 per cent from 2020-21 to 2023-24.The remaining major countries like Bangladesh, Vietnam Indonesia, Malaysia Taiwan and Sri Lanka, the projected value shown an increasing trend in both absolute and relative to total export from India. Similar result found by Bansal and Singh (2020) reported that Nepal remained as the most stable market among the major importers of Indian maize and its reflected by the higher probability retention at 84.98 per cent Vietnam, Indonesia and Malaysia are the most reliable and loyal market for Indian maize.

Table 4.29: Projected exports of Maize to major importing countries (Quantity: Tonnes)

Countries	Nepal	Bangladesh	Vietnam	Indonesia	Malaysia	Taiwan	Sri Lanka	Other
2020-21	255450.08 (69.03)	39269.24 (10.61)	14118.96 (3.82)	5385.42 (1.46)	5291.74 (1.43)	672.38 (0.18)	0.54 (0.00)	49877.80 (13.48)
2021-22	246378.70 (66.58)	39503.37 (10.67)	17846.29 (4.82)	8032.97 (2.17)	8150.94 (2.20)	1151.38 (0.31)	1.97 (0.00)	49000.56 (13.24)
2022-23	239182.29 (64.63)	39335.48 (10.63)	20387.57 (5.51)	11615.85 (3.14)	9927.59 (2.68)	1490.68 (0.40)	3.63 (0.00)	48123.12 (13.00)
2023-24	233136.14 (63.00)	39593.85 (10.70)	22078.96 (5.97)	13885.90 (3.75)	11957.54 (3.23)	1822.21 (0.49)	5.72 (0.00)	47585.90 (12.86)

Note: Figures in parentheses indicates percentage to total export of maize

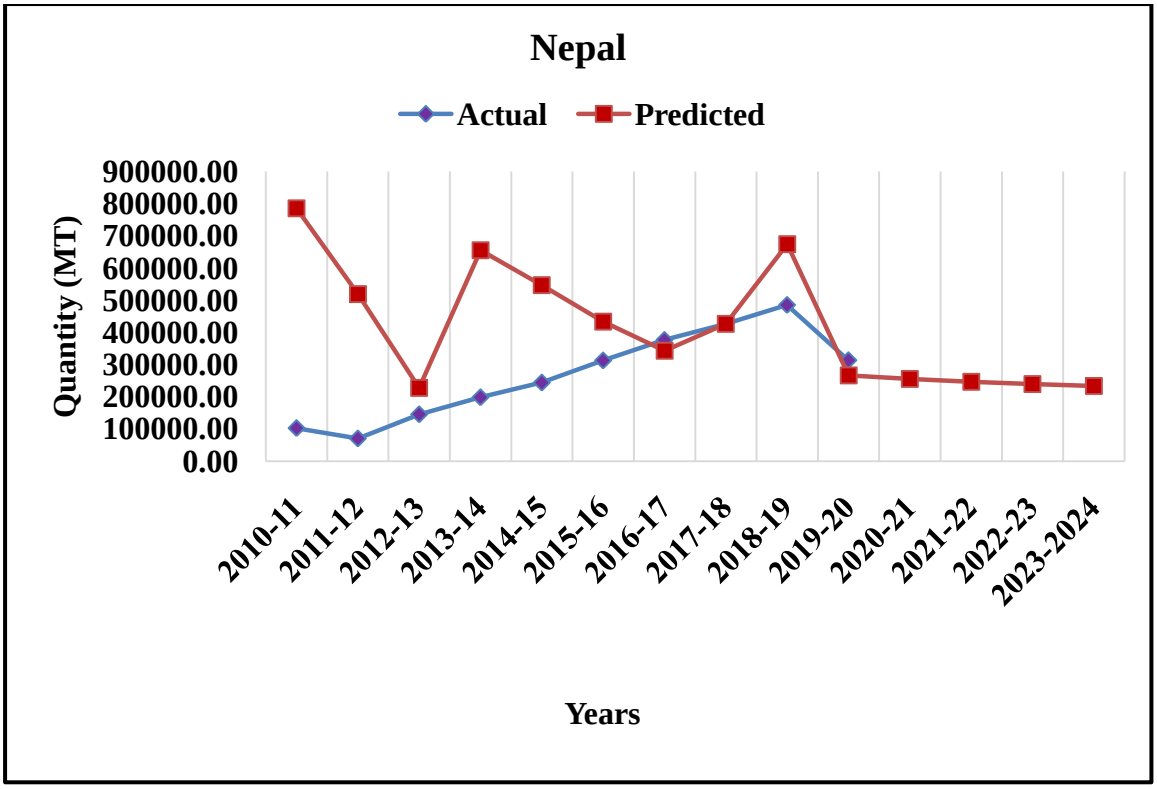

Figure 4.31: Actual and Predicted shares of maize export to Nepal

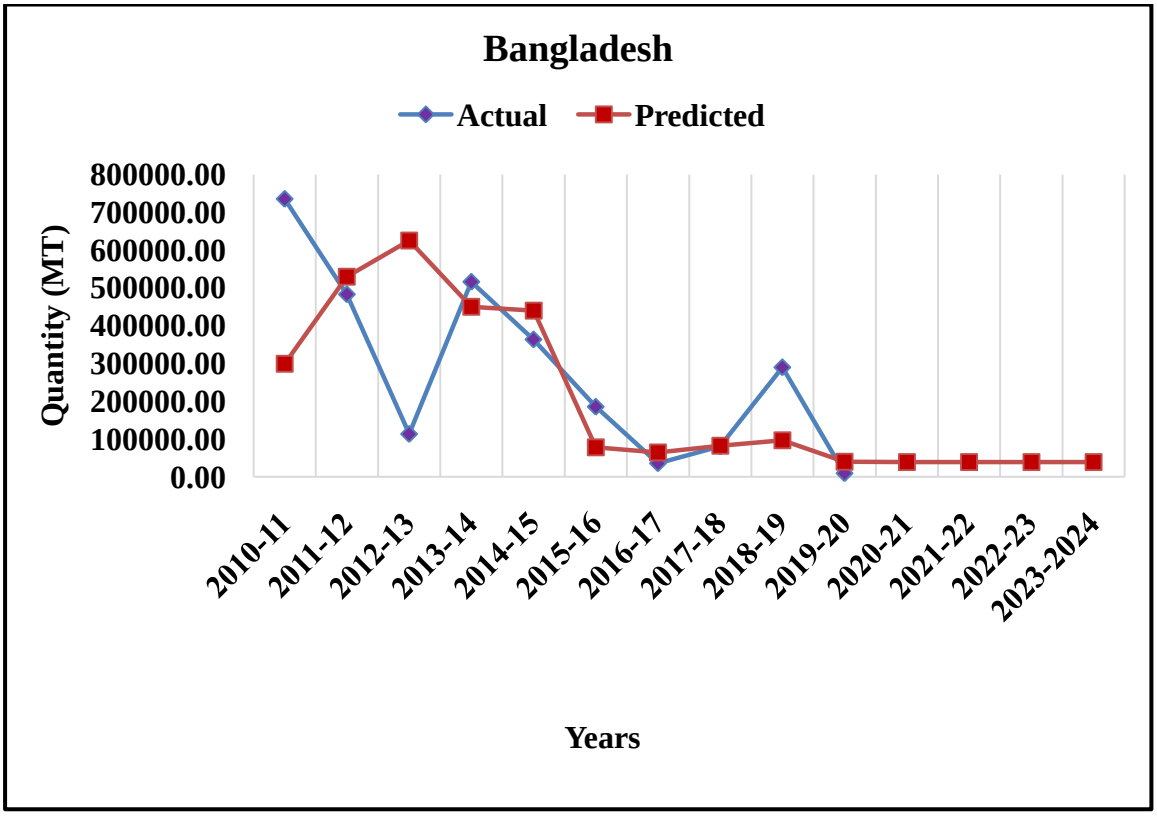

Figure 4.32: Actual and Predicted shares of maize export to Bangladesh

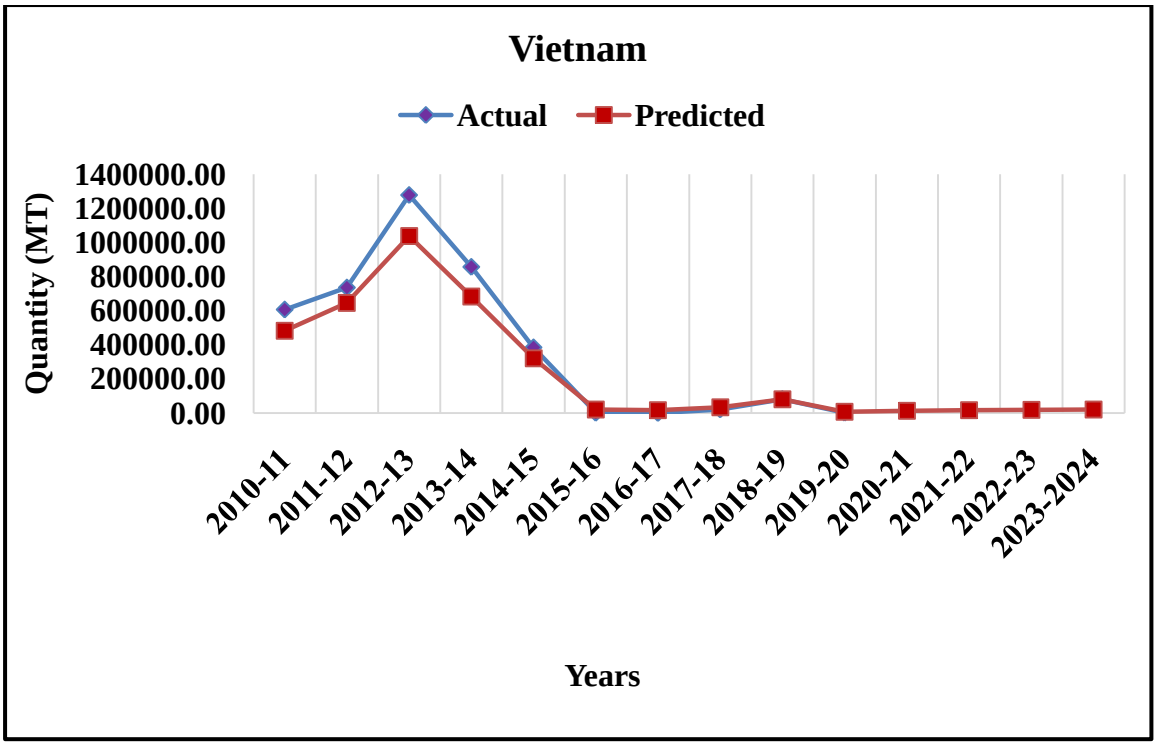

Figure 4.33: Actual and Predicted shares of maize export to Vietnam

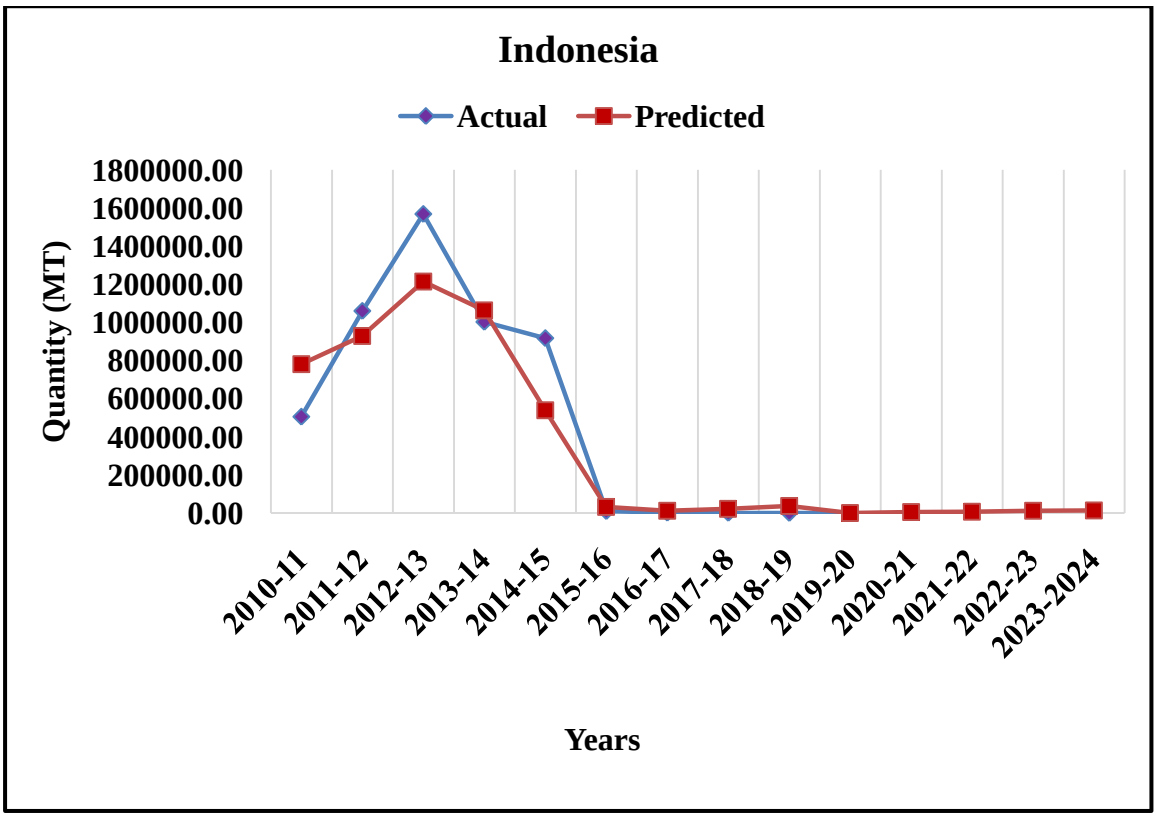

Figure 4.34: Actual and Predicted shares of maize export to Indonesia

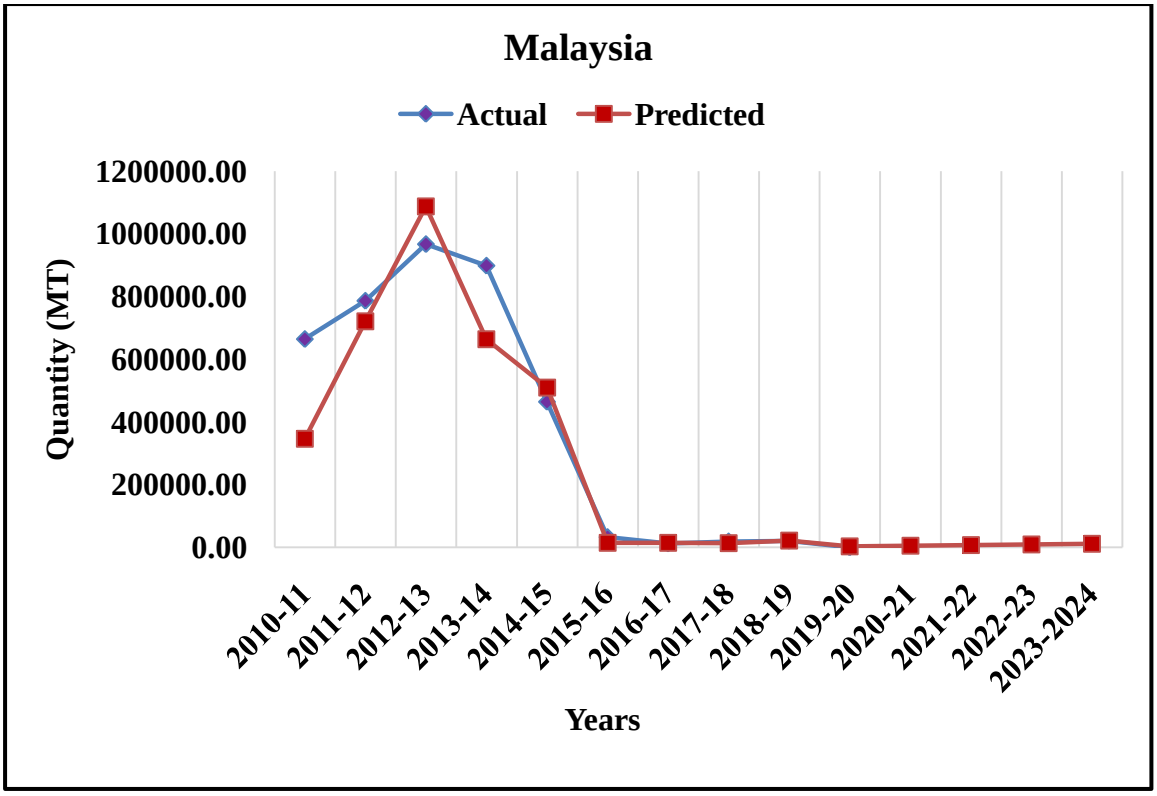

Figure 4.35: Actual and Predicted shares of maize export to Malaysia

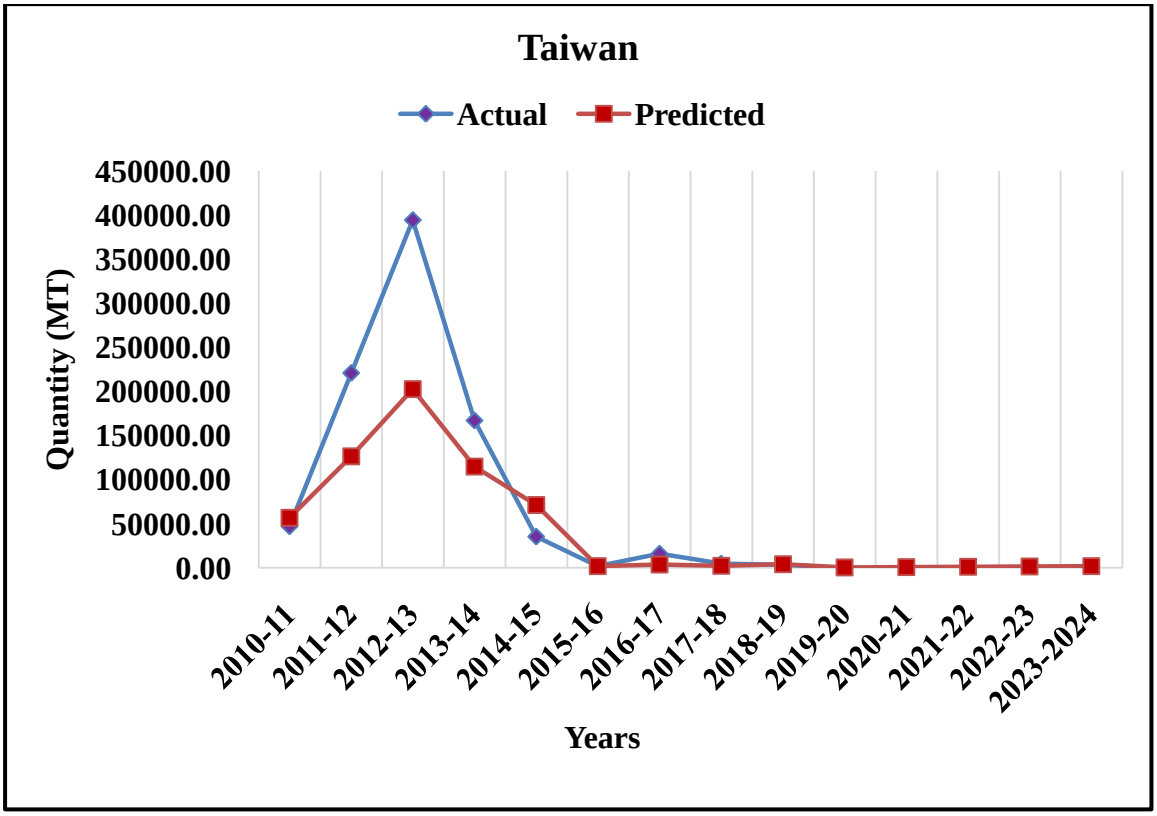

Figure 4.36: Actual and Predicted shares of maize export to Taiwan

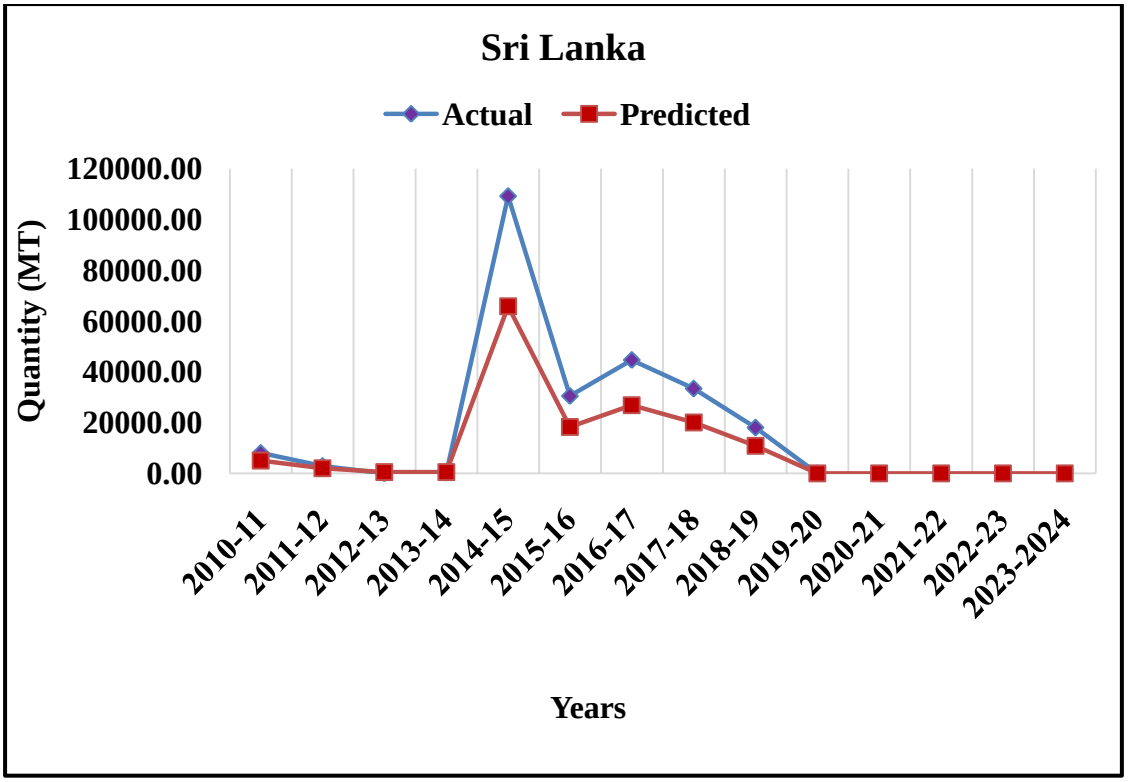

Figure 4.37: Actual and Predicted shares of maize export to Sri Lanka

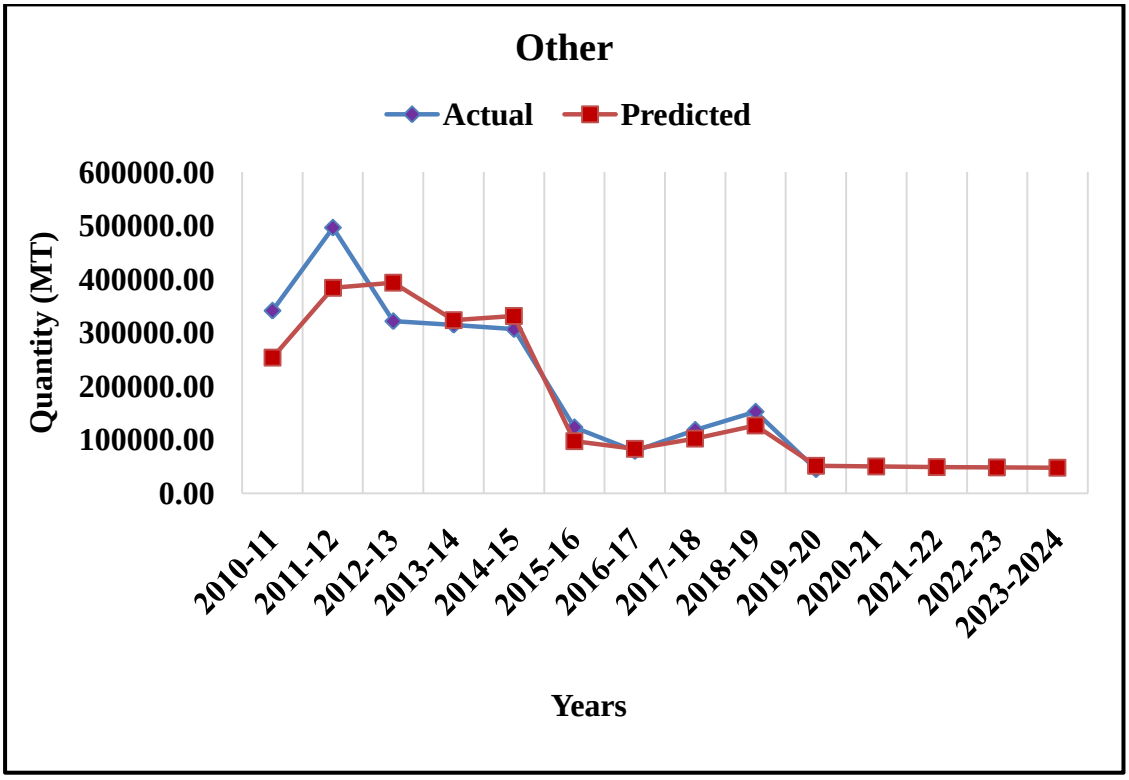

Figure 4.38: Actual and Predicted shares of maize export to other countries

4.5.30. Transitional probability matrix of wheat export (Period I: 1990-91 to 1999-00)

The transitional probability matrix for Indian wheat importing countries of period I (1990-91 to 1999-00) is presented in Table 4.30. The table clearly depicts that, Jordan, UAE and Turkey were the loyal markets of Indian wheat. Jordan was the most stable and loyal market as resembled by the highest probability retention of 0.5245 that interprets that Jordan retained its import share over the study period by 52.45 per cent followed by UAE, and Turkey which retained 23.93 per cent, and 8.50 per cent of their shares over the study period. Interestingly, the minor countries of wheat, categorized as other countries were found to be the most loyal markets with the higher probability retention at 0.8882 i.e. the probability that other countries retained its export share over the study period was 88.82 per cent.

Table 4.30: Transitional probability matrix of wheat export (Period I: 1990-91 to 1999-00)

Countries	UAE	Netherland	Yemen	Jordan	Korea	Bangladesh	Turkey	Other
UAE	**0.2393**	0.1573	0.0000	0.0000	0.0000	0.5263	0.0000	0.0771
Netherland	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Yemen	0.0000	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.0000	1.0000
Jordan	0.0715	0.0000	0.0000	**0.5245**	0.4040	0.0000	0.0000	0.0000
Korea	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000	0.0000	1.0000
Bangladesh	0.0000	0.0075	0.5728	0.1208	0.0000	**0.0000**	0.2989	0.0000
Turkey	0.0272	0.6036	0.2842	0.0000	0.0000	0.0000	**0.0850**	0.0000
Other	0.1118	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.8882**

UAE had retained 23.93 per cent share of imports of wheat and lost share to Bangladesh and Netherland to the extent of 52.63 and 15.73 per cent respectively. It gained 7.15 per cent from Jordan, 2.72 per cent Turkey and 11.18 per cent share from other country.

Netherland retained zero probability of its own share of Indian wheat and lost its share to 100 per cent share to other country categories and it gained 60.36 per cent share from Turkey, 15.73 per cent from UAE and 0.75 per cent share from Bangladesh.

Similarly, Yemen retained zero probability of its own share of Indian wheat and lost its share to 100 per cent share to other country categories. It gained to Bangladesh with 57.28 per cent and also gained share to Turkey i.e. 28.42 per cent.

Korea was also another importer which also has zero probability retention of its own share of import, lost to its 100 per cent share to other country categories. It gained 40.40 per cent share from Jordan.

Same condition observed in Bangladesh market has zero probability retention of its own share of import, lost it share to Yemen (57.28 %) followed by Turkey (29.89 %), Jordan (12.08 %) and (0.75 %) Netherland and it gained 52.63 per cent share from UAE.

Turkey had retained 8.50 per cent share of imports of wheat and lost share to Netherland, Yemen and UAE to the extent of 60.36, 28.42 and 2.72 per cent respectively. It gained 29.89 per cent share from Bangladesh.

The Other countries importing Indian Wheat in addition to have a reasonably high retention probability of 88.82 per cent, which implied that even though the import in quantities , there was high stability. They have retained most of their original share. It gained 100 per cent share from Netherland, Yemen and Korea also, from UAE 7.71 per cent share.

Therefore, it is clear from the analysis that, Jordan, UAE and Turkey were the only countries that were found to be the loyal markets among the major importing countries of Indian maize during period I. Netherland, Korea and Bangladesh were the most unstable importers as they could not retain their original share.

4.5.31 Transitional probability matrix of wheat export (Period II: 2000-01 to 2009-10)

The transitional probability matrix for Indian wheat importing countries of period II (2000-01 to 2009-10) is presented in Table 31. The table clearly depicts that, Bangladesh, Sri Lanka, Korea, UEA and Indonesia were the loyal markets of Indian wheat. Bangladesh was the most stable and loyal market as resembled by the highest probability retention of 0.6777 that interprets that Bangladesh retained its import share over the study period by 67.77 per cent followed by Sri Lanka, Korea, UEA and Indonesia which retained 18.95 per cent, 13.14 per cent, 11.06 per cent and 6.18 per

cent of their shares over the study period. Interestingly, the minor countries of wheat import,

Table 4.31: Transitional probability matrix of wheat export (Period II: 2000-01 to 2009-10)

Countries	Sri Lanka	UAE	Indonesia	Philippines	Bangladesh	Korea	Yemen	Other
Sri Lanka	**0.1895**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8105
UAE	0.0000	**0.1106**	0.0000	0.0000	0.0000	0.0000	0.0000	0.8894
Indonesia	0.0000	0.0000	**0.0618**	0.0000	0.7206	0.0000	0.2176	0.0000
Philippines	0.2017	0.0000	0.6242	**0.0000**	0.0000	0.1229	0.0511	0.0000
Bangladesh	0.0129	0.2871	0.0000	0.0223	**0.6777**	0.0000	0.0000	0.0000
Korea	0.0000	0.0000	0.0000	0.6181	0.0472	**0.1314**	0.2033	0.0000
Yemen	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	**0.0000**	0.0000
Other	0.0000	0.0321	0.0000	0.0000	0.2660	0.0000	0.0000	**0.7019**

Sri Lanka was also another importer which also has 18.95 per cent probability retention of its own share of import, lost to its 100 per cent share to other country categories. It gained 20.17 per cent share from Philippines and from Bangladesh 1.29 per cent share.

Similarly, UAE also has 11.06 per cent probability retention of its own share of import, lost to its 88.94 per cent share to other country categories. It gained 28.71 per cent share from Bangladesh and 3.21 per cent from other countries.

Indonesia had retained 6.18 per cent share of imports of wheat and lost share to Bangladesh and Yemen to the extent of 72.06 and 21.76 per cent respectively. It gained 62.42 per cent share from Philippines.

Philippines unable to import of wheat because it could not retention of its own share of import, lost to Indonesia (62.42 %), Sri Lanka (20.17 %), Korea (12.29 %) and Yemen 5.11 per cent share t. It gained 61.81 per cent share from Korea and 2.23 per cent share from Bangladesh.

Korea had retained 13.14 per cent share of imports of wheat and lost share to Philippines, Bangladesh and Yemen to the extent of 61.81, 4.72 and 20.33 per cent share respectively. It gained 12.29 per cent share from Korea.

Yemen could not retention of its own share of import, lost 100 percent share to Indonesia. It gained 61.81 per cent share from Korea and 20.23 per cent, Indonesia gained share 21.76 per cent from and Philippines 5.11 per cent share.

Categorized as other countries were found to be the most loyal markets with the higher probability retention at 0.7019 i.e. the probability that other countries retained its export share over the study period was 70.19 per cent. And retained most of their original share. Gained from UAE (88.94 %) followed by Sri Lanka (81.05 %) share.

Therefore, it is clear from the analysis that, Bangladesh, Sri Lanka, Korea, UEA and Indonesia were the only countries that were found to be the loyal markets among the major importing countries of Indian maize during period II. Philippines and Yemen were the most unstable importers as they could not retain their original share.

4.5.32 Transitional probability matrix of wheat export (Period III: 2009-10 to 2019-20)

The transitional probability matrix for Indian wheat importing countries of period III (2009-10 to 2019-20) is presented in Table 32. The table clearly depicts that, Nepal, Bangladesh and Djibouti were the loyal markets of Indian wheat. Nepal was the most stable and loyal market as resembled by the highest probability retention of 0.8827 that interprets that Nepal retained its import share over the study period by 88.27 per cent followed by Bangladesh and Djibouti which retained 46.84 per cent and 44.40 per cent of their shares over the study period. Interestingly, the minor countries of wheat categorized as other countries were found to be the loyal markets with the higher probability retention at 0.3359 i.e. the probability that other countries retained its export share over the study period was 33.59 per cent.

Table 4.32: Transitional probability matrix of wheat export (Period III: 2009-10 to 2019-20)

Countries	Nepal	Bangladesh	UAE	Indonesia	Djibouti	Yemen	Korea	Other
Nepal	**0.8827**	0.1101	0.0000	0.0000	0.0000	0.0000	0.0000	0.0072
Bangladesh	0.4189	**0.4684**	0.1126	0.0000	0.0000	0.0000	0.0000	0.0000
UAE	0.0000	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.0000	1.0000
Indonesia	0.0000	1.0000	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.0000
Djibouti	0.0000	0.0000	0.0000	0.0000	**0.4440**	0.0682	0.4878	0.0000
Yemen	0.0000	1.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000	0.0000
Korea	0.0000	0.1494	0.0000	0.3431	0.0000	0.2868	**0.0000**	0.2207
Other	0.0000	0.2466	0.3148	0.0107	0.0803	0.0117	0.0000	**0.3359**

Bangladesh had retained 46.84 per cent share of imports of wheat and lost share to Nepal and UAE to the extent of 41.89 and 11.26 per cent respectively. It gained from Bangladesh 11.01 per cent share, 100 per cent share from Indonesia and Yemen, Korea and Other country gained 14.94 and 24.66 per cent share respectively.

UAE was also unable to import of Indian wheat which also has zero probability retention of its own share of import, lost to its 100 per cent share to other country categories. It gained 11.26 per cent share from Bangladesh. And also gain share from other country.

Similarly, Indonesia also zero probability retention of its original share of import, lost to the 100 per cent share from Bangladesh. It was gained from Korea 34.31 per cent and from Indonesia 1.07 per cent share.

Djibouti is the one of loyal importer for the period III which probability retention of its original share of import was 44.40 per cent and its lost share of import to Korea 48.78 per cent and Yemen 6.82 per cent share. Gained from other country i.e. 8.03 per cent share.

Yemen was also unable to import. It lost its 100 per cent share to Bangladesh it retain zero probability retention and lost its original share and gained from Korea and Djibouti 28.68 and 6.82 per cent.

Korea also found loyal importer but in period III, it was unable to Indian wheat importer zero probability retention of its original share of import, lost to Indonesia (34.31 %) Yemen (28.68 %), Bangladesh (14.94 %) and other (22.07 %). It gained from Djibouti 48.78 per cent share.

Therefore, it is clear from the analysis that, Nepal, Bangladesh and Djibouti were the only countries that were found to be the loyal markets among the major importing countries of Indian Wheat during period III. UAE, Indonesia, Yemen and Korea were the most unstable importers as they could not retain their original share. In the report of CACP Government of India has also found same results towards the exports of wheat.

4.5.33 Actual and predicted shares of wheat export from India

The actual and estimated shares of wheat exported from India to different countries (in percentage term) were shown in Table 4.33. A comparison of this proportion during the study period revealed that the observed proportions of export shares were consistent with the estimated shares of export, which were derived from the Markov chain process. However, differences have been observed in some years, which could be due to limitation of the model that the present estimates depend only on the previous year observations and the exports also depend on sudden policy changes, leading to abrupt increase or decrease in exports to a country.

Table 4.33 present that actual and predicted values of wheat export from India to major importer from 2010-11 to 2019-20. The actual share of Nepal in wheat export from India shown maximum fluctuation over the study period (2010-11 to 2019-20) trade had showed decreased 57.82 per cent to 19.45 per cent from the year (2010-11 to 2015-16). Then import of wheat was increased 71.51 per cent, 74.72 per cent during (2016-17 to 2019-2020) similar picture was observed in prediction of export share, where the 51.04 per cent to 72.38 per cent. The actual proportion of Bangladesh market share also showed fluctuation from 0.00 per cent to 15.33 per cent in actual wheat export and 16.71 per cent to 16.90 per cent predicted wheat export from India to Bangladesh. With regard to UAE the actual and predicted export share also showed fluctuation from 0.22 to 3.88 per cent and 13.21 to 3.64 per cent, respectively from 2010-11 to 2019-20.

With respect to Indonesia, the actual and predicted proportion of wheat export showed a decreased in trend also predicted value of wheat share had a fluctuation from 0.45 to 0.07 per cent.

The same picture as of Indonesia can be observed for Djibouti, Yemen and Korea. The actual and predicted proportion of this country showed decline in shares of wheat export from India during the period of study. The actual proportion of India's wheat export to other countries showed a fluctuating trend during the overall study period. The actual share proportion was increased 41.96 per cent during 2010-11, but then wheat export from India showed decreased in trend during study period and predicted value also showed same 14.73 per cent to 6.46 per cent share during 2010-11 to 2019-20.

Table 4.33: Actual and predicted shares of Wheat export from India **(Quantity: Metric Tons)**

Countries	Nepal		Bangladesh		UAE		Indonesia		Djibouti		Yemen		Korea		Other	
Year	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
2010-11	228.10 (57.82)	201.34 (51.04)	0.00 (0.00)	65.92 (16.71)	0.87 (0.22)	52.10 (13.21)	0.00 (0.00)	1.78 (0.45)	0.00 (0.00)	13.29 (3.37)	0.00 (0.00)	1.93 (0.49)	0.00 (0.00)	0.00 (0.00)	165.51 (41.96)	58.12 (14.73)
2011-12	2632.15 (0.36)	133233.83 (17.99)	312476.97 (42.18)	222168.01 (29.99)	115659.74 (15.61)	122711.22 (16.57)	3352.00 (0.45)	2981.69 (0.40)	25000.00 (3.37)	33429.57 (4.51)	3599.73 (0.49)	4950.84 (0.67)	0.00 (0.00)	12195.88 (1.65)	278026.18 (37.53)	209075.69 (28.22)
2012-13	6354.00 (0.10)	748832.05 (11.49)	1774038.22 (27.23)	2325168.47 (35.69)	498130.69 (7.65)	778614.47 (11.95)	375433.40 (5.76)	381224.53 (5.85)	461109.40 (7.08)	352412.05 (5.41)	507232.60 (7.79)	355138.79(5.45)	1053751.20 (16.17)	224945.44 (3.45)	1838761.09 (28.22)	1348474.44 (20.70)
2013-14	76348.06 (1.37)	899179.98 (16.17)	1985441.28 (35.69)	1963655.36 (35.30)	664860.25 (11.95)	586091.83 (10.54)	325504.80 (5.85)	271270.26 (4.88)	300938.80 (5.41)	226100.11 (4.06)	303040.60 (5.45)	250430.40 (4.50)	754729.20 (13.57)	146808.57 (2.64)	1151511.76 (20.70)	1218837.92 (21.91)
2014-15	111256.31 (3.80)	568804.90 (19.45)	1123304.18 (38.42)	1189886.17 (40.69)	391018.78 (13.37)	367984.56 (12.58)	348005.73 (11.90)	31007.96 (1.06)	12600.00 (0.43)	67203.66 (2.30)	104381.00 (3.57)	28863.05 (0.99)	66405.00 (2.27)	6146.72 (0.21)	767099.17 (26.23)	664173.00 (22.71)
2015-16	129646.74 (19.45)	273047.90 (40.96)	378600.00 (56.79)	208223.88 (31.23)	99722.30 (14.96)	59942.29 (8.99)	3038.00 (0.46)	623.75 (0.09)	600.00 (0.09)	4680.64 (0.70)	0.00 (0.00)	711.41 (0.11)	100.00 (0.01)	292.70 (0.04)	54961.92 (8.24)	119146.34 (17.87)
2016-17	189939.22 (71.51)	183268.04 (69.00)	37270.00 (14.03)	41993.42 (15.81)	23889.64 (8.99)	8733.73 (3.29)	72.00 (0.03)	154.54 (0.06)	25.00 (0.01)	1168.45 (0.44)	0.00 (0.00)	169.98 (0.06)	0.00 (0.00)	12.20 (0.00)	14410.18 (5.43)	30105.67 (11.33)
2017-18	184818.69 (57.26)	165792.43 (51.36)	6345.00 (1.97)	54026.60 (16.74)	7085.18 (2.19)	39917.17 (12.37)	0.00 (0.00)	1335.62 (0.41)	2.00 (0.00)	10003.21 (3.10)	0.00 (0.00)	1454.48 (0.45)	0.00 (0.00)	0.98 (0.00)	124539.26 (38.58)	50259.62 (15.57)
2018-19	180804.34 (79.92)	169041.70 (74.72)	22558.67 (9.97)	34344.01 (15.18)	7156.43 (3.16)	7484.57 (3.31)	0.00 (0.00)	168.43 (0.07)	0.00 (0.00)	1261.39 (0.56)	90.00 (0.00)	183.41 (0.08)	0.00 (0.00)	0.00 (0.00)	15705.56 (6.94)	13741.48 (6.07)
2019-20	162413.55 (74.72)	157313.35 (72.38)	33311.10 (15.33)	36739.68 (16.90)	8436.60 (3.88)	7903.40 (3.64)	4.09 (0.00)	141.44 (0.07)	0.00 (0.00)	1059.26 (0.49)	0.00 (0.00)	154.02 (0.07)	0.00 (0.00)	0.00 (0.00)	13188.89 (6.07)	14043.07 (6.46)

Note: Figure in parentheses indicates percentage to total export of wheat (A =Actual, P=Predicted)

4.5.34 Projection of Indian wheat Export to Major Importing Countries

The export of Indian wheat to different countries which was computed using the transitional probability matrix presented in Table 4.34 It was projected that during 2020-21, the major markets for Indian wheat would be Nepal (70.97 %), Bangladesh (17.61 %) and others (6.33 %).

Table 4.34: Projected exports of wheat to major importing countries (Quantity: Tonnes)

Countries	Nepal	Bangladesh	U Arab Emts	Indonesia	Djibouti	Yemen	Korea	Other
2020-21	154247.92 (70.97)	38286.23 (17.61)	8558.44 (3.94)	150.60 (0.07)	1598.18 (0.74)	236.20 (0.11)	516.74 (0.24)	13759.89 (6.33)
2021-22	152190.09 (70.02)	38771.92 (17.84)	8643.49 (3.98)	324.84 (0.15)	1814.71 (0.83)	417.84 (0.19)	779.65 (0.36)	14411.67 (6.63)
2022-23	150577.16 (69.28)	39328.75 (18.09)	8903.36 (4.10)	422.03 (0.19)	1963.20 (0.90)	515.61 (0.24)	885.28 (0.41)	14758.80 (6.79)
2023-24	149386.76 (68.73)	39708.35 (18.27)	9075.34 (4.18)	461.99 (0.21)	2057.01 (0.95)	560.08 (0.26)	957.72 (0.44)	15146.92 (6.97)

Note: Figures in parentheses indicates percentage to total export of wheat

The projected exports to Nepal have exhibited a decreasing trend in both absolute value and percentage to total export. The projected market share is likely to decrease marginally from 70.97 to 68.73 per cent from 2020-21 to 2023-24. The reason for showing decreasing trend by Nepal was that it had lost its market share to Bangladesh and other countries. The remaining major countries like Bangladesh, UAE ,Indonesia, Djibouti, Yemen, Korea and others, the projected value shown an increasing trend in both absolute and relative to total export from India.

4.5.35 Transitional probability matrix of rice export (Period I: 1990-91 to 1999-00)

The transitional probability matrix for Indian rice importing countries of period I (1990-91 to 1999-00) is presented in Table 4.35. The table clearly depicts that, South Africa, Bangladesh and Kenya were the loyal markets of Indian rice. South Africa was the most stable and loyal market as resembled by the highest probability retention of 0.5461 that interprets that South Africa retained its import share over the study period by 54.61 per cent followed by Bangladesh and Kenya which retained 51.86 per cent and 47.09 per cent of their shares over the study period. Interestingly, the minor countries of rice, categorized as other countries were found to be the most loyal markets with the higher probability retention at 0.6893 i.e. the

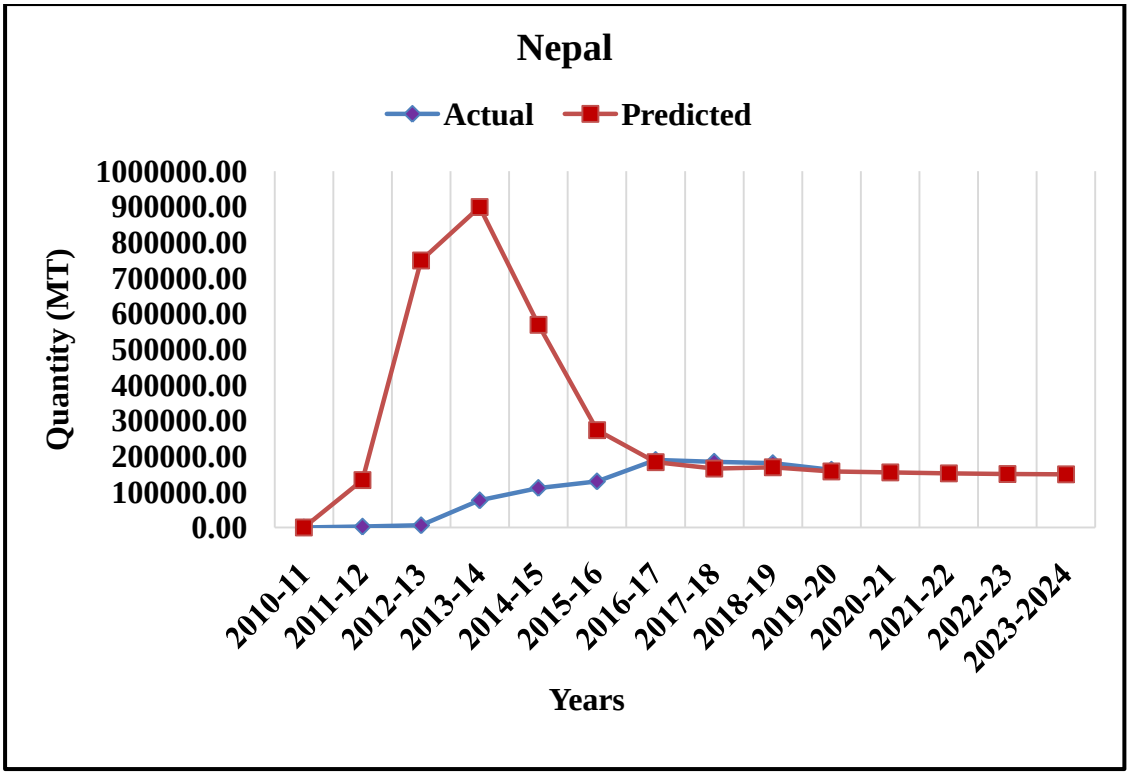

Figure 4.39: Actual and Predicted shares of wheat export to Nepal

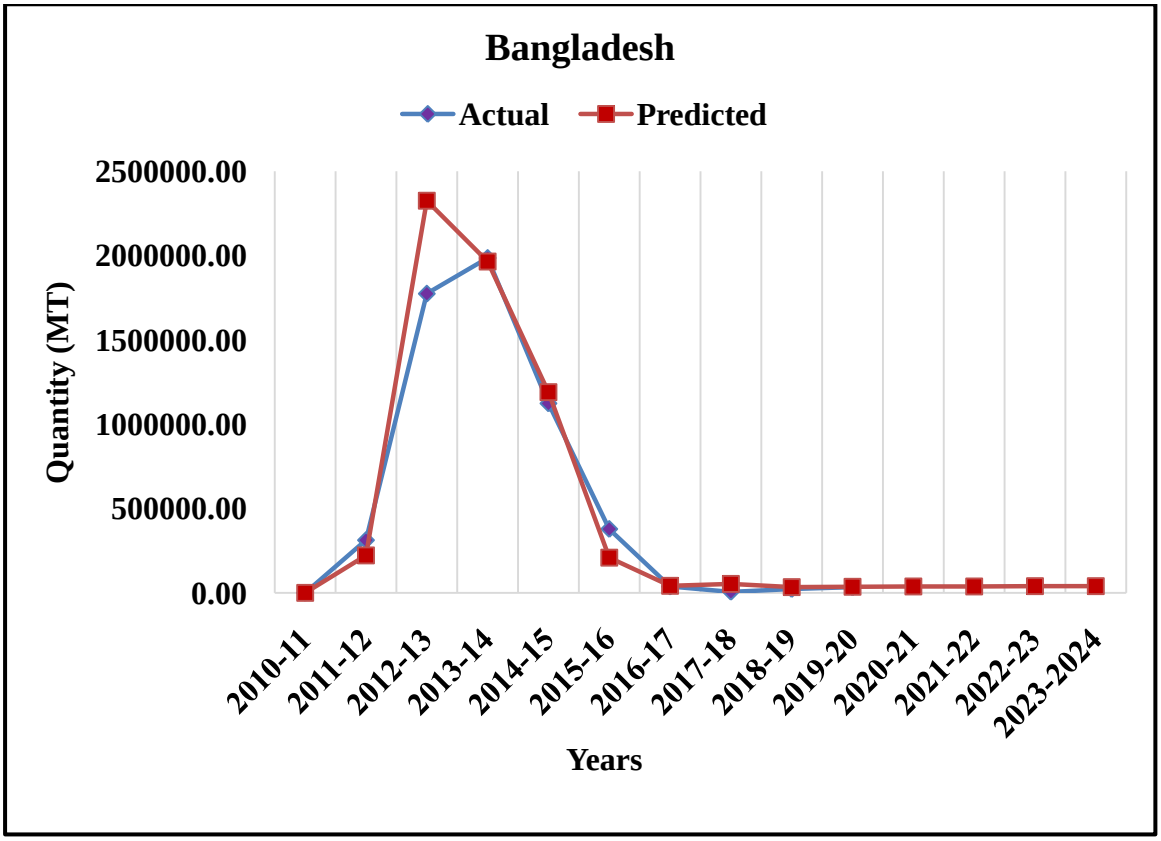

Figure 4.40 Actual and Predicted shares of wheat export to Bangladesh

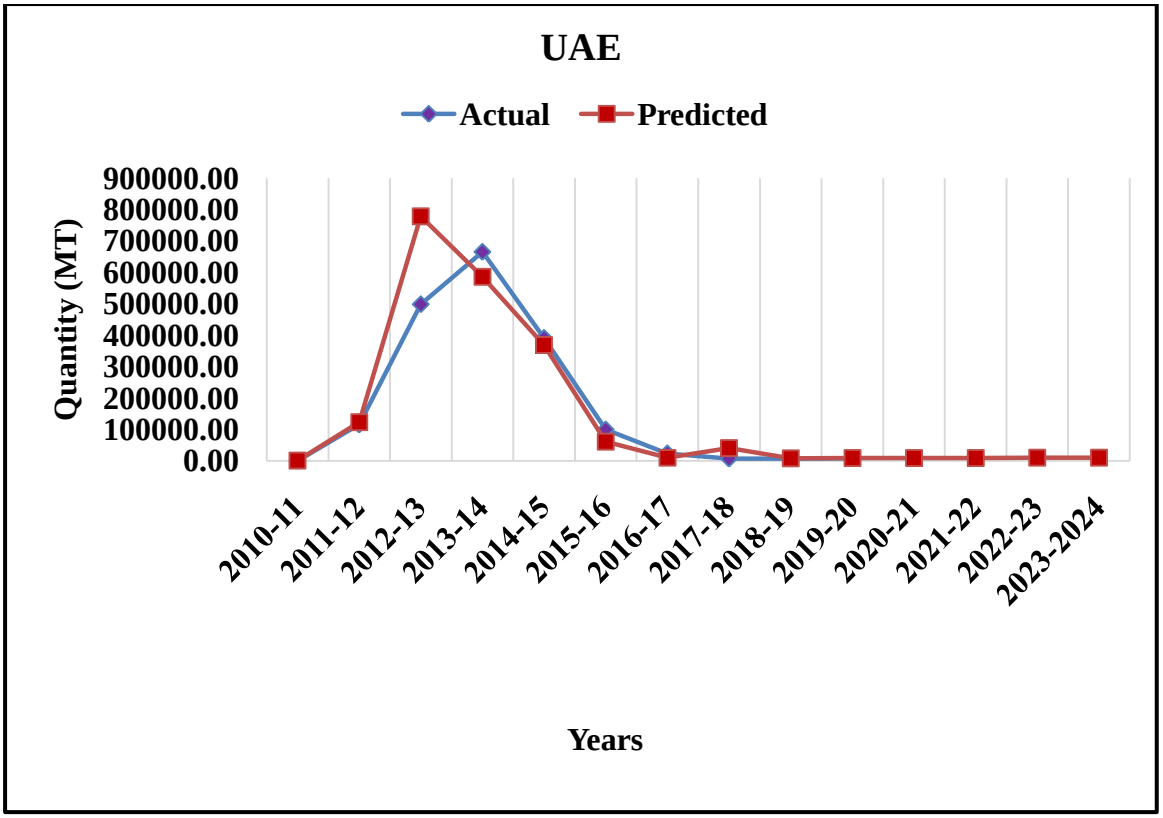

Figure 4.41: Actual and Predicted shares of wheat export to UAE

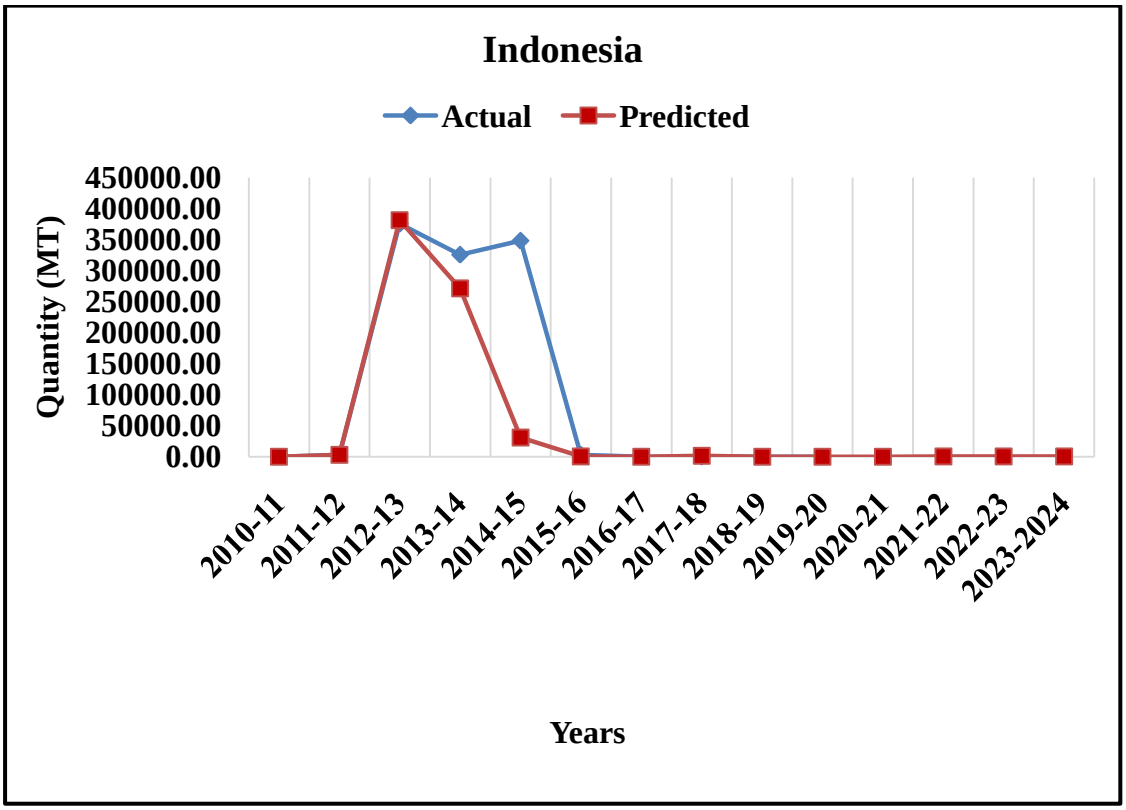

Figure 4.42: Actual and Predicted shares of wheat export to Indonesia

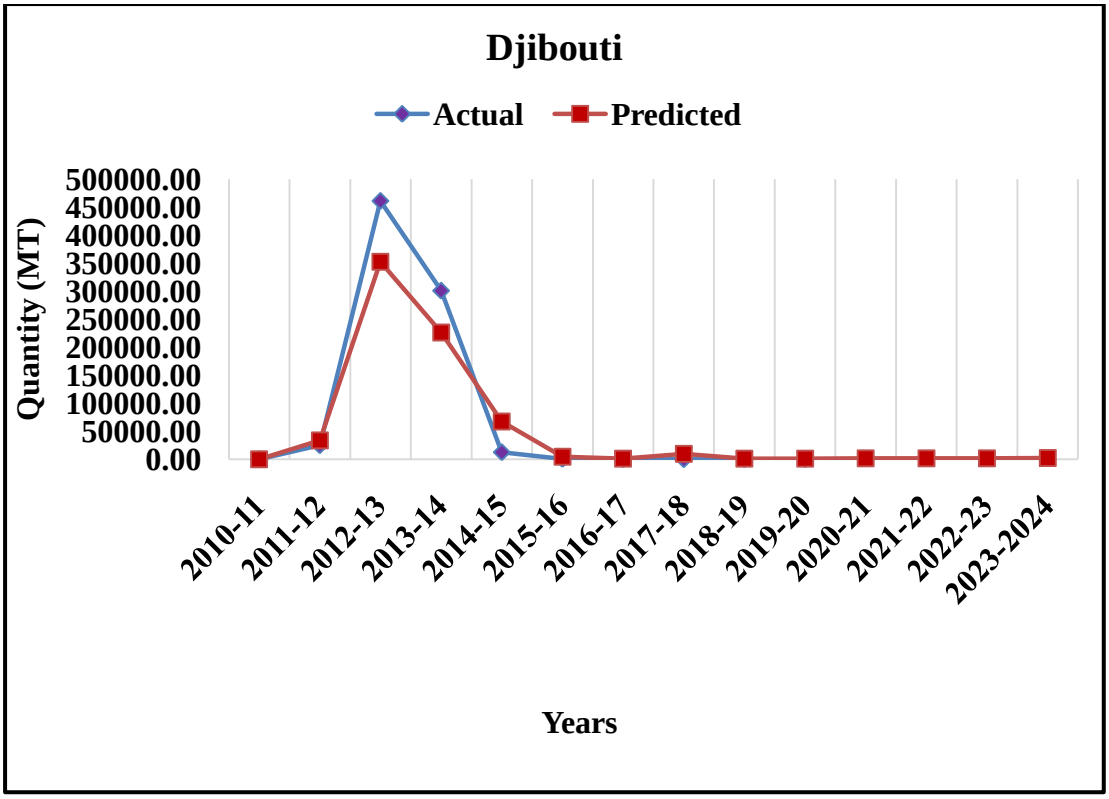

Figure 4.43: Actual and Predicted shares of wheat export to Djibouti

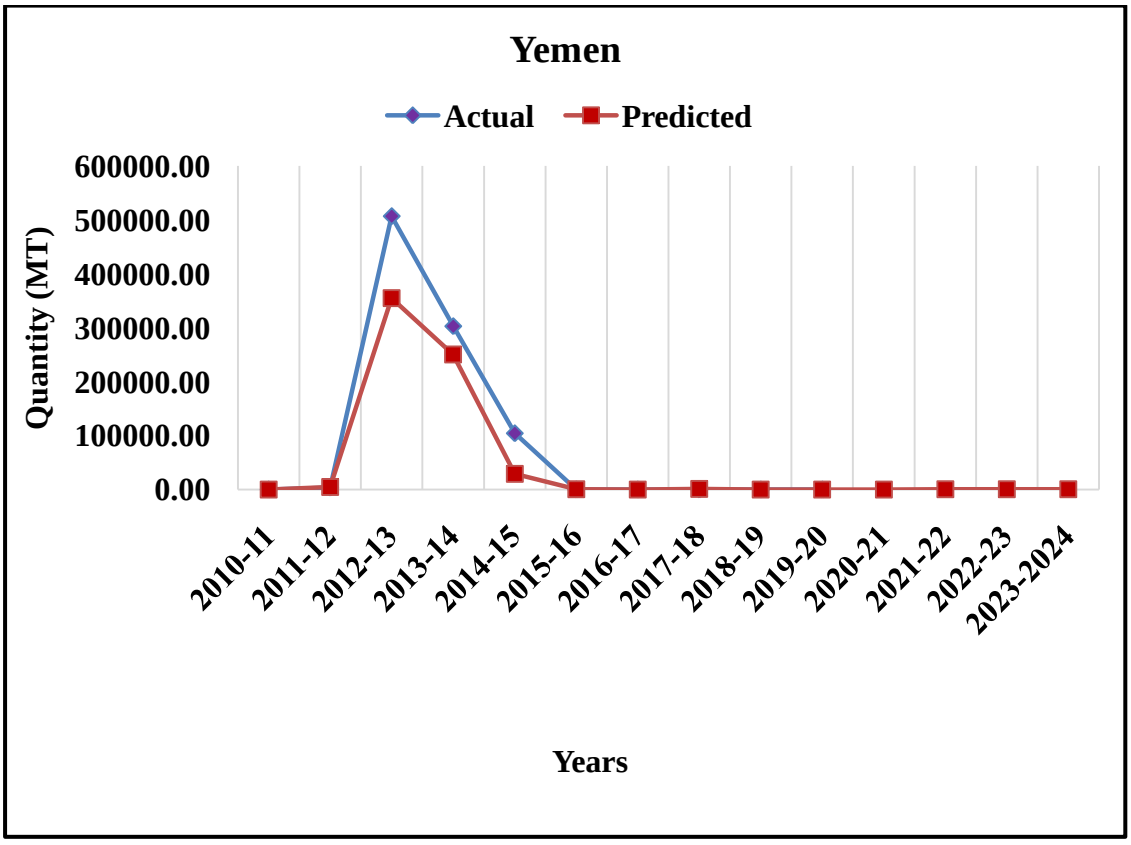

Figure 4.44: Actual and Predicted shares of wheat export to Yemen Republic

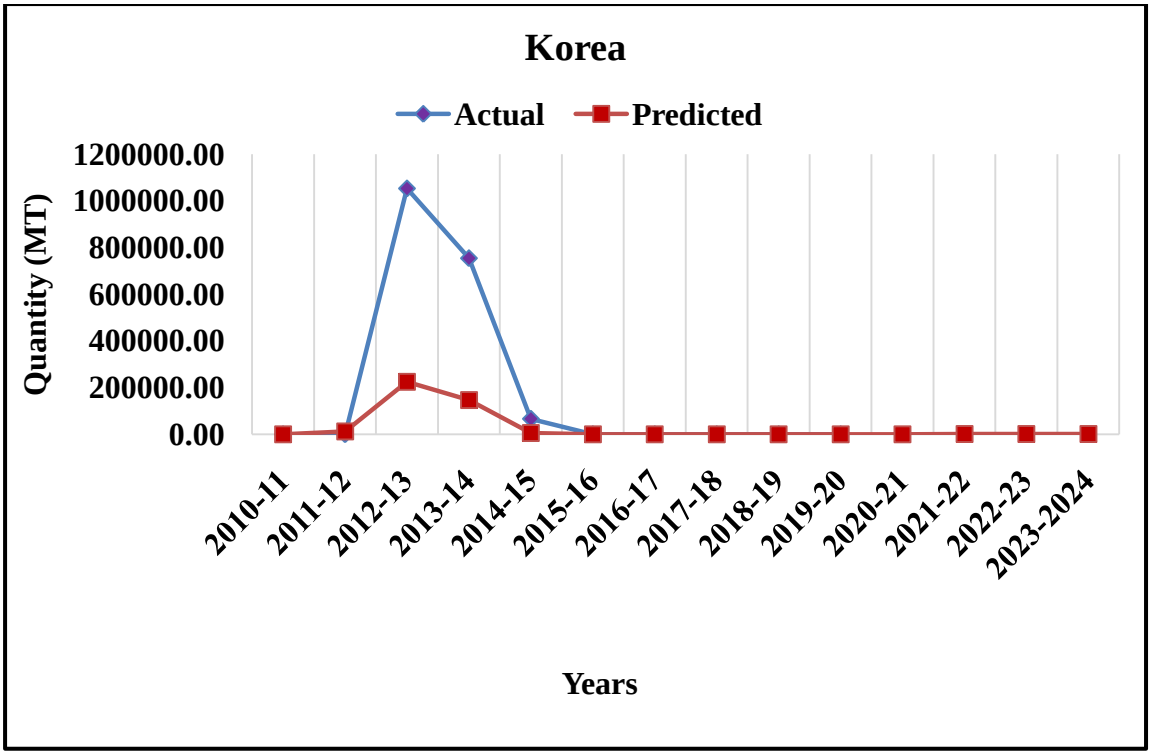

Figure 4.45: Actual and Predicted shares of wheat export to Korea

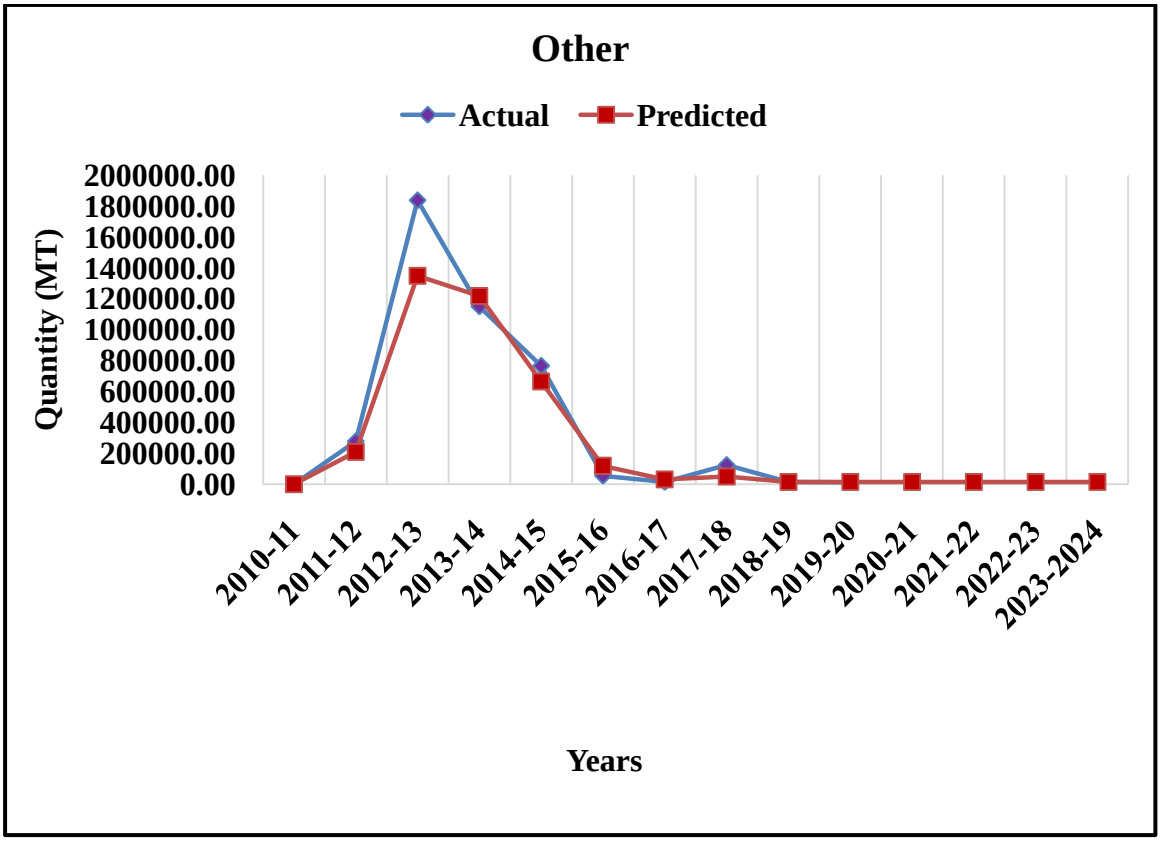

Figure 4.46: Actual and Predicted shares of wheat export to other

Table 4.35: Transitional probability matrix of rice export (Period I: 1990-91 to 1999-00)

Countries	Bangladesh	Saudi Arab	South Africa	Russia	Sri Lanka	Kenya	Indonesia	Other
Bangladesh	**0.5186**	0.1583	0.0765	0.1095	0.0097	0.0120	0.0169	0.1137
Saudi Arab	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
South Africa	0.0000	0.0000	**0.5461**	0.4539	0.0000	0.0000	0.0000	0.0000
Russia	0.7327	0.0000	0.2673	**0.0000**	0.0000	0.0000	0.0000	0.0000
Sri Lanka	0.7034	0.2013	0.0028	0.0000	**0.0000**	0.0023	0.0000	0.0902
Kenya	0.0872	0.0000	0.4419	0.0000	0.0000	**0.4709**	0.0000	0.0000
Indonesia	0.0000	0.1490	0.0000	0.0000	0.2765	0.0000	**0.0000**	0.5745
Other	0.0000	0.1524	0.0000	0.0000	0.1583	0.0000	0.0000	**0.6893**

Probability that other countries retained its export share over the study period was 68.93 per cent. Bangladesh found second most loyal importer retained its previous market share at 51.86 per cent it lost its share to Saudi Arab (15.83 %), Russia (10.95 %),

South Africa (7.65 %), Kenya (1.20 %), Indonesia (1.69 %), Sri Lanka (0.97 %) and other country (11.37 %) share. it gained from Russia, Sri Lanka and Kenya 73.27, 70.34 and 8.72 per cent share respectively. The rice export to Kenya could retain its share of 47.09 per cent. Kenya lost its 44.19 per cent share to South Africa and 8.72 per cent to Bangladesh. However, it gained 1.20 per cent from Bangladesh and 0.23 per cent share from Sri Lanka. Saudi Arab could not retain its original share and lost 100 per cent share to other country, it gained Sri Lanka (20.13 %) followed by Bangladesh (15.83 %), Other country (15.24 %) and Indonesia (14.90 %).

Russia was an unstable importer of rice, because it could not retain its original share. It lost 73.27 per cent share to Bangladesh and 26.73 per cent share to South Africa. While it gained 45.39 per cent from South Africa and 10.95 per cent share from Bangladesh.

Sri Lanka could not retain its original share and lost its share to Bangladesh (70.34 %), Saudi Arab (20.13 %), South Africa (0.28 %) and to other country (9.02 %) share. It gained from Indonesia (27.65 %), followed by other country (15.83 %) and Bangladesh (0.97 %) share.

Indonesia is also another unstable importer of rice, and it lost it share to other (57.45 %), Sri Lanka (27.65 %) and 14.90 per cent to Saudi Arab. Therefore, it is

clear from the analysis that, South Africa, Bangladesh and Kenya were the only countries that were found to be the loyal markets among the major importing countries of Indian maize during period I. Saudi Arab, Russia, Sri Lanka and Indonesia were the most unstable importers as they could not retain their original share.

4.5.36 Transitional probability matrix of rice export (Period II: 2000-01 to 2009-10)

The transitional probability matrix for Indian rice importing countries of period II (2000-01 to 2009-10) is presented in Table 4.36. The table clearly depicts that, Cote D Ivoire, South Africa and Bangladesh were the loyal markets of Indian rice. Cote D Ivoire was the most stable and loyal importer as resembled by the highest probability retention of 0.8659 that interprets that. Cote D Ivoire retained its import share over the study period by 86.59 per cent followed by South Africa and Bangladesh which retained 62.89 and 18.12 per cent of their shares over the study period. Categorized as other countries were found to be the loyal markets with the higher probability retention at 0.2206 i.e. the probability that other countries retained its export share over the study period was 22.06 per cent.

Table 4.36: Transitional probability matrix of rice export (Period II: 2000-01 to 2009-10)

Countries	Saudi Arab	UAE	Nepal	Cote D Ivoire	South Africa	Banglades h	Nigeri a	Other
Saudi Arab	**0.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
UAE	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000
Nepal	0.0000	0.0000	**0.0000**	0.1314	0.0000	0.0000	0.0000	0.8686
Cote D Ivoire	0.0031	0.0860	0.0450	**0.8659**	0.0000	0.0000	0.0000	0.0000
South Africa	0.0000	0.0000	0.0000	0.0000	**0.6289**	0.0000	0.3711	0.0000
Bangladesh	0.1487	0.1193	0.2298	0.0468	0.0000	**0.1812**	0.0178	0.2564
Nigeria	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**	1.0000
Other	0.0376	0.0257	0.0000	0.0000	0.0384	0.6777	0.0000	**0.2206**

Second most loyal importer of rice was South Africa which has retained 62.89 per cent share with its own lost to the Nigeria 37.11 per cent share. It gained from other country 3.84 per cent share.

Bangladesh was also another stable importer. It had retained its original share of 18.12 per cent. It can lost its share in to other country (25.64 %), Nepal (22.98 %), Saudi Arab (14.87 %), UAE (11.93 %) Cote D Ivoire (4.68 %) and Nigeria (1.78 %) share. It gained major share from other country (67.77 %).

Saudi Arab was zero retention of its own share of imports of Indian rice and lost its 100 per cent share to other country and gained very few share from Bangladesh (14.87 %) followed by other country (3.76 %)and Cote D Ivoire (0.31 %) share.

UAE also unable to retain its own share and lost its 100 per cent share to Nigeria and gained very few amount of share from Bangladesh (11.93 %), Cote D Ivoire (8.60 %) and other country categories (3.76 %) share. Cote D Ivoire

Nigeria has zero retention of its own share and lost 100 per cent share to other country and gained from 100 per cent from UAE 37.11 per cent and Bangladesh (1.78 %)

The same thing found in Nepal import it has zero probability of retention of its own share of import and lost 86.86 per cent to other country and 13.14 per cent to the Cote D Ivoire and gain from Bangladesh (22.98 %) and Cote D Ivoire (4.50 %) share.

The group of countries pooled under others retained categorized as other countries were found to be the loyal markets with the higher probability retention at 0.2206 i.e. the probability that other countries retained its export share over the study period was 22.06 per cent and lost it share to Bangladesh (67.77 %), and very less share to South Africa (3.84 %), Saudi Arab (3.76 %) and UAE (2.57 %).

Therefore, it is clear from the analysis that, Cote D Ivoire, South Africa and Bangladesh were the only countries that were found to be the loyal markets among the major importing countries of Indian maize during period II. Saudi Arab, UAE, Nepal, and Nigeria were the most unstable importers as they could not retain their original share. similar result found in Netherayini *et al.,* (2012) researcher reported that the during study period (1998-99 to 2009-10) There are five major counties importing non-basmati rice namely, Saudi Arabia, Bangladesh, Nigeria, South Africa, and UAE. The exports to remaining countries are pooled under ‘other’ category.

South Africa is one of the most stable importers of the Indian non-basmati rice. Srikala *et al.* (2017) revealed that the Bangladesh was one of the stable major importers of Indian rice Bangladesh lost its shares to other, Saudi Arabia, Sri Lanka and UAE Benin was also another stable importer during 2000-01 to 2014 -15.

4.5.37 Transitional probability matrix of rice export (Period III: 2009-10 to 2019-20)

The transitional probability matrix for Indian rice importing countries of period III (2009-10 to 2019-20) is presented in Table 4.37. The table clearly depicts that, Guinea, South Africa and Nepal were the loyal markets of Indian rice. Guinea was the most stable and loyal market as resembled by the highest probability retention of 0.2416 that interprets that Guinea retained its import share over the study period by 24.16 per cent followed by South Africa and Nepal which retained 12.64 per cent and 3.86 per cent of their shares over the study period. It lost share to other country (96.14 %). While it gained share from Senegal (28.91 %) followed by Bangladesh (15.18 %), Guinea (14.57 %) and Benin (7.50 %).

Table 4.37: Transitional probability matrix of rice export (Period III: 2009-10 to 2019-20)

Countries	Nepal	Benin	Guinea	Cote D Ivoire	Senegal	South Africa	Bangladesh	Other
Nepal	**0.0386**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9614
Benin	0.0750	**0.0000**	0.0000	0.0000	0.0000	0.0461	0.6826	0.1963
Guinea	0.1457	0.6126	**0.2416**	0.0000	0.0000	0.0000	0.0000	0.0000
Cote D Ivoire	0.0000	0.7799	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.2201
Senegal	0.2891	0.0000	0.4332	0.0000	**0.0000**	0.0447	0.0000	0.2330
South Africa	0.0000	0.1133	0.0000	0.1105	0.0074	**0.1264**	0.1069	0.5356
Bangladesh	0.1518	0.0370	0.0197	0.0647	0.0959	0.0000	**0.0000**	0.6310
Other	0.0355	0.0329	0.0064	0.1021	0.1806	0.0472	0.0000	**0.5952**

Rice export to Guinea could retain its share of 24.16 per cent. Guinea lost its 61.26 per cent share to Benin and 14.57 per cent to Nepal. However, it gained 43.32 per cent from Senegal, Bangladesh (1.97 %) and other countries share (0.64 %) share.

South Africa is also another importer of rice, it could retain original share of 12.64 per cent and lost to major share other country (53.56 %) and very few to Bangladesh (10.69 %), Cote D Ivoire (11.05 %), Benin (11.33 %) and Senegal (0.74 %).

Benin has zero retention of its own share and lost 100 per cent share to Bangladesh (68.26 %) other country (19.63 %) and South Africa (4.61 %) and Nepal (7.50 %) while gained from Guinea (61.26 %) Cote D Ivoire (77.99 %) and South Africa (11.33 %) and Bangladesh (3.70 %).

Cote D Ivoire was also unable to import. It lost its 77.99 per cent share to Benin and other country (22.01 %) it retain zero probability retention and lost its original share and gained from South Africa, Bangladesh and other country 11.02, 6.47 per cent and10.21 per cent share receptively.

Similarly Senegal could not retain its original share and lost all about its share to Benin and other country categories which was 77.99 per cent and 22.01 per cent. While it gained fewer shares from other country categories (18.06 %), 9.59 per cent share from Bangladesh and 0.74 per cent from South Africa.

Also Bangladesh loss their import value and unable to best loyal importer for Indian rice it's could not retain original share and it lost its most share to other country categories which was 63.10 per cent and very less to Nepal (15.18 %), Benin (3.70 %), Guinea (1.97 %), Cote D Ivoire (6.47 %) and Senegal (9.59 %) and it gain 68.26 per cent share from Benin and 10.69 per cent from South Africa.

Interestingly, the minor countries of rice, categorized as other countries were found to be the loyal markets with the higher probability retention at 0.5952 i.e. the probability that other countries retained its export share over the study period was 59.52 per cent. Was lost its share to (96.14 %) Nepal, South Africa (53.56 %), Cote D Ivoire (22.01 %), Senegal (23.30 %) and Benin (19.63 %). It gained 18.06 per cent from Sengal and followed Nepal (3.55 %), South Africa (4.72 %), Benin (3.29 %) Senegal (1.80 %) and Guinea (0.64 %).

Therefore, it is clear from the analysis that, Guinea, South Africa and Nepal were the only countries that were found to be the loyal markets among the major importing countries of Indian rice during period III. Benin, Cote D Ivoire, Senegal Bangladesh was the most unstable importers as they could not retain their original share. Similar result found in Satishkumar *et al.*, (2016) reported the rice export from India has indicated Benin, Bangladesh, and Senegal has the stable destination for rice export, Udhayakumar and Karunakaran, (2020).

4.5.38 Actual and predicted shares of rice export from India

The actual and estimated shares of rice exported from India to different countries (in percentage term) were shown in Table 4.38 and fig. 4.47, 4.48, 4.49, 4.50, 4.51, 4.52, 4.53 and 4.54. A comparison of this proportion during the study period revealed that the observed proportions of export shares were consistent with the estimated shares of export, which were derived from the Markov chain process. However, differences have been observed in some years, which could be due to limitation of the model that the present estimates depend only on the previous year observations and the exports also depend on sudden policy changes, leading to abrupt increase or decrease in exports to a country.

Actual and predicted values of rice export from India to major importer from 2010-11 to 2019-20 indicated that the actual share of Nepal in rice export from India shown maximum fluctuation over the study period (2010-11 to 2019-20) trade had showed decreased 26.97 per cent to 13.46 per cent. Predicted value of rice share showed decreased in trend 3.52 per cent to 5.54 per cent.

The actual proportion of Benin market share also showed fluctuation from 1.94 per cent to 10.62 per cent during study period and predicted rice share value also showed increased in trend that is 5.35 per cent to 10.72 per cent over the period of study.

Guinea market showed the mixed trend of import share of the actual and predicted export share also showed fluctuation from 0.002 to 6.50 per cent and 0.38 per cent to 3.81 per cent, respectively from 2010-11 to 2019-20.

With regards to Cote D Ivoire, the actual and predicted proportion of rice export was 1.69 per cent to 5.83 percent but in terms of predicted share showed opposite and fluctuation in value of rice share from 7.06 per cent to 6.07 per cent during 2010-11 to 2019-20

The actual value of rice export from India to Senegal showed the fluctuation in actual shares 0.002 per cent during 2010-11 then it showed the increased in trend 8.35 per cent to 14.14 per cent from 2012-13 to 2015-16. And again import of rice was decreased for period 2019-20 that is 4.32 per cent. The predicted shares of rice export form India was increased in trend 8.35 per cent to 10.17 per cent respectively from 2010-11 to 2019-20.

Table 4.38: Actual and predicted shares of rice export from India (Quantity: Metric Tonnes)

Countries	Nepal		Benin		Guinea		Cote D Ivoire		Senegal		South Africa		Bangladesh		Other	
Year	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
2010-11	27159.53 (26.97)	3544.95 (3.52)	1956.59 (1.94)	5385.56 (5.35)	0 (0.00)	382.66 (0.38)	1700 (1.69)	7108.72 (7.06)	0 (0.00)	8407.81 (8.35)	21627.06 (21.48)	4843.20 (4.81)	5499.56 (5.46)	3647.04 (3.62)	42743.05 (42.45)	67365.84 (66.91)
2011-12	140864.16 (3.52)	237069.81 (5.93)	213720 (5.35)	344542.91 (8.62)	15003.36 (0.38)	168311.18 (4.21)	282326.85 (7.06)	303679.37 (7.60)	333929 (8.35)	498512.48 (12.47)	192120.97 (4.81)	175418.21 (4.39)	144703.47 (3.62)	166424.46 (4.16)	2675051.78 (66.91)	2103761.31 (52.62)
2012-13	396586.72 (5.93)	476379.21 (7.12)	576544.8 (8.62)	803925.33 (12.02)	281845 (4.21)	461604.89 (6.90)	596843.86 (8.92)	408899.62 (6.11)	854741.01 (12.78)	641918.87 (9.60)	430702.04 (6.44)	285459.00 (4.27)	31333.01 (0.47)	439597.54 (6.57)	3519394.4 (52.62)	3170206.54 (47.40)
2013-14	404127.29 (5.67)	542793.73 (7.61)	1166593.92 (16.35)	519857.20 (7.29)	221773.25 (3.11)	370562.42 (5.19)	261503.7 (3.67)	430911.58 (6.04)	651983.32 (9.14)	676187.14 (9.48)	394304.61 (5.53)	292461.41 (4.10)	651640.6 (9.14)	838491.69 (11.75)	3381256.68 (47.40)	3461918.29 (48.53)
2014-15	629310.47 (7.61)	683316.96 (8.26)	598568.99 (7.23)	663658.67 (8.02)	397717.05 (4.81)	478252.49 (5.78)	259694.32 (3.14)	529542.35 (6.40)	765019 (9.25)	849681.97 (10.27)	338839.75 (4.10)	294334.42 (3.56)	1268342.81 (15.33)	444813.98 (5.38)	4016553.65 (48.54)	4330445.36 (52.34)
2015-16	534139 (8.26)	543767.09 (8.41)	623348.2 (9.64)	731805.04 (11.32)	395978.84 (6.13)	517045.52 (8.00)	448982.35 (6.95)	352259.40 (5.45)	913982 (14.14)	568199.66 (8.79)	260805.46 (4.03)	242470.17 (3.75)	325050.18 (5.03)	453388.96 (7.01)	2962283.74 (45.82)	3055634.04 (47.27)
2016-17	583733.76 (8.62)	488282.67 (7.21)	702181.65 (10.37)	773125.21 (11.42)	541573.75 (8.00)	448204.43 (6.62)	375024.92 (5.54)	396391.47 (5.85)	676060.2 (9.98)	652059.85 (9.63)	254070.26 (3.75)	262637.37 (3.88)	82688.19 (1.22)	506483.06 (7.48)	3555471.56 (52.51	3243620.39 47.91
2017-18	623932.98 (7.21)	799957.80 (9.25)	778778.8 (9.00)	795591.93 (9.20)	461978.17 (5.34)	532011.47 (6.15)	398489.73 (4.61)	498136.01 (5.76)	833059.17 (9.63)	819837.81 (9.48)	142722.51 (1.65)	258393.25 (2.99)	1869181.35 (21.61)	546870.01 (6.32)	3540345.88 (40.94)	4397690.43 (50.85)
2018-19	770113.06 (10.13)	568982.48 (7.49)	699004.8 (9.20)	790435.49 (10.40)	467691.22 (6.15)	459459.07 (6.05)	438089.53 (5.76)	443127.48 (5.83)	720474.29 (9.48)	746962.63 (9.83)	149879.99 (1.97)	266343.46 (3.50)	480567.47 (6.32)	493178.99 (6.49)	3873853.74 (50.97)	3831184.66 (50.41)
2019-20	678665 (13.46)	279217.37 (5.54)	535242.13 (10.62)	540212.06 (10.72)	327422.07 (6.50)	191863.07 (3.81)	293891.57 (5.83)	305776.98 (6.07)	217773.55 (4.32)	512661.31 (10.17)	149641.39 (2.97)	186755.38 (3.70)	13083.07 (0.26)	381364.47 (7.57)	2824988.96 (56.04)	2642857.20 (52.43)

Note: Figure in parentheses indicates percentage to total export of rice (A =Actual, P=Predicted)

With respect to South Africa the actual and predicted proportion of rice export was observed as decreased in trend 21.48 per cent to 2.97 per cent and predicted proportion of these country showed decline in shares from 3.62 per cent to 3.70 per cent over the period of time.

The actual proportion of India's rice export to Bangladesh showed a fluctuating trend during the study period. The actual share proportion was 5.46 per cent to 0.47 per cent during 2010-11 to 2012-13 then increased from 9.14 per cent to 21.61 per cent and then next year again import of Bangladesh was decreased from 6.32 per cent to 0.26 for period 2018-19 to 2019-20 and the predicted proportion showed the mixed trend 3.62 per cent to 7.57 per cent respectively from 2010-11 to 2019-20. The other countries showed an increased in trend during the overall study period. The actual share proportion was increased 42.45 per cent to 56.04 per cent during 2010-11 to 2019-20 .also predicted proportion showed the increased value shares 66.91 per cent to 52.43 per cent share during 2010-11 to 2019-20.

4.5.39 Projection of Indian Rice Export to Major Importing Countries

The export of Indian rice to different countries which was computed using the transitional probability matrix presented in Table 4.39.

Table 4.39: Projected exports of rice to major importing countries (Quantity: Tones)

Countries	Nepal	Benin	Guinea	Cote D Ivoire	Senegal	South Africa	Bangladesh	Other
2020-21	379127.49 (7.52)	478257.67 (9.49)	292923.13 (5.81)	315112.42 (6.25)	515353.90 (10.22)	196252.92 (3.89)	388723.69 (7.71)	2474956.75 (49.10)
2021-22	388998.88 (7.72)	543269.03 (10.78)	317576.98 (6.30)	299497.18 (5.94)	485800.20 (9.64)	186788.07 (3.71)	347446.94 (6.89)	2471330.80 (49.03)
2022-23	382911.76 (7.60)	543477.00 (10.78)	309896.92 (6.15)	295410.65 (5.86)	481116.91 (9.54)	187095.26 (3.71)	390813.96 (7.75)	2449985.70 (48.60)
2023-24	386043.39 (7.66)	536520.25 (10.64)	306727.81 (6.09)	296071.44 (5.87)	481422.45 (9.55)	185926.12 (3.69)	390988.75 (7.76)	2457008.04 (48.74)

Note: Figures in parentheses indicates percentage to total export of rice

It was projected that during 2020-21, the major markets for Indian wheat would be other (49.10 %), Senegal (10.22 %) and Benin (9.49 %). The projected exports to Nepal, Guinea and Bangladesh have exhibited an increasing trend in both absolute value and percentage to total export. The projected market share of Nepal is

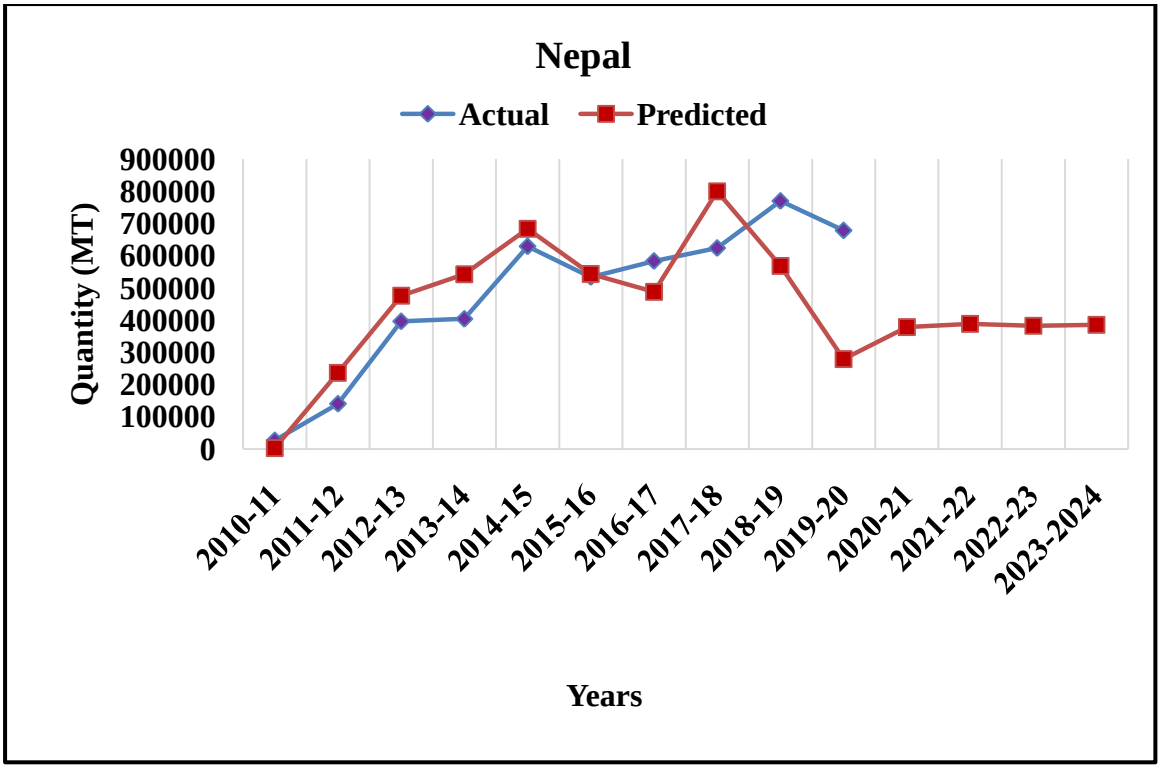

Figure 4.47: Actual and Predicted shares of Rice export to Nepal

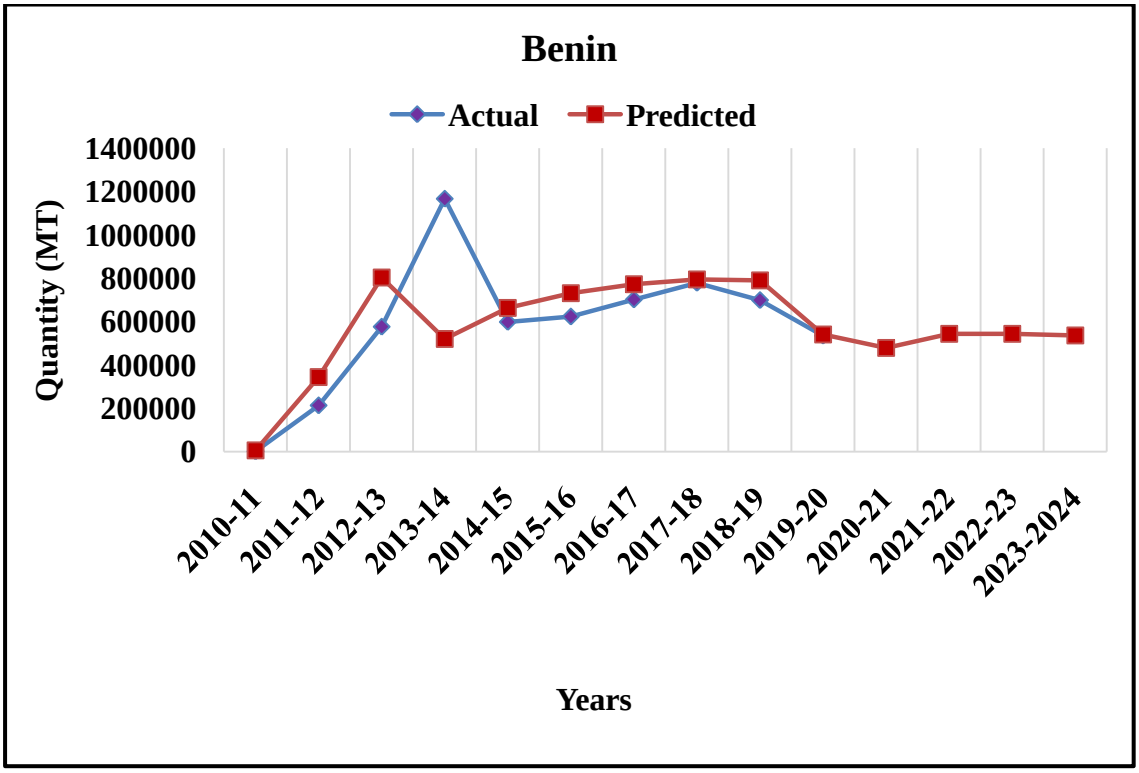

Figure 4.48: Actual and Predicted shares of Rice export to Benin

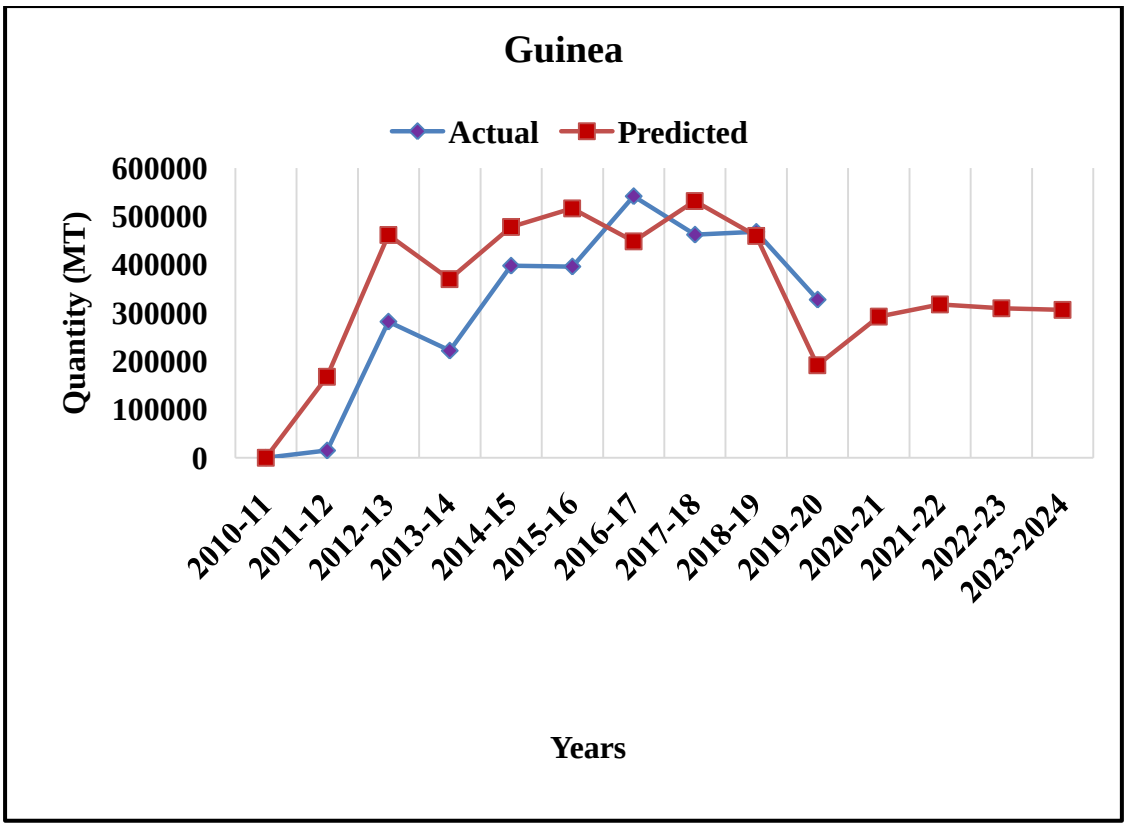

Figure 4.49: Actual and Predicted shares of Rice export to Guinea

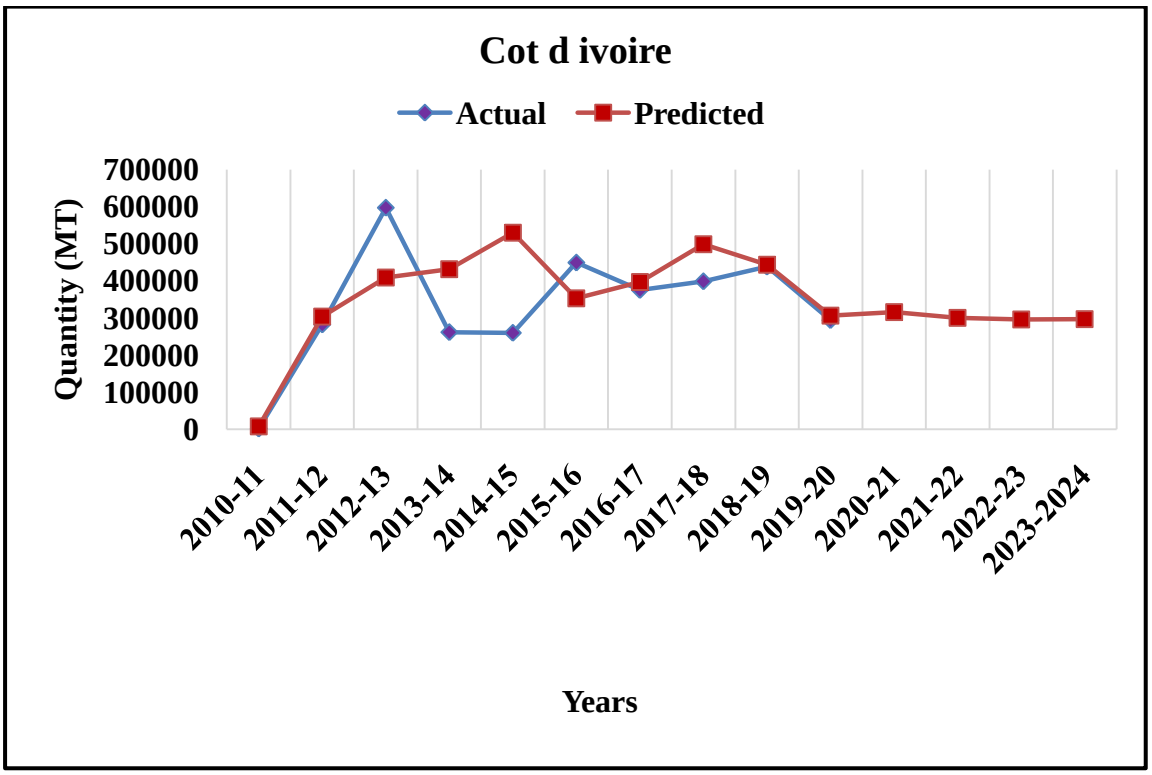

Figure 4.50: Actual and Predicted shares of Rice export to Cot D Ivoire

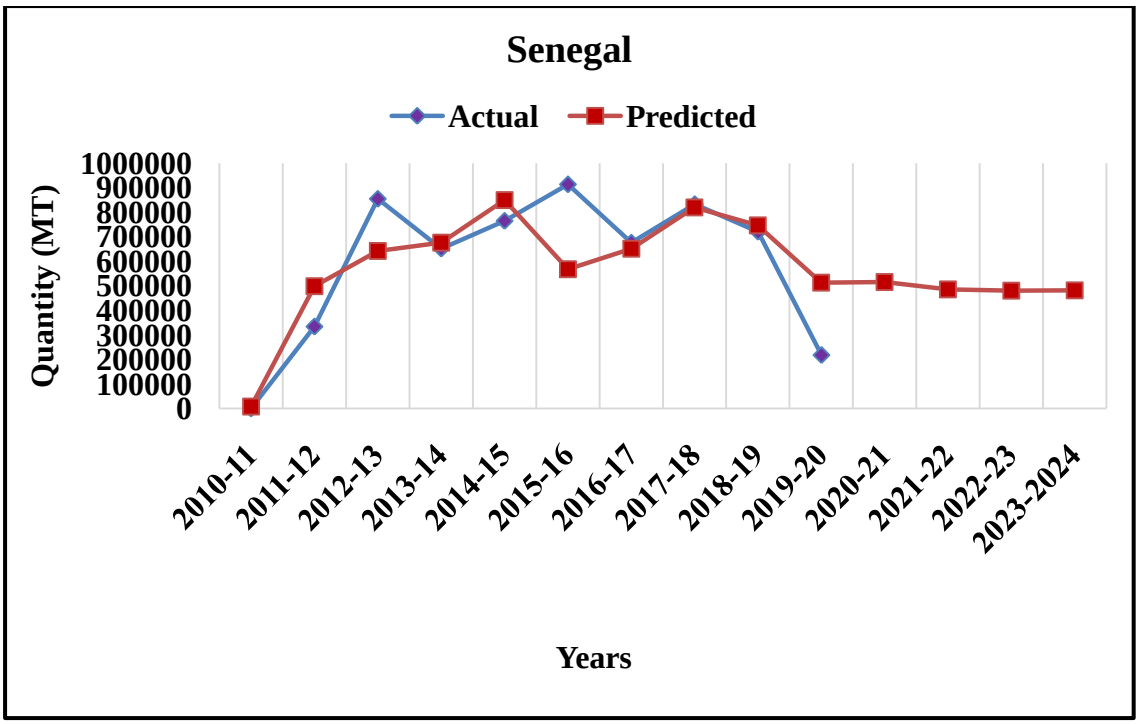

Figure 4.51: Actual and Predicted shares of Rice export to Senegal

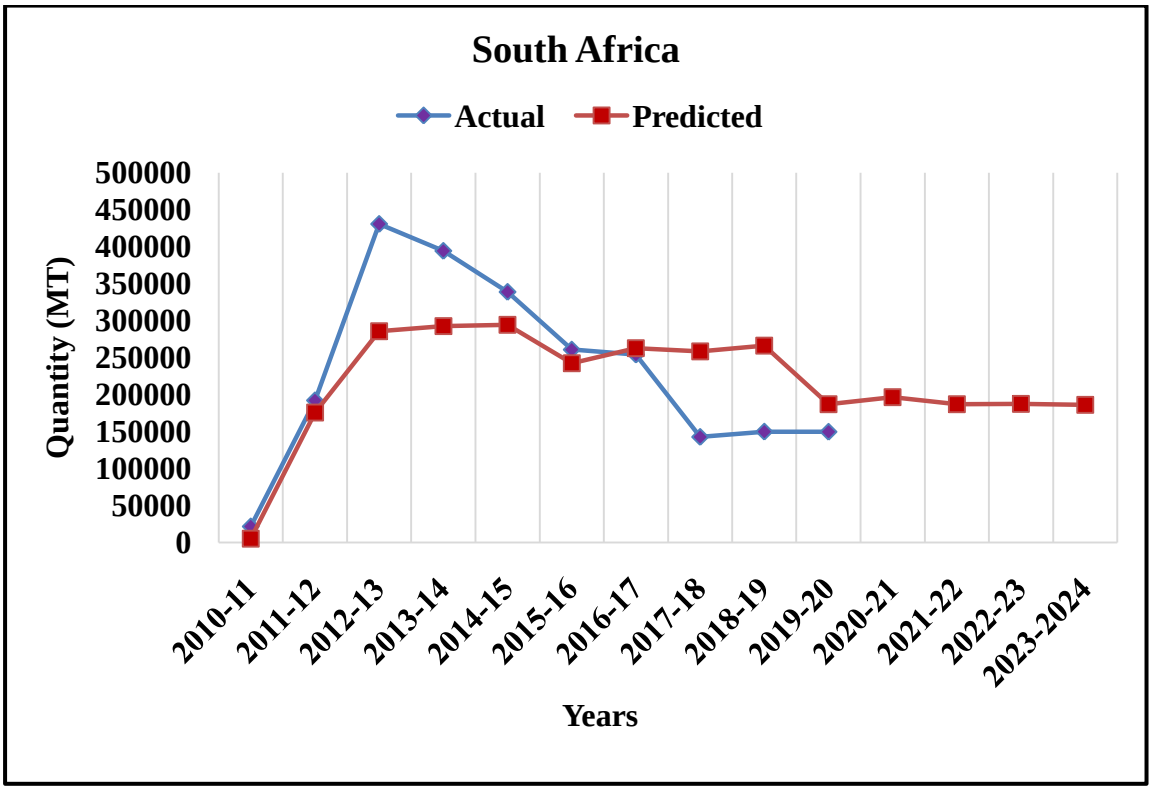

Figure 4.52: Actual and Predicted shares of rice export to South Africa

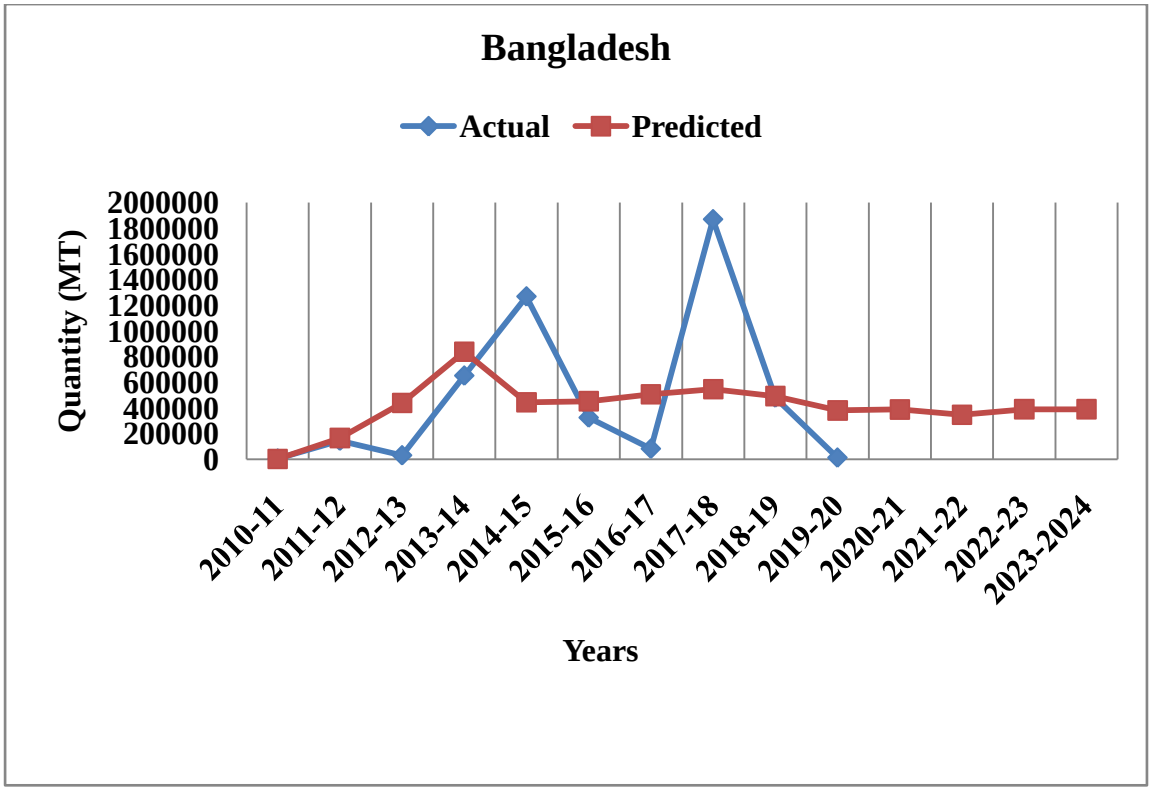

Figure 4.53: Actual and Predicted shares of rice export to Bangladesh

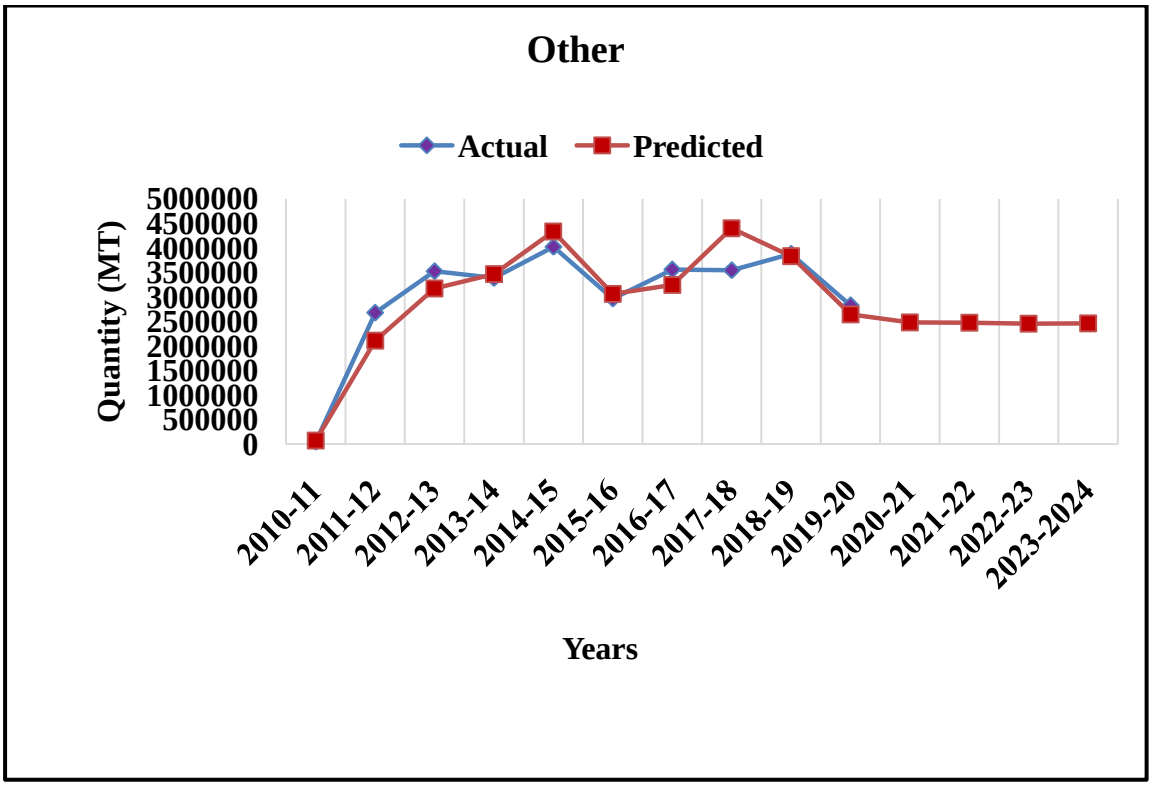

Figure 4.54: Actual and Predicted shares of rice export to other countries

likely to increase marginally from 7.52 per cent in 2020-21 to 7.66 per cent in 2023-24 Similarly, the projected value of rice export to Guinea is likely to increase from 9.49 per cent in 2020-21 to 10.64 per cent during 2023-24.The projected market share of Bangladesh is likely to increase marginally from 7.71 per cent in 2020-21 to 7.76 per cent in 2023-24.The remaining major countries like Benin, Cote D Ivoire, Senegal and South Africa, the projected value showed an increasing trend in both absolute and relative to total export from India.

CHAPTER V

SUMMARY AND CONCLUSIONS

CHAPTER- V

SUMMARY AND CONCLUSIONS

5.1 INTRODUCTION

The Export-Import Policy (EXIM Policy), announced under the Foreign Trade (Development and Regulation Act), 1992, would reflect the extent of regulations or liberalization of foreign trade and indicate the measures for export promotion. Export and import play a significant role in the economic development of all the developed and developing economies. With the growth of international organizations like WTO, UNCTAD, ASEAN, etc., world trade is growing at a very fast rate

The commodities which posted significant positive growth in exports were, Rice (38.34 %) Basmati rice (26.09 %), Non Basmati Rice (12.45 %), Maize (0.88 %).wheat (0.38 %).Cereals exported 40 per cent share in 2019-2020 from the total allied agriculture export from India. Rice (*Oryza sativa*) as a grain, rice crop is one of the main food grain crop domesticated.

Maize or corn (*Zea mays*) is cultivated globally being one of the most important cereal crops Worldwide. Maize accounts for one-third of total cereal trade in the world. Few of the countries in the world produce sufficient maize for their populations; others rely on imports of maize. Hence, it becomes a critical food security risk if major producers or exporters of maize worldwide are unable to meet expected demands in other parts of the world, due to plant diseases, increased domestic use of maize for a variety of purposes, or other reasons. India ranks 4th and 7th in terms of global maize acreage and production, contributing to about 4.6 per cent and 2.4 per cent respectively. Maize is the 3rd most important food grain for our country (after rice and wheat). It is the fastest growing cereal crop in terms of area, production as well as productivity.

In India, maize was sown in around 16.98 lakh hectares (41.95 lakh acres) as on 31st January 2020 which is higher than 14.78 lakh hectares (36.52 lakh acres) covered during corresponding period of last year, global consumption of top three cereals (maize, wheat and rice) stood at 2,365 million MT of which maize held about 48 per cent share. Over the last decade, both global production as well as consumption increased at a CAGR of about 3.4 per cent. Just above 15 per cent of

global production was traded internationally with about 89 per cent exports contributed by five exporters - USA, Brazil, Argentina, Ukraine and European Union. Over the last few decades, maize cultivation has shifted from being grown only during the kharif in traditional areas (such as Rajasthan, Uttar Pradesh and Bihar), primarily to be used as food, to being grown across non-traditional areas (such as Andhra Pradesh, Madhya Pradesh and Karnataka), across seasons and majorly produced for industrial use. Produce to the consumer at reasonable price on the other. In 2019-20, India's major export destinations

Wheat is the leading source of vegetable protein in human food, having higher protein content than other major cereals, maize or rice. In terms of total production tonnages used for food, it is currently second to rice as the main human food crop and ahead of maize, after allowing for maize's more extensive use in animal feeds. Along with this wheat can be used in cement. Wheat and other cereals posted huge growth over last year, i.e., increasing from Rs. 425 Crore to Rs. 3283 Crore and Rs. 1318 Crore to Rs. 4542 Crore, respectively. On specific demand from countries, NAFED has exported 50,000 MT wheat to Afghanistan and 40,000 MT wheat to Lebanon under G2G arrangement. India has witnessed tremendous growth of 727 per cent for Wheat export. Wheat production has increased to a record 107.06 million tonne (MT) for the crop year 2019-20 (July-June), up by 1.3 per cent world production. India's major export destinations were Nepal, Bangladesh, UAE, Somalia Afghanistan, and India's wheat export in 2019-20 has increased by 18.50 per cent over the corresponding period of the previous year. India's share in global exports was around 0.28 per cent in the year 2019-20.

Rice (*Oryza sativa*) as a cereal grain, rice crop is the one of the main food grain crop domesticated. Rice is the most widely grown cereal in the world and is staple food for more than 60 per cent of world's population. China is the largest producer of rice contributing for over 30 per cent of the world's rice output. India occupies the second position accounting for about 22 per cent followed by Indonesia. Rice is one of the most important exportable agricultural commodities from India with the third-highest worldwide production rice, 503.17 million metric tons (USDA), the export of Rice (Basmati, Non-Basmati rice). The global markets for Indian rice are highly dynamic and the barriers to trade are being lowered gradually all around the world. The export of rice is also related with the buffer stock of rice

held by the government. Because of comfortable buffer stock, India became a major exporter of rice in 2012. There is a strong demand for Indian rice in the international markets. Indian economy and is the oldest and largest occupation of India In agriculture rice is one of the most important food harvest of India and second across the world. Agriculture is still one of the priority sectors of the rural economy. Rice export by India is in three categories which is Basmati, non-Basmati and other. Any rice other than Basmati Rice is named as Non- Basmati rice. Rice is an important commodity which is being exported to different countries Basmati and non-basmati and other rice are exported from India to different countries. India is the leading exporter of the Basmati Rice to the global markets.

Rice constitutes around 44 per cent of total food grain consumption in the country and it occupies 23 per cent of gross sown area of India. Production of rice has tremendous impact on food and nutritional security, not only in India but also throughout the world. Rice is positively influenced by trade liberalization and it is emerged as significant export crop. Traditionally, India used to export basmati rice and a small quantity of non basmati rice. The export of rice is also related with the buffer stock held by the government. Because of comfortable buffer stock, India became a major exporter of rice in 2012 There is a strong demand for Indian rice in the international markets. The increasing consumer demand for rice and India's strength for production of basmati as well as non-basmati rice, coupled with liberal export policy, and large public stock have created ample scope for rice export. In recent years, the African countries have also shifted to Indian non-basmati rice because of price competitiveness. The future performance of any product in international markets can be judged in the light of its past performance. Therefore, evaluation of past performance of rice is necessary to work out its export potential, challenges and opportunities. Rice export from India is determined by various factors and therefore, reliable estimates of determinants of export are essential for the formulation of appropriate policies. The export promotion policy of a country must be in tune with the fast changing and dynamic international markets for commodities, India's direction of foreign trade has exhibited a structural shift during the last decade. India has comparative advantage in agriculture, so that there is considerable scope for raising farm income and employment by stepping up agro-based exports without jeopardizing and indeed by consolidating the food security already achieved.

Agricultural exports can thus serve as the bigger safety net in the process of structural adjustment in India.

5.2 OBJECTIVES

1. To study the growth in area, production, productivity and export of cereal crops in India
2. To measure instability in area, production, productivity and export of cereal crops in India
3. To study the export performance of cereal crops in India
4. To assess export competitiveness of cereal crops in India
5. To analyse direction of trade of cereal crops in India

5.3 METHODOLOGY

The present study is based on the secondary data collected from official website of Agricultural Processed Product Export Development Authority (APEDA) (https://apeda.gov.in/apedawebsite/), government reports, articles, magazines and Internet. The secondary data of cereal crops was collected from different sources like .Directorate General of Commercial Intelligence and Statistics (DGCIS) Indiastat.com. Time series data on cereals export collected for the period of 30 years from 1990-1991 to 2019-2020. The different analytical technique was used for the study are - Growth rate analysis, Instability analysis, Export Performance analysis, Nominal Protection Coefficient (NPC), Markov Chain analysis.

5.4 MAJOR FINDINGS AND RECOMANDATIONS

5.4.1 Growth in area, production and productivity of cereal crops

The compound growth rates (CGR) of area, production and yield of selected cereal crops *viz*., maize, wheat and rice were estimated at region national level for three sub-periods and overall period i.e. 1990-91 to 2019-20. The Period I starts from the year 1990-91 to 1999-00, period II starts from the year 2000-01 to 2009-10 and period III starts from 2010-11 to 2019-20.

Maize

The annual CGR in area of maize was highest during period II but growth in area of maize was slightly decreased during period III. Yield of maize has shown

positive and significant trend in entire study periods but maximum yield growth was observed during period III. The production of maize was significantly increased due to complementary effect of area expansion and significant positive growth in yield of maize in period II. Thus, at overall level, increase in production was due to improvement in yield and area expansion. The performance of maize in terms of area, production and yield revealed an expansion in these parameters at national level.

Wheat

The trends in area, production and productivity of wheat in the country revealed the area expansion growth by 1.71, 1.20 and 0.30 and 0.88 per cent per annum in three sub-periods and overall Period. In period III, the area under wheat crop increased at a non-significant rate. The production growth of wheat was much faster than area growth in India. As the yield is concerned, it was highly significant in period I. The yield growth of wheat crop was positive and significant in entire study period but it was improved at slower rate in subsequent periods. The production of wheat was significantly increased I to III period. The positive and significant growth in production was mainly due to yield improvement as area was non-significantly changed during period III. Thus, increased production of wheat crop was mainly due to yield improvement and slightly due to area expansion during overall period.

Rice

The area of rice in India was increased during overall period. In period I, area of rice was increased whereas the area of rice was non-significantly changed in II and III period. The production of rice was increased in during three sub-periods, respectively. It was mainly due to yield improvement in entire study period. Yield improvement was main reason for increase in production of rice.

Growth rates in exports of cereal crops

Compound growth rate of exported quantity, value and price of maize are shown in the export performance in terms of quantity showed that, there was positive and highly significant growth in the quantity in period I. In contrast, the export value of maize showed non-significant change while, the export unit price registered a positive growth in period. The export of maize in terms of quantity grew during the period II. At the same time, the value of maize exported also increased. The export performance of maize in terms of unit price showed positive but non-significant

growth in period II. The quantity and value of maize exported was found to be in period III. However, export unit price of maize was non-significantly increased in period III. Thus, the maize export in terms of quantity, value and unit price grew at a positive and significant growth during the overall period. It revealed that, export growth in terms of quantity and value was much higher than unit price in entire period.

The quantity of wheat exported from India and export value declined at a non-significant rate whereas, the export unit price recorded positive but non-significant growth in period I. The export of wheat in terms of quantity and export value was declined during period II. In contrary, the export unit price of wheat grew significantly. The quantity as well as export value of wheat showed positive but non-significant growth in III period. However, the export unit price of wheat was declined.

The export of rice in quantity grew during period I. It was also accompanied by positive and highly significant growth in export value but the export unit price of wheat was non-significantly declined in first period. In period II, the export of rice in terms of quantity and value showed non-significant changes but its unit price was significantly grew. The III period witnessed a significant growth in rice export terms of quantity and in terms of value. But the unit price of wheat export was declined in period III. During the overall period, the rice export in terms of quantity, value and unit price displayed positive and highly significant growth.

Country wise export performance of cereal crops

The major importing countries of maize were selected on the basis of share of the particular country to the total maize exported globally during the period I (1990-91 to 1999-2000). Based on the export quantity to different countries, the trend analysis was carried out for the top importing countries. The top countries are Indonesia, UAE, Sri Lanka, Bangladesh, South Africa, Malaysia and Iran.

The highest growth rate in exported quantity of maize was observed in Sri Lanka followed by UAE which was significant at 1 per cent level of significance in period I. Highest growth in case of export value of maize was observed in UAE whereas, lowest export value was found in Malaysia. In case of export unit price, the

highest growth was noticed in Sri Lanka and. While, the lowest growth in export unit price was recorded in UAE but it was non-significant.

Vietnam and Malaysia reported the highest growth in terms of exported quantity of maize during period II. However, Bangladesh exhibited lower growth. In case of export value, Taiwan recorded highest growth and lowest growth was noticed in Korea. The significantly highest growth in export unit price was realized in Taiwan which was significant at 1 per cent level of significance. It was followed by countries *viz*., Korea and Malaysia in second sub-period of study. In third period, the exported quantity of maize showed positive and significant growth only in Nepal having CGR per whereas, all other countries *viz*., Indonesia, Malaysia, Taiwan and Bangladesh revealed significant negative growth in quantity of maize exported from India. On the other hand, the countries such as Nepal and Bangladesh recorded significant positive growth in maize export value but the remaining countries showed declining growth in export value. The highest export unit price was realized in Indonesia which was significant too. In contrary, the lowest unit price was noticed in Nepal which was non-significant.

The wheat export in terms of quantity showed positive but non-significant growth in seven export destinations except Jordan, where it was negatively non-significant during period I. In a similar manner, there was non-significant growth in export value of wheat. In case of unit price of wheat, UAE was the single country which recorded positive and significant growth whereas; it was significantly declined in Netherland. The rest of countries realized non-significant growth in export unit price of wheat in the period. In II sub-period, the quantity of wheat export registered a positive and significant growth in Philippines and Korea. Indonesia and Yemen registered positive growth in export value of wheat but it was not significant while remaining countries displayed negative growth trend in export value. The export unit price of wheat registered negative growth in top seven export destinations in II sub-period. The export of wheat quantity was significantly increased at the rate during third period. In contrast, the countries *viz*., Bangladesh, Indonesia, Dijbouti, and Korea showed declined growth in exported quantity of wheat in the same period. The significant growth in export earning was recorded in Nepal and lowest growth was noticed in UAE but it was non-significant. Bangladesh recorded positive but non-significant growth in the export unit price of wheat whereas the rest of countries

realized negative and non-significant growth in export unit price of wheat in this period.

Country wise export performance of rice

The country-wise growth performance of rice exports in terms of quantity, value and unit price the highest growth in exported quantity of rice was observed in South Africa and lowest growth was noticed in Sri Lanka but the growth was non-significant. The export unit price grew in Russia and Bangladesh.

Nigeria was the one and only country which recorded significant positive growth in terms of exported quantity of rice during period II. On the other hand, South Africa showed significant but negative growth trend and the rest of countries registered non-significant growth in the exported quantity of rice. The export value of rice was non-significantly increased in Cote D Ivoire, Nepal and UAE while significantly declined in Nigeria. Cote D Ivoire reported the highest growth in rice export unit price. However, Nepal exhibited lowest growth in export unit price but it was non-significant in II period. In III period, the export of rice quantity and export value was significantly increased at the rate of in Guinea. The growth in export quantity was higher than export value and unit price in overall periods.

5.4.2 Instability in area, production and productivity of cereal crops

To examine the fluctuations in area, production and productivity of maize crop, the instability index was estimated and reported in at national level, the instability in area of maize crop was increased as instability index i.e. CDVI of maize area increased during III sub-periods of study. In these sub-periods, the magnitude of area instability was below 5 per cent which was considered as low level of instability. At national level, yield of maize crop was more unstable compared to area, which increased variability in production of maize during entire study period. Sudden rise in production variability of maize crop per cent was observed period I to II period. It was due to increased yield variability from. The area of maize crop was also unstable in period II as compared to I period. However, the production instability of maize was declined due to declined instability in yield and area in period III.

Maize crop showed low level of instability area, as compared to production and yield during entire period.

Instability in production of wheat was increased in third period as compared to I period due to rise in yield instability of wheat. The area of wheat crop was more stable as compared to production and yield in India.

Instability in production and productivity of rice at national level was increased during third sub period of study compared to I sub period. It was increased in production. In regards with yield, instability was increased In case of area, it fluctuated I to II period. Further, the area of rice crop became stable as instability index was declined in III period. During overall study period. Instability in rice production was maximum compared to yield and area at national level.

Instability in maize export from India

The export instability in terms of quantity of maize was higher in period I. export value were declined over the period of time. The unit price realization was more stable during period III as compared to I and II period. The instability index of maize export indicated that, the fluctuations in export quantity and export value were quite higher as compared to export unit price in entire study period.

The instability indices of wheat export the variations in exported quantity of wheat were high in period III. the fluctuations in the export value revealed mixed trend i.e. variations in export value were higher in period I, but declined in period II and again it increased in period III. The unit price of wheat registered higher fluctuations in period I but it became more stable during period III as compared to I and II period. Instability indices of wheat revealed that, the export unit price was more stable as compared to export quantity and export value in sub-sequent periods and overall period

The export instability in terms of quantity of rice was higher in period I, as which was further declined in period II and period III. The instability in quantity of rice exported during entire study period was quite high.

The export value registered instability during overall period which showed that, instability in export value of rice was declined over the period of time and it became more stable in period III. The unit price realization was more stable during period III as compared to I and II period. The instability index of rice export indicated that, the fluctuations in export quantity and export value were quite higher as compared to export unit price in entire study period.

Country wise instability indices of cereal crops

The country-wise variations in exports of selected cereal crops i.e. maize, wheat and rice from India were estimated for the period from 1990-91 to 2019-20

The results of instability indices of maize in terms of quantity, value and unit price. The top destinations of Indian maize exports in terms of quantity, South Africa was the most unstable market having the highest instability index in period I. Countries *viz*., Indonesia, Iran and Malaysia were also unstable markets followed by South Africa having higher fluctuations in this period. In terms of export value, South Africa, Iran and Malaysia were most unstable markets having the higher instability indices in period I. UAE was the most stable market in terms of unit price by showing the lowest instability whereas South Africa was found to be unstable market. It clearly indicated that, South Africa was the most unstable market in maize export in terms of quantity, value and unit price in the period I.

There was a steep decline in the instability indices of all the countries during period II. The highest instability in terms of export quantity, value was observed in Korea while lowest instability was observed in Bangladesh and Vietnam, respectively. Bangladesh was the most stable market in terms of unit price having the lowest instability followed by UAE however, Vietnam registered higher fluctuations in unit price realized.

In period III, Sri Lanka recorded highest variability in terms of export quantity and value while lowest instability was observed in Nepal. Malaysia was the most stable market in terms of unit price of maize by registering the lowest instability followed by Nepal and Taiwan. In contrast, Indonesia registered higher fluctuations in unit price realized in period III.

Country wise instability indices of wheat

Netherland was the most unstable market in terms export quantity having the highest instability index followed by Yemen and Turkey in period I. But in case of export value, the higher fluctuations were registered by Turkey and Bangladesh. Yemen and Netherland were the most stable market in terms of unit price having the lowest instability in period I. The instability indices of all countries showed declining trend in period II as compared to the period I. Indonesia emerged as a most unstable market as it recorded the highest instability in terms of export quantity and export

value in period II. But in case of export unit price, Korea showed higher variations followed by Indonesia in the same period.

Yemen was the most unstable market in terms of export quantity and export value however, Nepal recorded lowest fluctuations having instability indices during period III. Korea registered higher fluctuations in unit price realized whereas; Nepal was the most stable market having the lowest instability in period III.

Country wise instability indices of rice

The country wise instability indices of rice .The results showed that, Indonesia registered the highest variations in terms of export quantity and unit price in period I. On the other hand fewer variations in unit price of rice were realized in Bangladesh followed by Russia. Nepal was most unstable market in terms of unit price with highest instability. Nepal became more stable market in third period in terms of quantity, value and unit price.

5.4.3 Export performance of cereal crops in India

The Export Performance Ratio (EPR) for export of maize was estimated to compare the export Comparative advantage or comparative disadvantage of Indian maize. The negative values of RSCA gave a clear indication of comparative disadvantage of Indian maize, which was increased over the period of time. It revealed the fact that, India was not competitive in maize export throughout the study period. The Indian maize export was less comparative due to the low production and less productivity of seed variety over last three decade.

Indian wheat had a comparative disadvantage as the estimated RCAs were less than unity during entire study the negative values of RSCA gave a clear indication of comparative disadvantage of Indian wheat, which was increased over the period of time. It revealed the fact that, India was not comparative advantageous in wheat export throughout the study period.

The estimated RCAs were higher than unity revealed that, the Indian rice had a comparative advantage during entire study period. The positive values of RSCA gave a clear indication of comparative advantage of Indian rice, which was increased over the period of time. It high lightened the fact that, India was competitive in rice export throughout the study period and India had great potential in rice export globally.

5.4.4 Export competitiveness of cereals crops in India

The export competitiveness of maize was analyzed using Nominal Protection Coefficient (NPC). The NPC basically helps in measuring the divergence of domestic price from international price and thus determines the degree of export competitiveness of a commodity.

Maize was moderately competitive in global market as farmers received less price in domestic market than the global price. It indicated that, Indian maize trade was advantageous. The value of NPC for maize in period I maize was highly competitive in global market as the domestic price was quiet less than the global price. But the situation was changed in period II; as NPC of maize export was 1.02 which showed that, Indian maize has non-competitive market and it was protected from the distorted world prices. In period III, the NPC of maize export was moderately competitive as international price was greater than domestic price. The domestic prices of maize were consistently lower than the international prices proved that, Indian maize trade was advantageous except in the year 2018-19.

Indian wheat was found to be not competitive in global market as NPC value of wheat was 1.05 (exceeds unity) during the overall period. This implied that wheat was possibly protected in entire period.

The NPC for wheat during I and III was moderately competitive. During II period, the NPC was 1.18. The domestic prices of wheat were consistently higher than international prices and thus, Indian wheat was found to be disadvantageous

Export competitiveness of rice

The value of NPC for rice in period I was moderately competitive in global market as the domestic price was quiet less than the global price. The NPC value of rice was increased in II and III period. But still Indian rice has moderate competitiveness in global market. During overall period, the NPC values of rice was rice was moderately competitive in global market as farmers received less price in domestic market than the global price.

5.4.5 Direction of trade of cereal crops in India

The transitional probability matrix for Indian maize importing countries of period I (1990-91 to 1999-00) during the study period, Sri Lanka remained as the most stable market among the major importers of Indian. Sri Lanka lost share to Malaysia. It gained share from Iran, Indonesia, and others and share from Malaysia. Thus Nepal was the most reliable and loyal markets for Indian maize. Surprisingly, the minor countries of maize, categorized as other countries was found to be the loyal markets after Sri Lanka with the higher probability retention. The transitional probability matrix for Indian maize importing countries of period II (2000-01 to 2009-10) Bangladesh, Vietnam and Malaysia were the loyal markets of Indian maize. Bangladesh was the most stable and loyal market .The transitional probability matrix for Indian maize importing countries of period Nepal, Vietnam, Sri Lanka and Taiwan were the loyal markets of Indian maize. Nepal was the most stable and loyal market.

Projection of Indian Maize Export to Major Importing Countries

It was projected that during 2020-21, the major markets for Indian maize would be Nepal, Bangladesh and other. The projected exports to Nepal have exhibited a decreasing trend in both absolute value and percentage to total export. The projected market share is likely to decrease marginally from 69.03 per cent to 63.00 per cent from 2020-21 to 2023-24. The projected market share is likely to decrease from 13.48 per cent to 12.86 per cent from 2020-21 to 2023-24.The remaining major countries like Bangladesh, Vietnam Indonesia, Malaysia Taiwan and Sri Lanka, the projected value shown an increasing trend in both absolute and relative to total export from India.

The transitional probability matrix for Indian wheat importing countries of period I, Jordan, UAE and Turkey were the loyal markets of Indian wheat. Jordan was the most stable and loyal market.

Jordan, UAE and Turkey were the only countries that were found to be the loyal markets among the major importing countries of Indian maize during period I. Netherland, Korea and Bangladesh were the most unstable importers as they could not retain their original share. The transitional probability matrix for Indian wheat importing countries of period II, Bangladesh, Sri Lanka, Korea, UEA and Indonesia were the loyal markets of Indian wheat. Bangladesh, Sri Lanka, Korea, UEA and Indonesia were the only countries that were found to be the loyal markets among the major importing countries of Indian maize during period II. Philippines and Yemen were the most unstable importers as they could not retain their original share. The transitional probability matrix for Indian wheat importing countries of period III, Nepal, Bangladesh and Djibouti were the loyal markets of Indian wheat. It is clear from the analysis that, Nepal, Bangladesh and Djibouti were the only countries that were found to be the loyal markets among the major importing countries of Indian Wheat during period III. UEA, Indonesia, Yemen and Korea were the most unstable importers as they could not retain their original share.

The projected exports of wheat to Nepal have exhibited a decreasing trend in both absolute value and percentage to total export. The projected market share is likely to decrease marginally from 2020-21 to 2023-24. The reason for showing decreasing trend by Nepal was that it had lost its market share to Bangladesh and other countries. The remaining major countries like Bangladesh, UAE, Indonesia, Djibouti, Yemen, Korea and others, the projected value shown an increasing trend in both absolute and relative to total export from India.

The transitional probability matrix for Indian rice importing countries of period I (1990-91 to 1999-00) depicts that, South Africa, Bangladesh and Kenya were the loyal markets of Indian rice. South Africa was the most stable and loyal market. South Africa, Bangladesh and Kenya were the only countries that were found to be the loyal markets among the major importing countries of Indian maize during period I. Saudi Arab, Russia, Sri Lanka and Indonesia were the most unstable importers as they could not retain their original share.

The transitional probability matrix for Indian rice importing countries of period II (2000-01 to 2009-10), Cote D Ivoire, South Africa and Bangladesh were the loyal markets of Indian rice. Cote D Ivoire was the most stable and loyal market. Cote D Ivoire, South Africa and Bangladesh were the only countries that were found to be the loyal markets among the major importing countries of Indian maize during period II. Saudi Arab, UAE, Nepal, and Nigeria were the most unstable importers as they could not retain their original share. The transitional probability matrix for Indian rice importing countries of period III (2009-10 to 2019-20) Guinea, South Africa and Nepal were the loyal markets of Indian rice. Guinea was the most stable and loyal market as resembled by the highest probability retention. Guinea retained its import share over the study period.

Guinea, South Africa and Nepal were the only countries that were found to be the loyal markets among the major importing countries of Indian rice during period III. Benin, Cote D Ivoire, Senegal Bangladesh were the most unstable importers as they could not retain their original share Indian rice to different countries which was computed using the transitional probability matrix. It was projected that during 2020-21, the major markets for Indian wheat would be other country, Senegal and Benin. The projected exports to Nepal, Guinea and Bangladesh have exhibited an increasing trend in both absolute value and percentage to total export. The projected market share of Nepal is likely to increase marginally from in 2020-21 to 2023-24. Similarly, the projected value of rice export to Guinea is likely to increase in 2020-21 to 2023-24.The projected market share of Bangladesh is likely to increase marginally 2020-21 to per cent 2023-24. The remaining major countries like Benin, Cote D Ivoire, Senegal and South Africa, the projected value shown an increasing trend in both absolute and relative to total export from India.

Actual and predicted shares of cereals export from India

The actual share of Nepal in maize import from India had maximum fluctuation over the study period (2010-11 to 2019-20) on the whole it had increased Prediction of export maize share value, Bangladesh the actual and predicted export share also showed decreased in trend from 2010-11 to 2019-20.

The actual and estimated shares of wheat exported from India to different countries (in percentage term) that actual and predicted values of wheat export from

India to major importer from 2010-11 to 2019-20. Trade had showed decreased from the year (2010-11 to 2015-16). Then import of wheat was increased during (2016-17 to 2019-2020) similar picture was observe in prediction of export share. The actual proportion of Bangladesh market share also showed fluctuation in actual wheat export and 16.71 per cent to 16.90 per cent predicted wheat export from India to Bangladesh. With regard to UAE the actual and predicted export share also showed fluctuation.

Actual and predicted values of rice export from India to major importer from 2010-11 to 2019-20. The actual share of Nepal in rice export from India shown maximum fluctuation over the study period trade had decreased. Predicted value of rice share has showed decreased in trend.

5.5 CONCLUSIONS

1. Growth in production of maize was significantly increased due to complementary effect of area expansion.
2. Production growth of wheat was much faster than area growth. Production of wheat crop was mainly due to yield improvement and slightly due to area expansion over a period.
3. The production of rice was increased during entire periods. It was mainly due to yield improvement in entire study period .Yield improvement was main reason for increase in production of rice.
4. Export performance of maize growth in terms of quantity and value was much higher than unit price in entire period. The quantity as well as export value of wheat showed positive growth.
5. Rice export in terms of quantity, value and unit price showed positive and highly significant growth during the overall period. South Africa was the most unstable market in rice export in terms of quantity, value and unit price.
6. Netherland was the most unstable market for wheat in terms export quantity Indian Rice had a comparative advantage; whereas, maize and wheat had a comparative Disadvantage during entire study period.
7. India was not competitive in maize and wheat export throughout the study period. Indian rice has better competitiveness in International market.

8. Indian maize has non-competitive market and it was protected from the distorted world prices.
9. Nepal, Vietnam, Sri Lanka and Taiwan were found to be the loyal markets among the major importing countries of Indian maize during period of study
10. Nepal, Bangladesh and Djibouti were found to be the loyal markets among the major importing countries of Indian Wheat during period of Study.
11. Guinea, South Africa, Cote D Ivoire and Nepal were found to be the loyal markets among the major importing countries of Indian rice during period of study.
12. South Africa was the most unstable market in maize export in terms of quantity, value and unit price.
13. Netherland was the most unstable market for wheat in terms export quantity Indian Rice had a comparative advantage; whereas, maize and wheat had a comparative disadvantage during entire study period.
14. India was not competitive in maize and wheat export throughout the study period. Indian rice has better competitiveness in International market.
15. Indian maize has non-competitive market and it was protected from the distorted world prices.
16. Nepal, Vietnam, Sri Lanka and Taiwan were found to be the loyal markets among the major importing countries of Indian maize during period of study.
17. Nepal, Bangladesh and Djibouti are the countries that were found to be the loyal markets among the major importing countries of Indian Wheat during period of Study.
18. Guinea, South Africa, Cote D Ivoire and Nepal were found to be the loyal markets among the major importing countries of Indian rice during period of study.

5.6 SUGGESTIONS AND RECOMMENDATIONS

1. The Indian government will have to evolve a comprehensive long term strategy, which can be formulated only on the basis of an extensive study of consumer preferences.
2. There is an urgent need for the technological up gradation of export industries. Improvement in the quality of product, standards and packaging.
3. There has been emerged need of promoting diversification of export.
4. Policy makers and scientists are drawing aggressive plans to enhance the productivity, the technologies developed through new researches and strategies would help in enhancing the production and quality of cereals which will in turn help in maintaining global standards and demand for cereals export. Still there is a need to develop technology to help farmer yield better quality of cereals.
5. India can improve its current export performance by implementing new steps and initiatives, like developing the varieties, revered for the drought-tolerance so that domestic production does not suffer and thus exports.
6. India should not depend on few countries for the export for long run India should diversify to other countries for reducing price variability.
7. In International market cereals should be promoted as brand. The export channel should be simplified to occupy higher share in world trade.

CHAPTER VI

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APPENDICES

APPENDIX

Appendix 1: Country wise export of maize from India in terms of quantity (1990-91 to 1999-00) **(Quantity: Metric Tons)**

Year	Indonesia	U Arab Emts	Sri Lanka	Bangladesh	South Africa	Malaysia	Iran	Other	Total
1990-91	10	6	0	5	0	1	0	1.32	23.32
1991-92	6	15	0	0	0	0	0	1.4	22.4
1992-93	403	0	0	20	0	0	0	2	425
1993-94	0	18	3099	525	0	17033	4985	1012	26672
1994-95	0	65	1864	1867	2872	532	9752	1946	18898
1995-96	0	124	9773	4801	0	2798	0	1255	18751
1996-97	4749	2128	8903	4028	0	33285.9	0	2269.08	55363.09
1997-98	0	144	118.5	394.8	0	0	0	948	1605.25
1998-99	0	262.9	180.5	1345	0	0	0	274.75	2063.35
1999-00	794.16	158.5	25	12	0	0	0	281.92	1271.58

Appendix 2: Country wise export of maize from India in terms of quantity (2000-01 to 2009-10) **(Quantity: Metric Tons)**

Year	Bangladesh	Vietnam	Malaysia	Indonesia	Taiwan	U Arab Emts	Korea	other	Total
2000-01	22540.36	0	0	870.24	0	371.5	0	8682.06	32464.16
2001-02	95655.92	0	6666.39	1480	0	713.44	0	8988.4	113504.2
2002-03	65033.86	291.4	0	4200	0	870.13	79.4	7703.47	78178.26
2003-04	285929.36	62.53	78251.9	12882	2348.44	20870.4	16600	126326.3	543270.9
2004-05	245797.89	5617.25	357150.97	56374	8763	38315.97	130066	240171.3	1082256
2005-06	264092.87	592.42	4104.9	1200	542.55	6884.04	37.5	142493.5	419947.8
2006-07	294167.18	11944	46946.13	113508.66	5799	25225.9	118	139702.5	637411.3
2007-08	202034.22	215566.88	1252302.32	38211.14	259229.5	85552.87	286550	388268.4	2727715
2008-09	111144.24	436854.87	1284347.28	43050.45	559928.1	199296.07	9357	893325	902682
2009-10	595161.09	597694.2	550690.42	106598.13	110580.1	69563.21	1082	601505.8	2632875

Appendix 3 : Country wise export of maize from India in terms of quantity ((2010-11 to 2019-20) (Quantity: Metric Tons)

Year	Nepal	Bangladesh	Vietnam	Indonesia	Malaysia	Taiwan	Sri Lanka	Other	Total
2010-2011	102413.2	735582	606800.6	505472.4	664158.6	47013	8051	340932.8	3010423
2011-2012	70205.99	483274.3	735603.2	1060593	786164.9	220984.8	2872.4	496022.9	3855721
2012-2013	145191.1	113736	1277522	1569349	966747.6	394496.5	15.03	321271.9	4788328
2013-2014	198217.6	516258.8	856660.1	1003131	898103.4	167112	255	314498.9	3954237
2014-2015	243947.1	363950.5	385023.5	917664.1	464158.8	35387	109176.1	306303.6	2825611
2015-2016	312629.2	185877	1498.28	9871.21	32736.58	1772	30463.4	123099.5	697947.2
2016-2017	376391.2	36337.77	403.05	1484.04	12459.6	15970	44655	78651.56	566352.2
2017-2018	426667.9	81033.26	21828.61	641.53	18920.8	4642.8	33396.13	118382.8	705513.8
2018-2019	484927.2	290195.7	81834.07	27.91	21050.73	3490	18027	152303.3	1051856
2019-2020	313322.7	9962.19	1893	47.99	192.27	48	1	44598.97	370066.1

Appendix 4: Country wise export of Maize from India in terms of value (1990-91 to 1999-00) (Value: Thousand US$)

Year	Indonesia	U Arab Emts	Sri Lanka	Bangladesh	South Africa	Malaysia	Iran	Other	Total
1990-91	3	2.1	0	0	0	0	0	0	5.1
1991-92	1.5	2	0	0	0	0	0	0	3.2
1992-93	73.4	0	0	2.29	0	0	0	0.15	75.84
1993-94	0	4.55	361.3	63.54	0	1892.98	592.61	164.43	3079.41
1994-95	0	9.35	280.56	274.67	341.51	63.66	1379.1	294.56	2643.41
1995-96	0	22.52	1651.21	702.18	0	467.96	0	440.78	3284.65
1996-97	1039.14	462.55	1725.8	709.65	0	5637.68	0	883.1	10457.92
1997-98	0	35.62	20.11	62.89	0	0	0	317.47	436.09
1998-99	0	68.03	19.06	252.09	0	0	0	102.84	442.02
1999-00	842.4	36.28	5.49	4.64	0	0	0	232.64	1121.45

Appendix 5: Country wise export of Maize from India in terms of value (2000-01 to 2009-10) **(Value: Thousand US$)**

Year	Bangladesh	Vietnam	Malaysia	Indonesia	Taiwan	U Arab Emts	Korea	Other	Total
2000-01	3108.88	0	0	875	0	79.88	0	1909.77	5973.53
2001-02	12155.81	0	725.5	1469.63	0	132.76	0	4903.92	19387.62
2002-03	7749.74	207.91	0	2075.16	0	164.87	61.27	3719.07	13978.02
2003-04	37196.54	80.57	10970.45	2337.78	371.43	3107.77	2363.57	22321.47	78749.58
2004-05	33204.9	961.4	51939.83	8619.02	1336.71	5672.44	20061.75	38650.34	160446.4
2005-06	42133.86	277.99	663.52	634.97	185.56	1085.37	29.67	26370.02	71380.96
2006-07	48015.94	2232.78	7676.44	19302.66	1157.21	4672.48	41.34	27561.34	110660.2
2007-08	40886.5	48935.29	275381.1	8464.91	59557.37	19071.6	65633.34	85984.27	603914.4
2008-09	22433.62	64029.04	267580.8	10769.4	124382.8	43213.5	2169.38	199275	733853.5
2009-10	120795.3	120758.6	112858	22414.16	21810.27	14750.48	272.63	125109.9	538769.3

Appendix 6: Country wise export of Maize from India in terms of value (2010-11 to 2019-20) **(Value: Thousand US$)**

Year	Nepal	Bangladesh	Vietnam	Indonesia	Malaysia	Taiwan	Sri Lanka	Other	Total
2010-2011	18775.24	169796.4	148901.5	131531.4	160943.2	12453.26	2033.34	92613.58	737047.9
2011-2012	18524.76	128008.3	206694.3	290540.7	222209.7	66222.68	866.86	142631.9	1075699
2012-2013	34329.49	38975.69	338637.3	425885.4	257787.4	115720.8	4.06	93954.76	1305295
2013-2014	46604.36	139925.8	206439.8	253625.9	220695.4	43604.3	69.22	93213.73	1004178
2014-2015	49566.38	89004.61	88827.97	209507.8	107712.6	8542.84	26950.63	86604.37	666717.2
2015-2016	69236.63	51176.89	1834.36	2499.55	8344.12	478.85	7696.55	36722.77	177989.7
2016-2017	86275.59	20717.85	585.5	2025.75	3238.93	4010.38	10076.08	26636.95	153567
2017-2018	95486.31	29882.73	5776.72	1208.97	4435.18	1292.86	7940.67	44318.13	190341.6
2018-2019	104599.66	72523.16	18584.08	174.08	4550.13	867.15	4024.85	64978.89	270302
2019-2020	97297.51	15261.67	927.68	123.06	48.65	18.76	1.11	29099.39	142777.8

Appendix 7: Country wise export of Wheat from India in terms of quantity (1990-91 to 1999-00) **(Quantity: Metric Tons)**

Year	U Arab Emts	Netherland	Yemen	Jordan	Korea	Bangladesh	Turkey	Other	Total
1990-91	0	0	0	89640	23068	2971	0	23779	139458
1991-92	49827	0	0	248773	170968	0	0	188682	658250
1992-93	0	0	0	0	0	103	0	36646	36749
1993-94	40	0	0	0	0	0	0	310	350
1994-95	35572	0	0	0	0	22960	0	28096	86628
1995-96	85057	42216	96031	20249	0	136670	50067	202178	632468
1996-97	83385	153250	249569	59082	69255	53422.92	79518	398413.25	1145895.17
1997-98	0	0	0	0	0	0	0	3.15	3.15
1998-99	3.6	0	0	0	0	0	0	1757.4	1761
1999-00	0	0	0	0	0	0	0	3.15	3.15

Appendix 9: Country wise export of Wheat from India in terms of quantity (2000-01 to 2009-10) **(Quantity: Metric Tons)**

Year	Sri Lanka	U Arab Emts	Indonesia	Philippines	Bangladesh	Korea	Yemen	Other	total
2000-01	0	106156	0	69345.2	220840.07	228645	56000	132505.01	813492.28
2001-02	53646	347170.3	73916.85	476400.13	840064.71	125700	163001	569481.25	2649380.2
2002-03	162296.1	128390.5	610058.4	831202	1000165.16	136055	91345	711741.81	3671254
2003-04	322278	361226.85	620583.8	118830	1566070.1	133707.3	347443.3	622941.17	4093080.5
2004-05	48077	199285.86	22810	23947.5	1176309.66	12000	70250	456663.01	2009343
2005-06	10813.97	18043.09	44	98350	579020.46	0.1	0	39901.61	746173.23
2006-07	4959	19777.6	0	2	5621.15	0	0	16273.46	46633.21
2007-08	5.14	22	0	0	0	0	0	210.12	237.26
2008-09	0	48	0	0	264	0	0	808.51	1120.51
2009-10	0	0	0	0	0	0	0	47.3	47.3

Appendix 10: Country wise export of Wheat from India in terms of quantity (2010-11 to 2019-20) **(Quantity: Metric Tons)**

Country wheat	Nepal	Bangladesh	U Arab Emts	Indonesia	Djibouti	Yemen	Korea	Other	Total
2010-11	228.1	0	0.87	0	0	0	0	165.51	394.48
2011-12	2632.15	312477	115659.7	3352	25000	3599.73	0	278026.2	740746.8
2012-13	6354	1774038	498130.7	375433.4	461109.4	507232.6	1053751.2	1838761	6514811
2013-14	76348.06	1985441	664860.3	325504.8	300938.8	303040.6	754729.2	1151512	5562375
2014-15	111256.3	1123304	391018.8	348005.7	12600	104381	66405	767099.2	2924070
2015-16	129646.7	378600	99722.3	3038	600	0	100	54961.92	666669
2016-17	189939.2	37270	23889.64	72	25	0	0	14410.18	265606
2017-18	184818.7	6345	7085.18	0	2	0	0	124539.3	322790.1
2018-19	180804.3	22558.67	7156.43	0	0	0	0	15705.56	226225
2019-20	162413.6	33311.1	8436.6	4.09	0	0	0	13188.89	217354.2

Appendix 11 : Country wise export of wheat from India in terms of value (1990-91 to 1999-00) **(Value: Thousand US$)**

Year	U Arab Emts	Netherland	Yemen	Jordan	Korea	Bangladesh	Turkey	Other	Total
1990-91	0	0	0	9315.82	4113.22	1158.51	0	2760.4	17347.95
1991-92	4336.62	0	0	23502.06	13373.24	0	0	23380.46	64592.38
1992-93	0	0	0	0	0	9.39	0	3321.82	3331.21
1993-94	8.37	0	0	0	0	0	0	50.69	59.06
1994-95	5380.77	0	0	0	0	3531.84	0	4572.1	13484.71
1995-96	14680.74	7743.94	16043.66	3844.9	0	22836.46	9221.31	35274.57	109645.58
1996-97	14293.55	25999.96	42724.3	10501.6	11631.09	9657.13	13412.69	68527.21	196747.53
1997-98	0	0	0	0	0	0	0	0.56	0.56
1998-99	1.95	0	0	0	0	0	0	320.81	322.76
1999-00	0	0	0	0	0	0	0	0.61	0.61

Appendix 12 : Country wise export of wheat from India in terms of value (2000-01 to 2009-10) **(Value: Thousand US$)**

Year	Sri Lanka Dsr	U Arab Emts	Indonesia	Philippines	Bangladesh	Korea	Yemen	Other	Total
2000-01	0	11089.14	1.11	8257.09	25217.7	23759.23	5822.05	16721.98	90868.3
2001-02	5408.55	34746.83	7902.99	54556.9	87246.16	12448.19	16561.02	64152.04	283022.68
2002-03	17357.88	13842.92	63772.25	79632.65	96451.61	12578.13	9196.41	70326.86	363158.71
2003-04	45803.5	49581.03	74474.85	14257.57	199977.74	12740.43	48244.24	86169.84	531249.2
2004-05	7490.5	33006.14	3452.76	2997.16	190048.96	1732.51	12074.59	74542.68	325345.3
2005-06	1724.52	3163.28	9.68	11444.84	102488.3	0.09	0	7107.33	125938.04
2006-07	857.74	2700.3	0	0.67	978.83	0	0	3304.29	7841.83
2007-08	1.69	7.83	0	0	0	0	0	49.64	59.16
2008-09	0	10.9	0	0	71.46	0	0	234.51	316.87
2009-10	0	0	0	0	0	0	0	11.8	11.8

Appendix 13: Country wise export of wheat from India in terms of value (2010-11 to 2019-20) **(Value: Thousand US$)**

Year	Nepal	Bangladesh Pr	U Arab Emts	Nepal	Djibouti	Yemen Republc	Korea Rp	Other	Total
2010-11	79.06	0	1.31	0	0	0	0	73.13	153.5
2011-12	608.38	89167.33	32486.01	932.9	7366.54	1008.87	0	81852.35	213422.4
2012-13	1667.33	514573.97	148215.9	112924.9	138836.1	152734.4	317001.1	548286.6	1934240
2013-14	20623.47	524786.43	191889.2	95914.66	86978.08	86262.73	221032	339008.3	1566495
2014-15	28317.44	311576.11	112340.1	97883.94	3531.24	29266.79	17870.42	227973.6	828759.7
2015-16	30836.49	92999.54	24836.69	711.93	151.15	0	47.34	14632.35	164215.5
2016-17	46716.11	9095.1	6858.17	23.51	8.57	0	0	4534.96	67236.42
2017-18	47069.96	1619.36	2309.55	0	0.74	0	0	45725.18	96724.79
2018-19	46837.18	5784.12	2505.32	0	0	0	0	5417.96	60544.58
2019-20	44494.68	9039.06	3140.06	3.08	0	0	0	5162.1	61838.98

Appendix 14: Country wise export of rice from India in terms of Quantity (1990-91to 1999-00) (Quantity: Metric Tons)

Year	Bangladesh	Saudi Arab	South Africa	Russia	Sri Lanka	Kenya	Indonesia	Other	Total
1990-91	0	11552	0	0	0	0	0	9472	21024
1991-92	0	21071	0	0	0	0	0	504719	525790
1992-93	0	40500	0	0	48772.41	0	0	187462.14	276734.55
1993-94	0	61777	116	0	25781	89	0	152691	240454
1994-95	125668	94719	1782	988	3083	58124	20528	143554	448446
1995-96	1255830	122999	370292	100581	98	391258	1035722	1263919	4540699
1996-97	175983.67	238978.4	218224.5	287559.2	221224.3	87367	821	758689.19	1988847.22
1997-98	420237	92934.97	266107.9	137945.7	151152	3042.2	0	724859.8	1796279.55
1998-99	2331638.2	126036	525012.9	121827.2	20450.91	37073.5	18701	1185101.9	4365841.56
1999-00	379176.56	160358.4	148103.6	142275.1	61983.52	13042	1183.64	351624.73	1257747.49

Appendix 15: Country wise export of rice from India in terms of Quantity (2000-01 to 2009-10) (Quantity: Metric Tons)

Year	Saudi Arab	U Arab Emts	Nepal	Cote D Ivoire	South Africa	Bangladesh	Nigeria	Other	Total
2000-01	176789.9	32868.6	7805.7	0	318444.9	102645.3	302149.1	557857.4	1541485
2001-02	34820.64	52837.68	24112.17	59686	559431.2	930717.3	156777.5	2518681	4337063
2002-03	142064	110175.5	66106.78	28153.8	273142.4	1239261	168705	612830.6	2640439
2003-04	237680.1	157316.2	20824.44	256084.5	466476	951962.3	537481	987285.1	3615110
2004-05	147241.8	167998.8	223604.3	217285.5	267601.5	593820.3	464327	839722.8	2921602
2005-06	133159.9	128634.5	162241.5	337893.4	391505.5	512920.2	547632.5	1488204	3702192
2006-07	133159.9	128634.5	162241.5	337893.4	391505.5	512920.2	547632.5	1488204	3702192
2007-08	221754.8	312181.9	231988.2	624973.6	271693.1	1906856	204747.5	1511721	5285916
2008-09	723.55	21311.83	24141.64	4425	2.7	603417.1	22112.5	255745.5	931879.8
2009-10	14877.29	11815.43	20794.86	5275	1035.33	64.88	0.03	85677.94	139540.8

Appendix 16: Country wise export of rice from India in terms of Quantity (2010-11 to 2019-20) (Quantity: Metric Tons)

Country	Nepal	Benin	Guinea	Cote D Ivoire	Senegal	South Africa	Bangladesh	Other	Total
2010-11	27159.53	1956.59	0	1700	0	21627.06	5499.56	42743.05	100685.79
2011-12	140864.16	213720	15003.36	282326.85	333929	192120.97	144703.47	2675051.78	3997719.59
2012-13	396586.72	576544.8	281845	596843.86	854741.01	430702.04	31333.01	3519394.4	6687990.84
2013-14	404127.29	1166593.92	221773.25	261503.7	651983.32	394304.61	651640.6	3381256.68	7133183.37
2014-15	629310.47	598568.99	397717.05	259694.32	765019	338839.75	1268342.81	4016553.65	8274046.04
2015-16	534139	623348.2	395978.84	448982.35	913982	260805.46	325050.18	2962283.74	6464569.77
2016-17	583733.76	702181.65	541573.75	375024.92	676060.2	254070.26	82688.19	3555471.56	6770804.29
2017-18	623932.98	778778.8	461978.17	398489.73	833059.17	142722.51	1869181.35	3540345.88	8648488.59
2018-19	770113.06	699004.8	467691.22	438089.53	720474.29	149879.99	480567.47	3873853.74	7599674.1
2019-20	678665	535242.13	327422.07	293891.57	217773.55	149641.39	13083.07	2824988.96	5040707.74

Appendix 17: Country wise export of rice from India in terms value (1990-91 to 1999-00) (Value: Thousand US$)

Year	Bangladesh	Saudi Arab	South Africa	Russia	Sri Lanka	Kenya	Indonesia	SUM	Other	Total
1990-91	0	4224.26	0	0	0	0	0	4224.26	3826.29	8050.55
1991-92	0	6239.35	0	0	0	0	0	6239.35	124541.9	130781.2
1992-93	0	11333.76	0	0	12094.6	0	0	23428.36	41223.21	64651.57
1993-94	0	17810.99	30.17	0	7415.86	31.16	0	25288.18	46587.9	71876.08
1994-95	28247.05	28932.67	431.81	457.84	681.94	12654.44	4422.38	75828.13	32583.46	108411.6
1995-96	284083	34477.41	90888.81	31562.9	19.26	91411.36	248526.5	780969.2	330370.2	1111339
1996-97	40928.09	71493.34	53326.14	89437.94	54140.77	18455.85	130.39	327912.5	214264.2	542176.7
1997-98	96858.7	28455.76	65540.1	41329.16	34052.18	779.97	0	267015.9	186689.4	453705.3
1998-99	533868.2	36820.97	127974.8	33518.39	4214.07	8776.13	4430.23	749602.8	297187.2	1046790
1999-00	83430.8	48725.64	36502.69	36049.03	11804.42	2027.37	404.22	218944.2	91599.02	310543.2

Appendix 18: Country wise export of rice from India in terms value (2000-01 to 2009-10) **(Value: Thousand US$)**

Year	Saudi Arab	U Arab Emts	Nepal	Cote D Ivoire	South Africa	Bangladesh	Nigeria	Other	Total
2000-01	46097.36	6887.21	4168.52	0	13329.89	64913.32	58836.08	34802.57	170198.9
2001-02	39616.56	7217.04	1469.79	5849.17	50448.39	17079.36	58836.08	102753.9	283270.3
2002-03	9493.16	11642.03	3911.35	6130.75	138818.4	125694.5	25554.89	468308.7	789553.9
2003-04	37331.67	29243.45	12411.86	4869.06	46910.69	198574	32797	121043.3	483181
2004-05	68076.12	50045.24	4494.9	65443.74	112186.7	185543.1	142590.6	250830.5	879210.9
2005-06	47369.38	54283.73	34667.09	49231.07	69310.06	123484.7	125457.5	214102.1	717905.6
2006-07	42776.77	52621.69	33634.36	78087.93	98293.9	107998.8	139750.2	388069.4	941233
2007-08	102079	204674.8	60599.15	170763.4	85454.89	653759.1	58974.91	495082.5	1831388
2008-09	598.15	25373.89	6196.52	1722.39	0.59	214506	6368.13	112134.6	366900.2
2009-10	10782.16	8862.48	6533.17	1805.64	492.13	26.8	0.03	48564.31	77066.72

Appendix 19: Country wise export of rice from India in terms value (2010-11 to 20019-20) **(Value: Thousand US$)**

Year	Nepal	Benin	Guinea	Cote D Ivoire	Senegal	South Africa	Bangladesh	Other	Total
2010-11	9242.43	687.36	0	727.05	0	8923.78	2379.08	28783.64	50743.34
2011-12	43845.5	94428.91	6008.31	116039.2	122918.5	85089.73	56726.89	1280971	1806028
2012-13	106180.6	239732.7	106005.5	216212.7	267898.9	170080	15396.17	1530460	2651967
2013-14	119021.6	485173.7	87666.42	98673.41	195742.8	158810.5	245404.8	1527263	2917756
2014-15	216309.9	247115.2	152876.2	97928.78	226027.3	131428.1	450072.8	1812953	3334711
2015-16	193521.9	215525.8	133029.6	150267.6	245795.5	87066.29	134102.8	1209328	2368638
2016-17	210468.3	252648.7	183146.6	124336	190320.3	88521.34	29818.62	1452214	2531474
2017-18	240156	314187.3	173811.8	148954.9	263223	55079.7	763549.3	1605426	3564388
2018-19	281723.3	264664.4	176273.3	163652.2	221565.5	54523.67	222059.2	1663373	3047835
2019-20	242600.2	195222	119297.6	107595.2	67444.33	51799.12	11994.06	1218650	2014602

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