EXPORT PERFORMANCE AND VALUE CHAIN ANALYSIS OF CHILLI IN INDIA

By

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(2019-11-044)

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VELLANIKKARA, THRISSUR- 680 656

KERALA, INDIA

2021

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THESIS

Submitted in partial fulfillment of the

requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture

Kerala Agricultural University, Thrissur

DEPARTMENT OF AGRICULTURAL ECONOMICS

COLLEGE OF AGRICULTURE

VELLANIKKARA, THRISSUR- 680 656

KERALA, INDIA

2021

DECLARATION

I, hereby declare that this thesis entitled **"EXPORT PERFORMANCE AND VALUE CHAIN ANALYSIS OF CHILLI IN INDIA"** is a bonafide record of research work done by me during the course of research and that it has not previously formed the basis for the award to me of any degree, diploma, fellowship or other similar title, of any other University or Society.

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CERTIFICATE

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ACKNOWLEDGEMENT

*First and foremost, praises and thanks to the **Almighty** and my **parents** for the showers of blessings throughout my research work which enabled me to complete my research work successfully.*

*I express my deep sense of gratitude to my major advisor and mentor **Dr. Anil Kuruvila**, Professor, Department of Agricultural Economics, College of Agriculture, Vellanikkara and chairperson of my advisory committee, for his expert and timely advice, meticulous scrutiny, continuous support and guidance at various stages of my research work and thesis preparation. His dedication, keen interest and overwhelming attitude played a major role in the successful completion of my research work. The completion of this study would not have been possible without the expertise of my major advisor and I will be obliged to him forever.*

*I owe deep sense of gratitude **to Dr. Mini Raj M.** for her valuable suggestions, co-operation, and guidance throughout my research work and thesis preparation. I express my sincere gratitude to **Dr. A. Prema**, **Dr. Chitra Parayil, Dr. Hema. M. and Ms. Divya K M** for the genuine support, concern and good wishes extended to me.*

*I express my sincere gratitude to **Sachu chechi** for her enormous support, valuable suggestions, extreme patience and constant help throughout my study. I thank **Anila** for her timely help and prompt response during my research work. I am grateful to my beloved junior **Manoj** for his constant support throughout my thesis work.*

*I extend my sincere gratitude to **the members of Spices Board** for providing all the necessary data required for my research work. I wholeheartedly thank all staffs of **Central library, college library** and **computer club** for the timely assistance offered during the period of study.*

*For their affection and support, I am grateful to my classmates, **Ankitha Thakur, Nanda Baiju, Binu. V. K.**, and **Nithya Kalpana. E.** as well as my seniors **Lokesh, Abhinav, Tomson, Apeksha, Femi, Geethu, Sreelekshmi, Shilpa, Neetha,** and juniors **Anupama, Midhuna, Vaishnav** and **Haris.***

Heartfelt words of gratitude to all my friends, especially to my ever supporting and motivating ***Abhishek, Sharana Basappa, Venkateswar Reddy***. *I extend my gratefulness to my friends* ***Sri Hari prasad, Abin Divakaran, Anup, Kasi, Mahesh, Suhas, Manoj, Sunny, Mahesh and Likitha.***

I apologize to those whom I couldn't mention in person.

Akhil Reddy M.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Introduction

1. INTRODUCTION

Chilli, botanically "*Capsicum annuum* L.", is known as the wonder spice and is one of most important and widely used commercial spice in the world (Mendhe and Degaonkar, 2010). It is also called as bell pepper, hot pepper, sweet pepper and cayenne pepper (Moscone *et al*., 2006). There are more than 400 distinct varieties of chillies all over the world and thus, it possesses a significant role in the human diet because of its use as a spice, condiment and vegetable and, in pickles and sauces (Ravindran, 2019).

Dry chilli is broadly utilized as spice and powder in curried dishes, whereas bird chilli is utilized in making hot sauce and pepper sauce (Kumar *et al*., 2019). Few varieties of chilli are well-known for red colour due to the presence of the pigment 'capsanthin,' while others are recognized for pungency which is due to 'capsaicin' (Kumari *et al*., 2017). Chilli is rich in nutrients and vitamins particularly; vitamin A and C. Dry chilli is an important source of Vitamin 'C'. It is utilized as a counter irritant in backache, rheumatic problems and neuralgia (Spruce *et al*., 2003). Capsicum also has tonic and carminative properties. The enzyme extracted from chilli is utilized in therapy of particular types of cancers (Surh and Lee, 1996). The Capsaicin obtained from chilli is utilized in torment ointments (Mason *et al*., 2004).

India is the only country which is cultivating many varieties of chilli with different quality characteristics. Different varieties of chilli grown in India include bird’s eye chilli (Dhani), Guntur Sannam, Byadagi, Ellachipur Sannam, Jwala, Hindpur, Madras Puri, Nagpur, Tomato chilli, Kanthari White, Kashmiri chilli and Nalchetti. The most popular among them are Sannam and Mundu varieties, which are extensively exported for its flavour, colour and pungency (Spices Board, 2014).

Chilli was cultivated in an area of 1.761 million hectares in the world, with a production of 4.492 million tonnes during Triennium Ending (TE) 2019 (FAO, 2019). The major chilli producing countries are India, China, Korea, Pakistan, Indonesia, Sri Lanka and Turkey in Asia; Ghana, Tunisia, Nigeria, and Egypt in Africa; United States of America and Mexico in North- Central America; Spain, Romania, Yugoslavia, Bulgaria, Italy and Hungary in Europe and Argentina and Peru in South America.

India is one of the largest producer, exporter and consumer of chilli in the world. The area and production of chilli in India during the TE2019-20 was 0.69 million hectares and 1.72 million tonnes respectively and the major chilli producing states are Andhra Pradesh and Telangana, accounting for about 37 per cent and 18 per cent of the production respectively,

followed by Karnataka, Odisha, West Bengal, Maharashtra, Madhya Pradesh etc., (Spices Board, 2020).

The world export of chilli in TE2017 was 0.87 million tonnes, out of which India accounted for 45.8 per cent (WITS, 2019). India exported 0.46 million tonnes of chilli, valued at ₹5,45,930 crores in TE2019-20 (Spices Board, 2020). The major export markets for Indian chilli are China, Vietnam, Thailand, USA, Sri Lanka, Malaysia, UAE, Indonesia and Bangladesh. China has become the main export destination for Indian spices during the last two years, outperforming the US. With increasing chilli exports from India over time; the export competitiveness of Indian chilli has also been improving. Despite the positive trend in Indian chilli exports, the country has been facing strong competition in the international export market, since the price of Indian chilli is deemed to be excessively high, and other competing countries like China and Pakistan are supplying chilli to the key importing countries at competitive prices (Ramchandra *et al*., 2012).

Chillies are generally consumed and traded as whole dried chillies and different value-added products like chilli powder, chilli oleoresins and pickled chillies. Chilli is mainly exported from India in the unprocessed form (dried and whole), which accounted for 70 per cent of total chilli exports during TE2019-20 and the rest was exported from the country as value added products (GOI, 2020). The export intensity of production for Indian chilli was 23 per cent in TE2019-20 (Spices Board, 2020).

Even though India occupies a dominant position in the production of chilli, the country was unable to exploit the full export potential of this crop because of increasing domestic demand (Ashok, 2014). Along with the Indian production, the other determinants like exchange rate, domestic price, world export price, price volatility and production in competing countries influence the export performance of Indian chilli. Because of the dependence on monsoon and robust internal demand for chilli, the Indian prices tend to increase strongly during periods of deficit production (Balaji and singh, 2014).

Spices have a huge domestic market in India; however, production is inconsistent, and quality varies from season to season and region to region. The variations in quality could be attributed to the poor primary processing facilities and inadequate market infrastructure in the country (Sadeesh, 2007). Rigid food laws exist in almost all developed nations, which are modified as well as updated regularly in the light of new scientific discoveries. In such a scenario, the exported product has to adjust to the quality guidelines demanded by the country

which is importing it. Though Indian chilli had export competitiveness and international demand, detection of pesticide residues, aflatoxin and Sudan red have adversely affected the exports from the country (Devi *et al.*, 2016; Muthupandi *et al.*, 2018).

In order to reduce the rejections of chilli exports from India, the Spices Board insist pre-shipment sampling and testing of chilli and chilli products for Sudan dye I, II, III, and IV, aflatoxin, and other harmful ingredients before exporting to the European Union (EU). Apart from this, chilli and value-added products of chilli for export to other countries such as the United States, South Africa, and Japan are also subjected to pre-shipment quality checks. As a result, consignments of chilli which are approved by Spices Board only are permitted to be exported to various worldwide markets (GOI, 2012).

The Spices Board is also providing training to chilli growers in many chilli producing states on Good Agricultural Practices (GAP) to lower aflatoxin levels at various stages of harvesting and processing. Traders and exporters receive similar training in Good Manufacturing Practices (GMP), such as safe storage and hygienic shipping to avoid moisture and reduce aflatoxin levels. This is a continuous process that assists entire value chain actors including farmers, traders, and processors in exporting consignments without the risk of aflatoxin contamination.

The spices sector in the country is undergoing a rapid transformation with innovations and improvements in the production technology, post-harvest processing, value addition and value chains (Babu *et al.*, 2019). The spices value chain involves the entire gamut of activities involved in organizing production, processing and manufacturing of desired products which are further made available to the end users. There are many post-harvest operations like cleaning, drying, packaging, processing etc., involved in chilli value chain. The improved quality and efficiency of value chains in chilli will empower India to enhance export of chillies and its products, successfully meeting the competition from other exporting and producing nations. The development and promotion of an efficient value chain is critical for the accelerated development of any commodity sector and for ensuring distribution of substantial gains among the participants of the value chain. India has made every effort to avoid contamination during harvesting, post-harvest handling, processing and storage, as consumers in importing countries demand "clean spices." This could be possible only with an integrated approach involving the efforts of farmers, processors, and traders.

In this context, the present study was undertaken with the overall objective of analyzing the export performance and value chain of Indian chilli.

The specific objectives of study are

1. To analyse the performance of chilli exports from India,
2. To find out the determinants of exports and export competitiveness of the Indian chilli
3. To undertake value chain analysis of chilli in Telangana and Andhra Pradesh.

LIMITATIONS OF THE STUDY

The primary data used in the study was based on the responses from farmers and market intermediaries in the states of Andhra Pradesh and Telangana, which were collected using pre-tested interview schedules. Majority of the farmers were not keeping any field record and hence, the data collected from the farmers' memory may suffer from recall bias. However, constant efforts were made to limit and minimize the misconceptions and errors by cross checking the data.

PLAN OF THE THESIS

The thesis is divided into five main chapters. The first chapter of the thesis provides a general overview of the study's background and the rationale for the study, as well as its significance and objectives. The second chapter reviews past studies relevant to the current research in order to provide the study's theoretical and empirical context. The third chapter outlines the research topic and methods used. The results and discussion are presented in the fourth chapter, and a summary of the study is presented in the fifth chapter, which is followed by references, an abstract, and appendices.

2. REVIEW OF LITERATURE

A comprehensive review of literature is necessary for understanding the various concepts and more importantly to gain a clear knowledge about the particular area of research. Moreover, a review of related concepts and past studies will provide a holistic approach, which in turn helps in analyzing and understanding the problem from the right perspective. The review is presented in the following sub-headings:

2.1. Export performance

2.2. Determinants of exports

2.3. Export competitiveness

2.4. Value chain analysis

2.1 EXPORT PERFORMANCE

2.1.1 Growth and instability

Negi *et al*. (1994) found that the exports from horticultural sector in India grew at a CAGR of 14.8 per cent in the pre-liberalization period (1976-77 to 1990-91). In value terms, the growth rate of potato exports was positive (30.8 percent), but the growth rate of dried onion exports was found to be negative (-3.9 percent). Meanwhile, in terms of export quantity, the respective Compound Annual Growth Rates (CAGRs) were 23.1 per cent and 9.7 per cent per annum.

Mamatha (1995) examined the growth rates in production and export of selected spices such as black pepper, chilli, turmeric, and ginger in the pre-liberalisation period and found positive growth rates in both production and export of those spices, which were attributed to the increased domestic production as well as demand in the international market.

Rajesh *et al*. (2002) estimated the trend in exports of major spices from India during the period from 1970-71 to 1990-00. It was found that black pepper exhibited CAGRs of 2.38 per cent per annum in export quantity and 12.78 per cent in export volume, whereas cardamom registered CAGRs of 12.76 per cent and 21.4 per cent per annum for export quantity and export value respectively. They also analyzed the instability in the export of major spices from India by using Coppock's instability index and found that black pepper had the highest variation in export quantity.

Shivshankar and Banakar (2008) in their study on the export performance of dry chillies and its products from India reported that the growth rates in quantity and value of exports were

7.78 per cent and 15.71 per cent per annum respectively. The export of dried chilli from India increased significantly during the period from 1960-61 to 2004-05, which was a clear indication of the rising export competitiveness of Indian chilli.

Soumya *et al*. (2014) analysed the growth and instability in production and export of selected Indian spices for the period from 2001 to 2010. The growth in export of black pepper, cumin and coriander were found to be positive. The instabilities in the export of cumin and pepper were found to be low, while coriander exhibited higher instability.

Meena *et al*. (2018) estimated the growth rates and instability indices for the exports of Indian spices during the pre-WTO (1985-1994) and post-WTO (1995-2015) periods. It was evident from results that the quantity of spices exported from India has increased at a CAGR of 8.23 per cent per annum during the overall period. In terms of value, it grew at a higher rate of 15.69 per cent as a result of the higher unit price, in addition to quantity exported, while the instability was found to be declining over the study period.

Indhushree and Kuruvila (2019) examined the growth and instability in the exports of small cardamom from India during the period from 1970-71 to 2017-18. The findings showed that the growth in export value, quantity, and unit value declined in the pre- WTO period, while export instability was higher during the same period. The post-WTO period observed positive and higher growth rates as well as less export instability. Due to rising domestic demand and intense competition in the foreign markets, especially from Guatemala, the growth and stability of small cardamom exports during the pre-WTO period were comparatively less.

Nagani *et al*. (2020) analysed growth and stability in exports of spices and spice products from India during the Pre-National Horticulture Mission (NHM) and Post-NHM periods i.e., from 1993-94 to 2004-05 and 2005-06 to 2017-18. It was observed that the growth in export quantity was lower in Period I than it was during Period II. In comparison to pre-NHM period, the growths in exports of spices and spice products were found to be high and significant in the post-NHM period, while the instability was found to be lower in Period II.

2.1.2 Decomposition analysis

Shyam *et al*. (2004) used the decomposition analysis to find out the components of change in mean export value of Indian marine products. The results showed that 95.93 per cent

of the increase in mean export value was due to the changes in average export quantity, which was mainly due to considerably higher growth in quantity of exports and lower unit value.

Qammer and Baba (2016) in their study on decomposition analysis of export of walnut from India, found that the contribution of the change in mean export quantity was highest to change in the average export value of walnut exports i.e., 81.90 per cent of increase in average export value was due to increase in mean export quantity. This was mainly attributed to the higher growth rate of export quantity during both the periods, whereas the export unit value recorded a negative growth rate.

Sebastian and Praveen (2019) analysed the sources of growth and variance in the exports of Indian spices between two time periods, *viz*., the base period from 2005 to 2010 and the terminal period from 2011 to 2016 by using Hazell's decomposition method. The study found that change in average export value was highly contributed by change in mean export quantity for crops like pepper, chilli, ginger and cardamom, whereas for turmeric, nutmeg and seed spices, it was mainly due to changes in mean export unit value.

2.1.3 Export diversification

Salim and Ojha (2004) used the Gini-Hirschmann index to examine the commodity diversification and spatial concentration of fisheries exports from India. The findings showed that the commodity concentration of Indian fisheries exports decreased both in terms of value and quantity in the post-liberalisation period, which resulted in reduced instability and diversification of the export basket. The expansion of the number of destinations/markets in the post-liberalisation period was due to the entry of more countries into "the European Union" and significant demand from Southeast Asian countries such as China, Hong Kong, and Thailand.

Veena (2017) used the Hirschman index to find out the geographic concentration of India's fishery sector exports. The study discovered that the expansion in the number of export destinations following the WTO agreement has lowered geographic concentration from 50.78 in 1998 to 22.9 in 2009. This was linked to the WTO's market access policies, particularly in relation to exports from developing countries.

Mohandas *et al.* (2018) analysed the commodity and geographical diversifications of major vegetable exports from India during the period from 1988 to 2016. In the export of vegetables from India, they employed the Gini concentration and Hirschman indices to measure commodity concentration and geography concentration, respectively. The findings revealed

that commodity as well as geographic diversifications in India's vegetable exports have increased over the study period.

UNCTAD (2019) examined the export concentration of 173 countries using multiple metrics of export concentration, such as the Hirschman index, the Gini coefficient, and Theil's T index for the period from 1995 to 2017. The findings revealed that many developing economies were characterised by a highly concentrated export sector, which is associated with poor levels of development. Export commodity dependence was widespread in the developing nations, with over two-thirds of developing countries being commodity-dependent, indicating that commodity exports accounted for at least 60 per cent of their merchandise export revenues.

2.1.4 Dynamics in direction of trade

Ajjan *et al.* (1998) investigated the changes in the direction of trade for senna and periwinkle from India by using Markov Chain analysis. The probability of Germany and United States maintaining their shares of imports of senna from India in the future were assessed to be 0.8258 and 0.8188, respectively, implying that these two nations would sustain the similar import shares in the future.

Srinivasamurthy and Subramanyam (1999) used a Markov chain model to examine the dynamics in the direction of onion exports from India during the period from 1980 to 1996. Malaysia, with a transition probability of 0.6459 from Saudi Arabia and 0.3488 from the UAE, was found to be the biggest gainer among the Indian onion importers over time. Sri Lanka, in addition to having a high probability of retaining its own share, was found to be having a moderate probability of gain of 0.3488 from Saudi Arabia. Even though the chance of retaining its own share of fresh onion exports from India was low for Saudi Arabia, it was also found to gain some share from Bangladesh and other countries.

Angles *et al*. (2001) employed Markov chain analysis to determine the dynamics in the destinations of turmeric exports from India. The results revealed that the probability of retention of past export share for Indian turmeric was strong for United Kingdom (42.99 percent) and other countries (58.77 percent). The United States, Iran, Japan, and the United Arab Emirates were not consistent importers of Indian turmeric. It was concluded that the strategies for export need to be geared towards the stable countries and plans for stabilising exports to other countries should also be developed.

Joshi *et al*. (2015) conducted a study on stability of Indian spices exports using Markov chain analysis. The study analyzed the dynamics of spices export to different countries and

observed that the stable destinations for Indian spices exports were Canada for black pepper, UK for chilli, Bangladesh for turmeric, UAE for cumin and Malaysia for coriander. The transition probability matrix indicated that most of the traditional importers have shown low retention probabilities, which may be due to the tough competition in trade of spices and trade related barriers in the developed nations.

Anantha and Sidana (2019) in their study reported that the retention ability for most of the major spice export destinations, with the exception of chilli, decreased during the post-NHM era as compared to the pre-NHM period. It was attributed to the increased spice production in countries such as China, Bangladesh and Turkey; as well as price fluctuations in the global market.

2.1.5 Trade complementarity

Basu and Datta (2007) studied the reasons for Bangladesh's lasting bilateral trade deficit with India and discovered that Bangladesh's exports were similar to India's and therefore, Bangladesh faced highly competitive exports from India. Bangladesh's exports and India's imports had more in common, which limited their trade complementarity.

Sarath (2010) examined the trade complementarity between India and ASEAN countries in the context of Regional Trade Agreements (RTAs) during the period from 1990 to 2007. The findings revealed that for the majority of the years, India's export and import intensity with ASEAN was greater than one. As a result, India's exports and imports to and from ASEAN countries were more intense than its trading pattern with the rest of the world.

A report published by International Monetary Fund (IMF, 2011) found strong economic complementarities between low-income countries and the BRICS (Brazil, Russian Federation, India, China and South Africa) based on complementarities in resource endowments and production structures. The export complementarity between low-income nations and China or India was shown to be higher than that between low-income countries and the United States or the European Union on the basis of trade complementarity indices.

2.2 Determinants of exports

Kumar and Rai (2007) analysed the factors determining the export demand for Indian tomato using regression analysis. The study revealed that around 98 per cent of the total variations in tomato export from India were due to four factors, *viz.*, domestic production, international trade, exchange rate and the ratio of Indian and international export price.

Kumar *et al*. (2008) analysed the determinants of export demand for India tea by the Ordinary Least Squares (OLS) method. They observed that the five determinants of export demand *viz.*, the export price, market size, exchange rate, international coffee price, and world tea production excluding India, accounted for 59 per cent of the overall variation in the demand for tea exports from India. It was found that a one per cent increase in global tea export would result in a 1.4 per cent increase in export demand for Indian tea.

Kumar *et al*. (2008) used regression analysis to identify the determinants of cucumber and gherkin demands and found out that the factors influencing export from India were world market size, exchange rate, and Indian export price, which together accounted for 96 per cent of the total variation in export of these commodities. It was also found that the exchange rate was the major determinant for Indian exports than the price of the commodity.

Hatab (2009) analysed the main factors influencing Egyptian cotton exports and found a negative but significant association between Egyptian export price and the quantity of cotton exported to the US. The study also found that the formation of World Trade Organisation (WTO) had a favourable and significant impact on exports. The growth in exports was ascribed to the modern methods of production, introduction of new varieties and efforts taken to achieve high quality requirements.

Krishnadas (2010) identified the factors that influenced spices exports from India for the period from 1979-80 to 2006-07 and reported that the export prices and output had positive effects on chilli exports, whereas the domestic prices had negative effect on exports of chilli during the study period.

Adhikari *et al*. (2016) examined the determinants of basmati rice exports from India during the period from 1980-81 to 2012-13. The estimated regression model showed that the export price, international price, lagged production, domestic consumption, and exchange rate were the major determinants of rice exports from India.

2.3 EXPORT COMPETITIVENESS

2.3.1 Comparative advantage

Ansari and Khan (2015) analysed the export competitiveness of Indian agricultural commodities by using Balassa's Revealed Comparative Advantage (RCA) index. It was reported that India had comparative advantage in the export of certain agricultural commodities such as meat, oilseeds, coffee, wheat, rice, and tea.

Suresh and Mathur (2016) studied India's comparative advantage by using the RCA index. They observed that the RCA improved over time in cotton, maize, and several fruits and vegetables, but declined in some spices, rice, and wheat. It was concluded that India was gradually losing its comparative advantage in plantation-based spices and other commodities, primarily to Asian countries.

Singh *et al*. (2020) in their study on the competitive scenario of India's spice exports by using RCA index, found that India retained its competitive position throughout the study period from 1990 to 2018 as the RCA values were found to be more than one, which indicated the higher competitiveness of India in the exports of spices.

Kumar and Gummagolmath (2021) conducted a study on the domestic and export competitiveness of major agricultural commodities in India with special reference to Telangana. The findings revealed that in the Pre-WTO and Post-WTO regimes, chillies and rice had higher comparative advantages for exports, but maize had the lowest RCA over time, implying that it had a lower comparative advantage than other exported commodities.

2.3.2 Competitive advantage

The Policy Analysis Matrix (PAM) is a computational framework for calculating the efficiency of input utilisation, comparative advantage, and the extent of government intervention in the production process (Monke and Scott, 1989). It can be used to determine key trade policy indicators such as the Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), and Domestic Resource Cost Ratio (DRCR).

Ravi and Reddy (1998) examined the competitiveness for jowar, maize, peanuts, sunflower, cotton, and coffee exports from Karnataka by estimating the NPCs under the importable and exportable hypotheses for the period from 1984-85 to 1994-95. It was found that with the exception of cotton, Karnataka had no competitive advantage in any of the six commodities studied. The export potential determined for jowar, maize, groundnut, and sunflower were found to be considerably low.

Datta (2000) used Policy Analysis Matrix (PAM) to estimate the global competitiveness of basmati and non-basmati rice exports from India for the post-WTO period (1994-95 to 1998-99). The NPC, EPC and DRCR values were found to be less than unity, indicating that India had export competitiveness for both basmati and non-basmati rice. The export competitiveness increased in the case of basmati rice, but reduced in the case of non-

basmati rice. During study period, he observed a rise in private and social profitabilities of rice exports in nominal terms.

Mahesh (2000) analysed the trade competitiveness of Indian tea using the NPC and DRCR indicators. Under the importable hypothesis, the NPC and DRCR were found to be 0.71 and 0.66 respectively, which showed Indian tea as a good import substitute. Under the exportable hypothesis, the NPC and DRCR values showed that the country was competitive in the export of tea.

Jose (2002) calculated the NPC and DRCR for potato exports from Karnataka by using PAM under the importable hypothesis. The NPC for potato was 0.38, indicating disprotection in potato cultivation. The DRCR was found to be 0.27, suggesting the higher competitiveness in potato exports.

Bastine *et al.*, (2012) estimated the NPC for black pepper in India for the years 2009-10, 2010-11 and 2011-12 as 0.973, 0.966 and 0.899 respectively and found that India was competitive in the export of black pepper. The (1-EPC) values though positive, were only marginal, indicating the sensitivity of the domestic producers against their foreign competitors. The Domestic Cost Resource Ratio (DRCR) values of less than one indicated efficient and internationally competitive production of black pepper in India.

Dastagiri *et al*. (2013) used NPC estimates to examine the export competitiveness of Indian vegetables. They found the NPC values were less than one for all vegetables, which showed the competitiveness of Indian vegetables in the international market.

Devi *et al*. (2016) analysed the competitiveness of Indian chilli by estimating NPCs for period from 2006-07 to 2010-11. The estimated NPC values under exportable hypothesis varied from 0.46 to 0.69, which implied that India had competitive price advantage for chilli exports in the world market.

Ramanathan *et al*. (2019) in their study on trade competitiveness of major Indian spices in post-WTO era, identified that the NPC estimates were considerably lower than one and the average NPC value for all spices during the period from 2010-11 to 2015-16 was 0.43, indicating that these spices were competitive in the global market. The study concluded that coriander and turmeric were the most export competitive among the spices in India.

2.4 Value chain analysis

Porter (1985) introduced the term "value chain" to characterize the whole range of activities required to carry a product or service from conception through various stages of production, distribution to customers, and final disposal after use. As a result, the value chain analysis could be applied to disaggregate a firm into major activities, allowing sources of competitive advantage to be identified.

Kaplinsky and Morris (2000) described the value chains as the interconnected groups of elements (public and private agents; domestic and international markets; inputs, outputs, production factors, institutions, environment and natural resources), and also as a group of vertically linked economic agents. It was observed that the focus of the analysis of the value chain could be on the elements or the agents, depending on the scope of the study.

A value chain approach could able to mitigate some of the constraints faced by the producer in product and financial markets. This brings together chain actors such as producers, aggregators, traders, processors, and financial institutions to gain control over the production, marketing, processing, and distribution processes (Trienekens, 2011).

Birthal *et al.* (2007) had analyzed the integration of smallholders in the value chain and found lower participation due to lack of access to inputs, capital, markets technology and extension services. The study explained the possibility of exploring market linkages through institutions such as cooperatives, producers' associations and contract farming, which could reduce transaction and marketing costs as well as avert some production risks.

Singh (2006) conducted a study on small producer's participation in cotton value chain in India, which was wide and complex due to presence of large number of final goods. It was found from the results that farmers and labourers were the weakest actors in the cotton supply chain as it was mainly controlled by exporters, importers and retails players.

Babu and Verma (2010) analysed the milk value chains in the private and co-operative dairy plants. According to the study, the average total procurement cost per litre of milk for co-operative dairy plants was found to be higher than for private dairy plants due to higher costs incurred on transportation, chilling, and receiving of milk. The private plants outperformed the co-operative dairy plants in the production of butter and skimmed milk powder (SMP), while

the co-operative dairy plants surpassed the private dairy plants in the production of toned milk, standardised milk, full cream milk, SMP and ghee.

Bolwig *et al*. (2010) studied the importance of value chain mapping and found that it is significant to know how actors and activities are linked vertically and to understand the horizontal dimension, i.e., the relationships between actors at the same level of the chain.

Devi *et al.* (2010) examined value chain concept from the perspectives of institutional framework, capacity building and poverty alleviation. The study revealed that there was a significant rise in income i.e., 1.5 times and 20 per cent increase in number of working days per member upon joining Food Security Army (FSA), which has been initiated by Kerala Agricultural University (KAU) with the goal of effective utilization of educated unemployed youth of Kerala for promoting mechanization in paddy cultivation. In addition to the socio-economic upliftment of the FSA members, this programme could enhance mechanization and increase area under paddy farming in the state.

According to Fearne *et al*. (2012), there are substantial contrasts between value chain and supply chain philosophies. Value chain thinking is better suited to differentiated products and segmented markets than supply chain thinking, which is better suited to commodities and commodity markets. The objective of supply chain management is to cut down costs, improve margins, and increase market share, while the goal of value chain management is to add value and segment the market with differentiated goods that increase profitability at all levels of the chain.

Reddy (2013) analysed the integration of smallholder farmers into the value chain of dry land crops. It was observed that institutional changes had little impact on production costs. However, by lowering transaction costs, they were able to significantly increase the farm profitability. Small farmers have higher transaction costs, therefore institutional innovations such as contract farming, cooperatives, and producers' associations benefit them the most.

A value chain is a sequence of actors and activities that add value to agricultural products before it reaches the end-users. Dunn (2014) claimed that an agricultural value chain connects or networks business organisations vertically through processing, packaging, storage, transportation, and distribution. It includes the flow of products, knowledge and information, finance and social capital, and culminates in the final product for customers, while choosing price points and dispersing profits at various phases (Gereffi *et al*. 2001).

A value chain is defined as the "organised links across group of producers, traders, processors, and service providers, including Non-Governmental Organisations (NGOs), who collaborate to boost productivity and value addition" (ADB, 2015).

Zamora (2016) had reviewed dimensions and applications of value chain analysis to identify factors that influence the performance of value chains and examined the interactions between various stakeholders in a specific industry. Despite the fact that all firms are part of the value-creating network, some have more power than others.

Mani *et al.* (2018) examined the problems in production and marketing, as well as the potential for value chain development in kiwi. It was identified that kiwi produced in Arunachal Pradesh had a unique selling appeal, because of which the demand exceeded the supply. This would necessitate a far more targeted approach that focuses on farmers who are already cultivating kiwis and also encouraging new farmers to venture into it. Furthermore, it was concluded that the entrepreneurs who have taken the investment risk and gained the first mover advantage could solidify position as the market leader, at least in high-value markets.

A study conducted on value chain of tomato by National Horticultural Research and Development Foundation (NHRDF, 2018), observed that the marginal farmers were obliged to sell around 90 per cent of their produce to traders or wholesalers through commission agents, as they had smaller holdings and only 5-10 per cent of the goods was sold directly through the mandi due to immediate cash needs. According to the report, there was 13.34 percent post-harvest loss in the tomato value chain at the farmer's level. The highest losses of 6.21 per cent was found at the cleaning, grading, weighing, and packaging stage, followed by harvesting and transportation accounting for 4.80 per cent and 2.33 per cent of the losses respectively.

Chengappa *et al.* (2019) mapped coffee value chains in India by using the value links methodology. The study had observed three distinct forms of production systems *viz*., conventional, certified and organic. It also showed that better and sustainable gains were provided to producers in certified and organic systems, whereas coordination was greater in the conventional system.

A study conducted on a multi-impact appraisal of a rice value chain in India by Food and Agricultural Organisation (FAO, 2019), emphasized the adoption of the System of Rice Intensification (SRI) methodology to replace conventional rice, which was highly reliant on water and agricultural inputs and also resulted in production of high levels of methane. The

SRI technique had a favorable influence on the value chain from farmers (households) to the downstream operators through processors. The major implications included strengthening of household resilience to food security and self-organization as well as increase in gross income per household and annual yield by 14 per cent and 15 per cent respectively. The analysis highlighted a reduction in carbon footprint from 3.1 to 2.2 t CO_2-e per tonne of the product.

Kulakarni *et al.* (2019) mapped the value chains of maize in public and private seed systems and showed substantial differences under maize seed production of single-cross and double-cross hybrids, in terms of gross income, net income, Cost-Benefit Ratio and value added at successive levels of the movement of the seeds. It was suggested that suitable infrastructure, an institutional framework and an innovative public–private collaboration models across value chain were required for growth of the maize seed sector.

Manaswi *et al.* (2019) analysed the impact of Farmer Producer Organisations (FPOs) on production of organic chilli. The findings showed that the members of FPOs used much fewer inputs in the production of chilli, owing to the adoption of low-inputs in organic farming practices. Despite the yield reduction, the members could realize 13.86 percent increase in gross profits due to FPOs enabled access to technology and markets. Farmers in the study region used three different marketing channels to sell their produce. In the case of organic chilli, the channel that involved FPOs, with member farmers on one end and customers on the other, was found to have the highest marketing efficiency.

Sowjanya *et al.* (2020) conducted a study on chilli cultivation to assess the prices and profitability in marketing. Price spread analysis indicated that majority of farm produce was routed through two marketing channels, *viz*; Channel-I (producer-trader-wholesaler-retailer-consumer) and Channel-II (producer-processor-retailer-consumer). The producer's share in consumer rupee was found to be 80.51 per cent and 76.72 per cent, while the price spread was Rs.1500.67 and Rs.1971.92 in Channel-I and Channel-II respectively. It was also found that low price for the produce at the time of harvest and lack of transportation with respective scores of 78.26 and 63.13, were the most important constraints faced by the farmers.

3. METHODOLOGY

This chapter is intended to address different methodologies adopted for analyses of the data. The types and sources of data, sampling design, method of data collection and the analytical tools used in the study are included under the following headings.

3.1 TYPES OF DATA

The present study entitled "analyses of export performance and value chain of Indian chilli" was based on primary as well as secondary data. The annual data on production, export and imports were used to analyse the dynamics in growth and variability of chilli exports from India. The country-wise and product-wise export data were used to determine the extent of diversification of chilli exports from India. The data on shipping and handling costs, domestic and international prices of chilli, and other secondary data published by various institutions were collected to determine the dynamics in the direction of trade and export competitiveness of Indian chilli. The primary data was collected from selected farm households, village traders, commission agents, wholesalers, processors and exporters in the states of Andhra Pradesh and Telangana to undertake the value chain analysis of chilli in India.

3.2 DATA SOURCES AND PERIOD OF STUDY

The details of the secondary data, the sources of data and time periods for which data were collected are depicted in Table 3.1. The time series data on area and production of chilli in India during the period from 1970-71 to 2019-20 were collected from the publications of Spices Board, Kochi, and Directorate of Arecanut and Spices Development, while that for the world were collected from the FAO database. The annual data on the export and import of chilli in India and the rest of the world from 1960-61 to 2019-20 were collected from the World Integrated Trade Solutions (WITS) up to the six-digit Harmonised System (HS) code. The annual and monthly data on the product-wise import and export of chilli (quantity, value, and unit value) up to 8-digit level were collected from the website of the Ministry of Commerce and Industry, Government of India. The domestic and international prices of chilli were collected from the publications as well as the website of the Spices Board, Kochi. The costs on shipping and handling in international trade were obtained from the UNCTAD database.

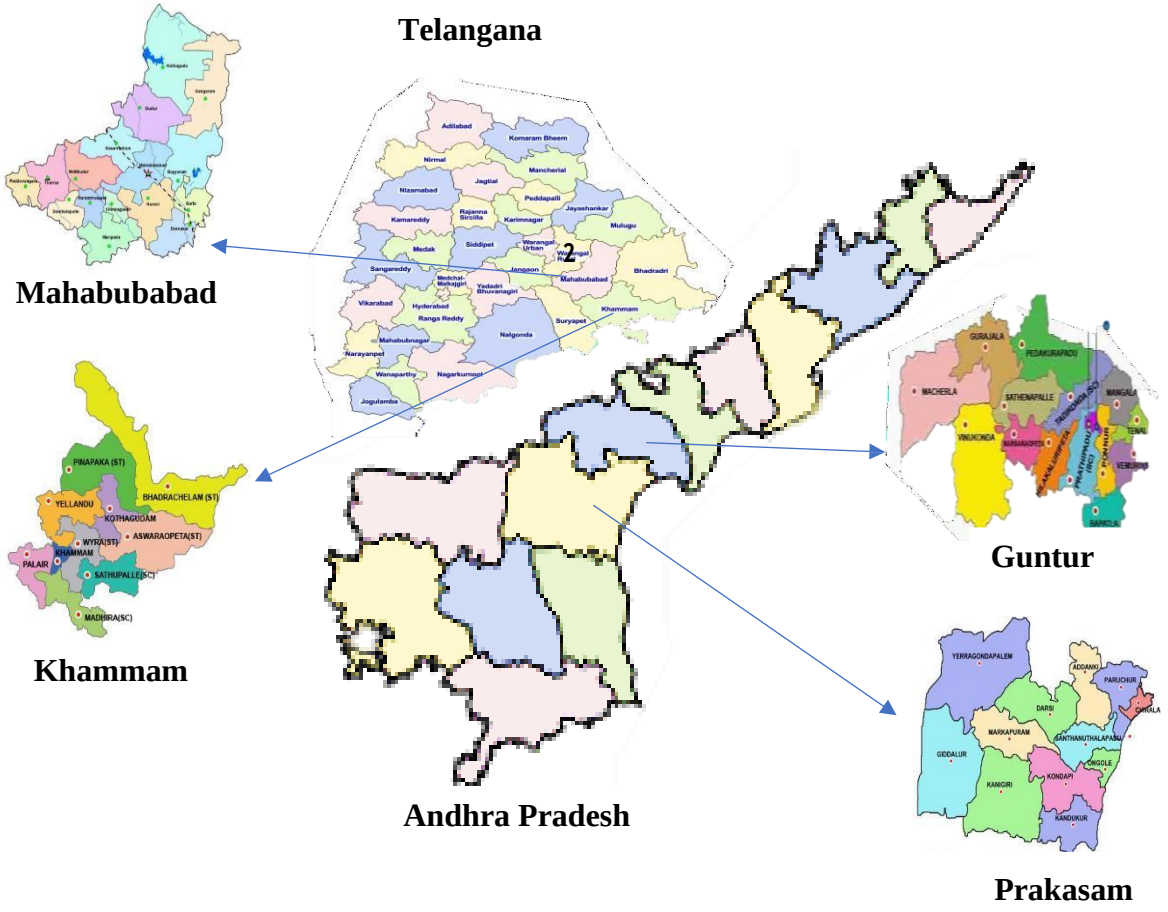
Table 3.1 Details of Secondary data used for the study

Sl. No.	Details of secondary data	Time period	Sources
1	Time series data on production of chilli in India and world	1970-71 to 2019-20	Spices Statistics and Spices Market Weekly, Spices Board, Ministry of Commerce & Industry,
2	Time series data on export and import of chilli in India and world	1960-61 to 2019-20	Directorate of Arecanut and Spices Development, FAO database, World Integrated Trade Solutions (WITS).
3	Annual data on export of chilli and its products from India (quantity, value and unit value)	1986-87 to 2019-20	Export-Import data bank, Ministry of Commerce and Industry, GoI. Directorate General of Commercial Intelligence and Statistics (DGCI&S), Ministry of Commerce and Industry, GoI.
4	Country-wise export of chilli in India (quantity, value and unit value)	1986-87 to 2019-20	
5	Data on costs incurred for shipping and handling	1990-91 to 2018-19	United Nations Conference on Trade and Development (UNCTAD) database

3.3 LOCATION OF THE STUDY

For the collection of primary data, field-level survey was conducted in the states of Andhra Pradesh and Telangana, which together accounted for more than 50 per cent of the area under chilli production in India during Triennium Ending (TE) 2019-20. Andhra Pradesh and Telangana states were therefore selected purposively for the study.

Figure 1 Map of the study area



3.3.1 Telangana

Agriculture is the mainstay in Telangana and the development of the state is very much dependent on agriculture and allied activities. Not only does the sector contributes to food security, but it also employs over half of the state's workers and around 55 percent of the workforce in the state is engaged in agriculture and allied activities. The contribution from agriculture and allied sectors to Gross Value Added (GVA) at current prices in the state for the year 2016-17 was about 14 percent. Telangana, with 112.08 lakh hectares of geographical area, is India's 12th largest state and 60 percent is arable (GoT, 2017).

3.3.1.1 Land utilization pattern

The land utilization pattern of Telangana state for TE2016-17 is presented in Table 3.2. The gross cropped area of Telangana state was 48.11 per cent of the geographical area, and the state had a cropping intensity of 121.4 per cent. The net area sown for the state was 39.63 per cent of the gross sown area. Forest accounted for 23.13 per cent area of the state and 7.82 per cent of the total geographical area was put to non-agricultural uses.

Table 3.2 Land utilization pattern in Telangana during TE2016-17

Particulars	**Area (Lakh hectare)**	**Share in total geographical area (per cent)**
Forest	25.93	23.13
Barren and uncultivable land	6.07	5.43
Land put to non-agricultural uses	8.76	7.82
Cultivable waste land	1.82	1.62
Permanent pastures and other grazing land	2.99	2.67
Land under miscellaneous tree crops and groves	1.12	1.0
Other fallow lands	7.65	6.82
Current fallow lands	13.32	11.88
Net area sown (including fish culture)	44.42	39.63
Gross cropped area	53.93	48.11
Total geographical area	112.08	100.00

Source: Agricultural Statistics at a glance 2016-17, Directorate of Economics and Statistics, Telangana.

3.3.1.2 Cropping pattern

The cropping pattern of Telangana state is given in Table 3.3. As could be observed from the table, the major crops grown in Telangana were paddy, maize, groundnut, chilli and cotton. Even though food crops occupied the major share in gross cropped area, the area under food crops has decreased over the years, which accounted for 71 per cent in 2001-02, which in turn reduced to 66 per cent during 2016-17 (GoT, 2017). It could also be observed that 1.7 per cent of the gross cropped area in the state was under cultivation of chilli.

Table 3.3 Cropping pattern in Telangana during TE2016-17

Sl. No.	Crops	Area (in lakh hectares)	Share in total gross cropped area (Per cent)
1	Paddy	14.29	26.50
2	Maize	6.89	12.78
3	Groundnut	1.50	2.78
4	Cotton	16.24	30.11
5	Chilli	0.92	1.70
6	Others	14.09	26.13
7	Gross Cropped area	53.93	100

Source: Agricultural Statistics at a glance 2016-17, Directorate of Economics and Statistics, Telangana

3.3.2 Andhra Pradesh

Andhra Pradesh economy is much dependent on agriculture as 70 per cent of the state's population live in rural areas and hence rely on agriculture and allied activities for livelihood options. The contribution of agriculture to state GDP was 27 per cent and Andhra Pradesh, with 13 districts and has 76.21 lakh agricultural holdings. There are six agro-climatic zones and five different soil types, which allow the state to cultivate a diversity of crops throughout the year (GoA, 2020)

3.3.2.1 Land utilization pattern

The land utilization pattern of Andhra Pradesh state for TE2017-18 is presented in Table 3.4. The net area sown was 60.11 lakh hectares and it accounted for 37.50 percent of the total geographical area, while the area under forest was 36.88 lakh hectares, which accounted for 22.63 percent.

Table 3.4 Pattern of land use in Andhra Pradesh in TE2017-18

Particulars	Area (in lakh hectare)	Share in total geographical area (in per cent)
Forest	36.88	22.63
Barren and uncultivable land	13.46	8.26
Land put to non-agricultural uses	20.45	12.55
Cultivable waste land	4.13	2.53
Permanent pastures and other grazing land	2.11	1.29
Land under miscellaneous tree crops and groves	1.56	0.96
Other fallow lands	8.77	5.38
Current fallow lands	14.50	8.90
Net area sown (including fish culture)	61.11	37.50
Gross cropped area	74.65	45.81
Total geographical area	162.97	100

Source: Agricultural Statistics at a glance 2017-18, Directorate of Economics and Statistics, Andhra Pradesh.

3.3.1.2 Cropping pattern

The cropping pattern of Andhra Pradesh state is given in Table 3.5. It could be observed from the table that food crops had occupied the major share of 71.56 per cent of the gross cropped area. The major crops cultivated in the state are rice, cotton, sugarcane, chilli, mango, and tobacco.

Table 3.5 Cropping pattern in Andhra Pradesh during TE2017-18

Sl. No.	Crops	Area (in lakh hectares)	Share in total gross cropped area (Per cent)
1	Paddy	21.61	28.95
2	Maize	2.73	3.66
3	Bengal gram	4.79	6.42
4	Groundnut	8.41	11.27
5	Cotton	5.95	7.97
6	Mango	2.81	3.76
7	Chilli	1.61	2.16
8	Others	26.73	35.81
9	Gross Cropped area	74.65	100

Source: Agricultural Statistics at a glance 2017-18, Directorate of Economics and Statistics, Andhra Pradesh.

3.4 SAMPLING DESIGN

The primary data was collected from two states, Andhra Pradesh and Telangana, which were purposively selected for the study, as these two states were accounting for the highest share in area and production of chilli in the country. From each of the state, 60 farmers were selected, thus making a total sample size of 120. Two districts with highest area under chilli from each of the state, *viz*., Khammam and Mahabubabad from Telangana and, Guntur and Prakasham from Andhra Pradesh were purposively selected for the study. The samples were proportionately selected from each district based on the share of the district in total area under chilli in the state. From each of the selected district, two mandals or blocks, with maximum area under chilli were purposively selected, the details of which are presented in Figure 2. The proportionate samples allocated for each of the district were equally distributed among two blocks by randomly selecting farmers with chilli as the major crop in the gross cropped area from the list of chilli farmers obtained from the Departments of Agriculture in the respective states.

The data was also collected from 30 market intermediaries including, village traders, commission agents, wholesalers cum traders, processors, retailers and exporters from each of the state, making a total sample size of 60 market intermediaries from two states as shown in Figure 3. The data on various aspects of production and marketing of chilli was collected from the farm households and different market intermediaries by using pretested interview schedules, which are given in Appendix I, II, III and IV.

Figure 2 Distribution of sample chilli farmers

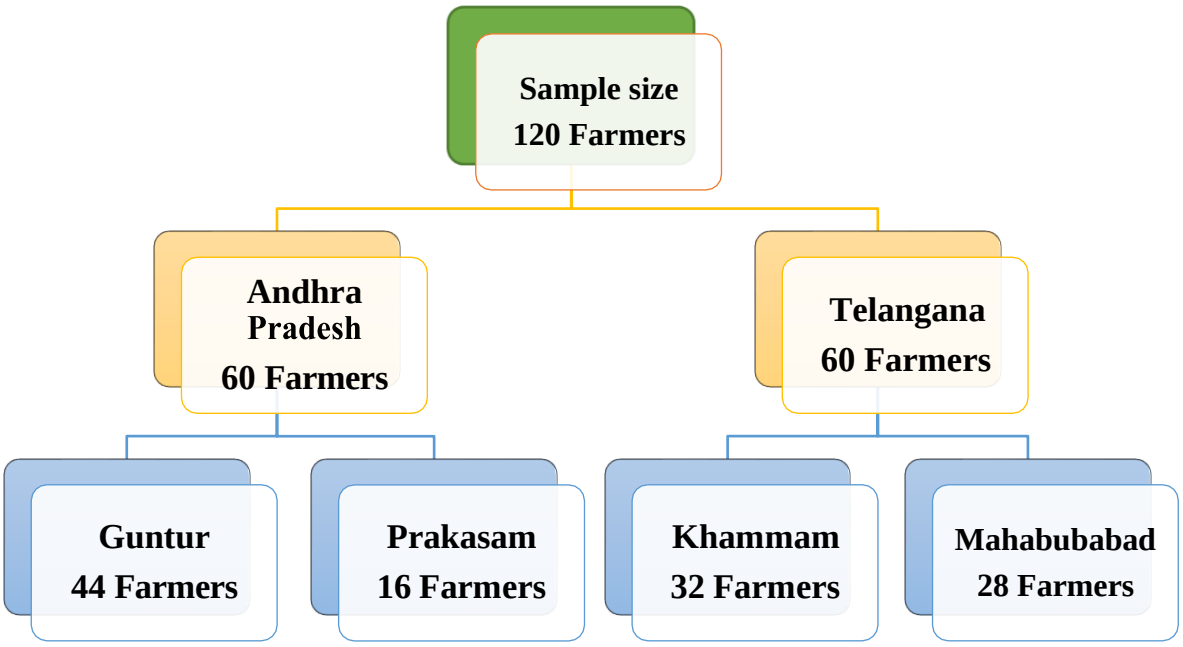
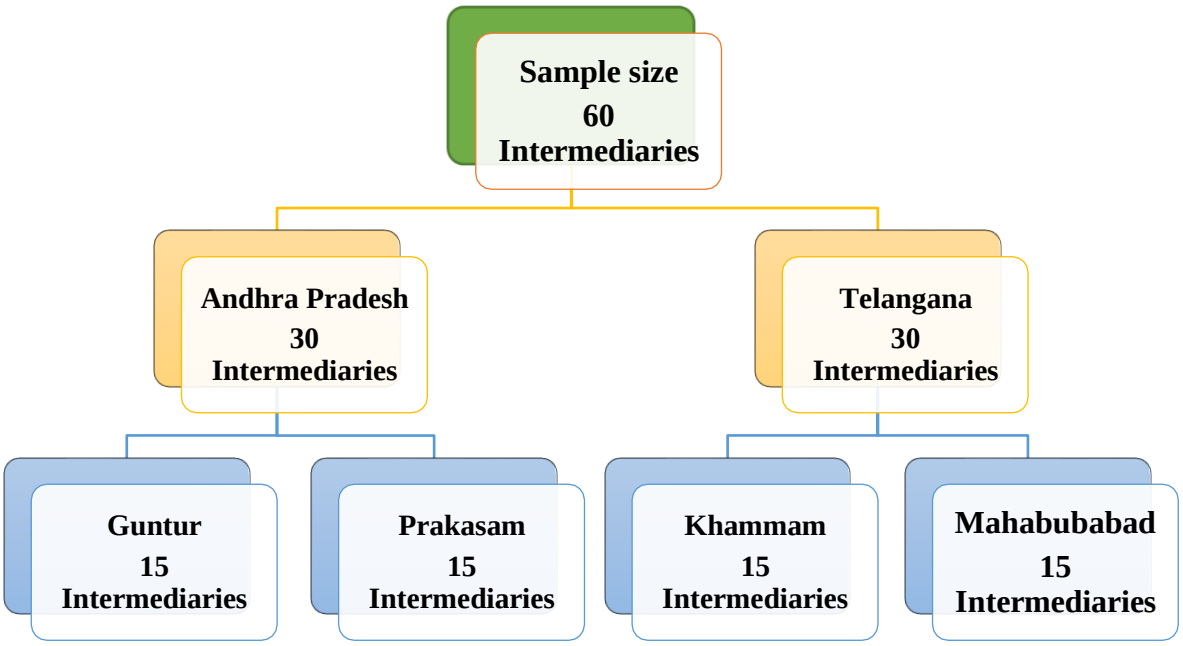


Figure 3 Distribution of sample chilli market Intermediaries



3.5 TOOLS OF ANALYSIS

The various tools that were employed in the analysis of both primary and secondary data are discussed under the following sub-headings:

3.5.1 Export performance

3.5.2 Export competitiveness and determinants of exports

3.5.3 Value chain analysis

3.5.1 Export performance

3.5.1.1 Trend break analysis

The number of breaks in a particular series can be determined by analysing the trend breaks. Bai and Perron's (1998, 2003) approach, which provides a complete analysis of the numerous concerns in the context of many structural modifications in a single (linear) equation framework, was adopted for this purpose. Their method is based on a sequential procedure in which the first step is the identification of a single break. If the test rejects the null hypothesis that there is no structural break, the sample is divided into two sub-samples, and the test is repeated until each sub-sample test fails to uncover evidence of a break.

Consider the following multiple linear regression model with m breaks (m+1 rule) and h as the minimum segment length:

$$y_t = x_t' \beta_j + z_t' \delta_j + u_t \qquad t = T_{j-1} + 1, \ldots\ldots\ldots, T_j$$

For $j = 1, \ldots\ldots, m+1$.

Where,

y_t = dependent variable at time *t*

$x_t (p \times 1)$ and $z_t (q \times 1)$ = vectors of covariates

β *and* δ_j $(j = 1, \ldots, m+1)$ = corresponding vectors of coefficients

u_t = disturbance at time *t*.

The break points or indices ($T_1, .., T_m$), are explicitly considered as unknown (T_0=0 and $T_{(m+1)}$=T are assumed). When T data on (y_t, x_t and z_t) are available, the objective is to estimate

the unknown regression coefficients as well as the break points. Because the parameter vector is not subject to shifts and is calculated using the complete sample, this is a partial structural change model. When p=0, a pure structural change model is obtained, with all coefficients subject to change. The variance of u_t does not have to be constant. As a result, breakdowns in variance are allowed as long as they occur at the same time as breaks in the regression parameters.

The multiple linear regressions (i) may be expressed in matrix form as,

$$Y = X\beta + \bar{Z}\delta + U$$

Where:

$Y = (y_1, \ldots, y_T)'$

$X = (x_1, \ldots, x_T)'$ $U = (u_1, \ldots, u_T)'$

$\delta = (\delta_1', \delta_2', \ldots, \delta_{m+1}')'$

$\bar{Z}$ = the matrix which diagonally partitions Z at $(T_1, \ldots, T_m)$, i.e., $\bar{Z} = diag(Z_1, \ldots, Z_{m+1})$ with $Z_i = (z_{T-1} + 1, \ldots z_T)'$.

A 0 superscript denotes the true value of a parameter. In particular, $\delta^0 = (\delta_1^{o\prime}, \ldots, \delta_{m+1}^{o\prime})$ and $(T_1^o, \ldots, T_m^o)$ are used to represent the true values of the parameters δ and the true break points respectively. Z^0 is the diagonally partitioning matrix of Z at $(T_1^0, \ldots, T_m^0)$. As a result the data collection procedure is expected to be $Y = X\beta^0 + \bar{Z}^0\delta^0 + U$.

As a result, the least-squares concept is used to estimate the data. The corresponding least squares estimates of β and δ_i for each m-partition $(T_1, \ldots, T_m)$, are produced by minimizing the sum of squared residuals.

$$(Y - X\beta - \bar{Z}\delta)'(Y - X\beta - \bar{Z}\delta) = \sum_{i=1}^{m+1} \sum_{t=T_{i-1}+1}^{T_i} [y_t - x_t'\beta - z_t'\delta_i]^2$$

Let $\hat{\beta}(\{T_j\})$ and $\hat{\delta}(\{T_j\})$ represent estimates based on the given m-partition $(T_1, \ldots, T_m)$ denoted $\{T_j\}$. By substituting these in the objective function and denoting the resultant sum of squared residuals as $S_T(T_1, \ldots, T_m)$, the estimated break points $(\hat{T}_1, \ldots, \hat{T}_m)$

are such that $(\hat{T}_1, \ldots, \hat{T}_m) = argmin_{T_1, \ldots, T_m} S_T(T_1, \ldots T_m)$, where the minimization was taken over all partitions $(T_1, \ldots T_m)$ such that $T_i - T_{i-1} \geq q$.[2]

As a result, the break-point estimators are global objective function minimizers. The regression parameter estimates are those for the m-partition $\{\hat{T}_j\}$, *i.e.* $\hat{\beta} = \hat{\beta}(\{\hat{T}_j\}), \hat{\delta} = \hat{\delta}(\{T_j\})$. because the break points are discrete parameters with a finite number of possible values, a grid search can be used to estimate them. When m>2, this method quickly becomes computationally inefficient. Minimizers of the sum of squared residuals can be created to efficiently estimate the ideal break points for the series starting from one to the maximum allowed by T and h instead of a dynamic programming technique that permits computation of estimates of the break points as global.

3.5.1.2 Compound Annual Growth Rate (CAGR)

The growth rate is an effective tool for analysing the trend of a given variable during the period of study. The CAGR was used to determine the trend in the export of chilli from India during the period from 1960-61 to 2019-10. The growth in exports of chilli from India in terms of quantity, value and unit value were analysed using the exponential function of the following form (Gujarati and Sangeetha, 2007),

$$Y = ab^t e_t$$

Where,

Y is the dependent variable for which the growth rate is to be estimated

a is the intercept term

b is regression co-efficient

t is time variable in years

e is the error term

The compound growth rate was calculated using the logarithmic form of equation as shown below:

$$\ln Y = \ln a + t \log b + \log (e_t)$$

Then, the compound growth rate (r) in percent was estimated as,

$$r = [(\text{Antilog of } b) - 1] \times 100$$

The statistical significance of the CAGRs was examined using the t statistic,

$$t = r / SE(r)$$

Where,

$$SE(r) = [100 \times b \times SE(\ln b)] / \ln e$$

3.5.1.3 Export Instabiltity Index

The Coppock's instability index (Coppock, 1966) was used to study the variability in exports of chilli from India.

The Instability Index (CII) = $[(\text{Antilog})\sqrt{[V \log - 1]} \times 100$

Where, $V \log = \frac{1}{(N-1)} \Sigma (\log Y_{t+1} - \log Y_t - M)^2$

$$M = \frac{1}{(N-1)} \Sigma (\log Y_{t+1} - \log Y_t)$$

N = Number of years

Y= Value/Quantity of annual exports of chilli

M = Arithmetic mean of the differences between logs of Y_t and Y_{t+1}, Y_{t+1} and Y_{t+2} etc. V log = Logarithmic variance of the series

3.5.1.4 Decomposition Analysis

The causes of growth and variability in chilli exports were determined by using Hazell's decomposition approach (Hazell, 1990). The linear relations of the form, $Y_t = a + b + e_t$, was used in the first step to de-trend the chilli export quantity and export unit values.

Where,

'Y_t' is the dependent variable (export quantity and unit value),'t' is the time, and 'e_t' is the random variable residual with a mean of zero and variance σ^2

For decomposition, the detrended form of the time series data was used

$$Y^*_t = e_t + \bar{Y}$$

Where,

'Y^{*}_{t}' denotes the de-trended export amount or unit value, and '$\bar{Y}$'

is the export quantity/unit value mean.

The following components of average export value were calculated:

EV = $\bar{Q}_0\Delta\bar{U}V + \bar{U}V_1\Delta\bar{Q} + \Delta\bar{Q}\Delta\bar{U}V + \Delta Cov\,(Q, UV)$ (Method I) or

= $\bar{Q}_0\Delta\bar{U}V + \bar{U}V_1\Delta\bar{Q} + (-\Delta\bar{Q}\Delta\bar{U}V) + \Delta Cov\,(Q, UV)$ (Method II) Where,

$\bar{Q}_0$ = Average of chilli export quantity in first period,

$\bar{Q}_1$ = Average of chilli export quantity in second period,

$\bar{U}V_0$ = Average of unit value of chilli export in first period,

$\bar{U}V_1$ = Average of unit value of chilli export in second period,

$\Delta\bar{Q}$ = Change in export quantity ($\bar{Q}_1 - \bar{Q}_0$), and

$\Delta\bar{U}V$ = Average of unit value of chilli export ($\bar{U}V_1 - \bar{U}V_0$).

The method II explains all of the factors of change in the average export value of chilli from India, although in this study both techniques were estimated. As a result, as indicated in Table 3.6, the components of change in average export values were estimated as follows,

Table 3.6 Components of change in average export value of chilli

Sources of change in export value	**Components of change**		
Description	**Symbol**	**Method I (%)**	**Method II (%)**
Change in the average export unit value	$\Delta\bar{U}V$	$\bar{Q}_0\Delta\bar{U}V$	$\bar{Q}_0\Delta\bar{U}V$
Change in the average export volume	$\Delta\bar{Q}$	$\bar{U}V_1\Delta\bar{Q}$	$\bar{U}V_1\Delta\bar{Q}$
Interaction between change in mean quantity and mean unit value	$\Delta\bar{U}V\Delta\bar{Q}$	$\Delta\bar{Q}\Delta\bar{U}V$	$-\Delta\bar{Q}\Delta\bar{U}V$
Change in quantity-unit value covariance	$\Delta Cov\,(Q, UV)$	$\Delta Cov\,(Q,UV)$	$\Delta Cov\,(Q,UV)$

There are four sources for the difference in export value between two periods. The changes in the export unit value and export quantity give rise to $\Delta \bar{U}\bar{V}$ and $\Delta \bar{Q}$. These are the pure effects, which occur even when no other causes of change exist. The term $\Delta \bar{U}\bar{V}, \Delta \bar{Q}$ refers to the interaction effect, which occurs when changes in export quantity and export unit value occur at the same time. Obviously, if either the export quantity or the export unit value remains unchanged, this term will be zero. The changes in the variability of export quantity and export unit value, as well as changes in the correlation between export quantity and export unit value, give rise to the last term, $\Delta\, Cov(Q, UV)$.

3.5.1.5 Commodity diversification index

The commodity diversification index determines how concentrated a country's exports are by sector. It indicates how evenly a country's exports are distributed among various economic activities or commodities. More the commodity diversification, it lowers the country's risk of losing revenue on exports. The export concentration of chilli from India was calculated using the Gini concentration index. The index is a number that varies from 0 to 100. A higher value denotes a country's reliance on a small number of products.

$$\text{Gini Concentration Index} = 100\sqrt{\sum_{i=1}^{n} \left(\frac{X_{it}}{X_t}\right)^2}$$

Here,

X_{it} is the export value of chilli product ‘i’ from India in year‘t’

X_t is the export value of all chilli products from India in year t

The lower the commodity concentration index value, and more uniformly the exported goods are dispersed, and vice versa. A downward trend in the index shows that exports are becoming more diverse.

3.5.1.6 Geographic diversification index

If a country is excessively reliant on a small number of export markets or exports the majority of its commodities to a small number of countries, changes in those markets will impact the export earnings and make the value of exports highly unstable. The geographic concentration of chilli exports from India was determined by using Hirschman Index (Mikic and Gilbert, 2009).

Hirschman Index, HI = $100\sqrt{\sum_{i=1}^{n}(X_{it}/X_t)^2}$

X_{it} is the value of chilli exports from India to the i^{th} market in the year t.

X_t represents the total value of chilli exports from India in year t, whereas n represents the number of countries that import the commodity from India.

The Hirschman index ranged from 0 to 100. An index value closer to zero signifies increasing diversification, while when a country exports to a few markets, the value of the coefficient will be larger.

3.5.1.7 Region/country-wise trade pattern

The predictive analytics of trade pattern was done using the UN International Trade Statistics database (UN COMTRADE) and UNCTAD Trade Analysis Information System database (TRAINS) in World Integrated Trade Solutions (WITS), the software developed by the World Bank, and the Market Analysis Tools Portal developed by the International Trade Centre (ITC). They were used to demonstrate imports and exports of chilli by region/country, as well as to derive the data on trade in different products of chilli and the export or import shares of these commodities in chilli trade.

3.5.1.8 Markov chain analysis

The structural change in any system which progresses over time can be evaluated in terms of a single outcome variable using Markov chain analysis (Dent, 1967). The dynamic nature of trade patterns, i.e., profits and losses in Indian chilli exports to key importing countries, was investigated using the Markov chain model. Developing a transition probability matrix 'X', whose elements, X_{ab}, represent the chance of exports moving from nation 'a' to country 'b' over time, is the output of the Markov chain analysis. The diagonal element X_{ab}, where a=b, represents the likelihood of a country maintaining its market share. In other words, the loyalty of an importing country to a particular country's exports (Atkin and Blandford, 1982).

The main chilli importing countries from India, numbering, 54 and the rest as 'others' were considered, in the context of this application. The average chilli exports to a given country were thought to be a random variable that depended solely on previous exports to that country and could be expressed algebraically as,

$E_{bt} = \sum_{i=}^{n} E_{at-1} * X_{ab} + e_{jt}$

Where,

E_{bt} = Chilli exports from India to b^{th} country during the year t

E_{at-1} = Chilli exports from India to a^{th} country during the year t-1

X_{ab} = The probability that the exports will shift from a^{th} country to the b^{th} country

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

n = The number of chilli importing countries from India

The transitional probabilities X_{ab}, which can be arranged in a (c x n) matrix, have the following properties,

$\sum_{a=1}^{n} X_{ab} = 1$, Where $0 \leq X_{ab} \leq 1$

By multiplying the exports to these nations in the preceding period (t-1) with the transition probability matrix, the expected export shares of each country during period t were calculated.

In the linear programming (LP) paradigm, the transition probability matrix is evaluated using a method known as Minimisation of Mean Absolute Deviation (MAD). The LP formulation is as follows:

Min, $OX^* + Ie$

Subject to,

$BX^* + V = Y$

$GX^* = 1$

$X^* > 0$

Where,

X^* is a probability vector X_{ab}

O = Vector of zeros

I = area vector with acceptable dimensions

e = absolute error vector (|U|)

Y = Chilli exports to each country as a vector

B = block diagonal matrix of lagged values of Y

V = vector of errors.

G = grouping matrix for bringing the row elements of X in X* to unity.

3.5.1.9 Trade complementarity indices

The Trade Complementary Index (TCI), which was first introduced by Kojima Kiyoshi, was refined by Peter Drysdale in 1967. The TCIs are used to determine the degree to which two countries are "natural trading partners," in the sense that the exports of one country are similar to the imports of the other (Michaely, 1996). The following is a description of the model:

$$C^k_{ab} = RCA^k_{xa} \times RCA^k_{mb}$$

Where, C^k_a is the complementarity index for commodity k between country a and country b; RCA^k_x shows country a's comparative advantage in commodity k through exports, and RCA^k_m shows country b's comparative disadvantage in commodity k through imports, and the formulae for both are provided below.

$$RCA^k_{xa} = \frac{(X^k_a / X_a)}{(X^k_w / X_w)}$$

Where X^k_a and X^k_a represent the export value of commodity k in country a and the world's total, respectively; X_a and X_w represent country's overall export values of a and the world's total, respectively.

$$RCA^k_{mb} = \frac{(M^k_b / M_b)}{(M^k_w / M_w)}$$

Where, M^k_b and M_b denote import value of commodity k of 'country *b'* and the world's total respectively; M^k_w and M_w denote total import values of 'country *b'* and the world

The RCA^k_x is the revealed comparative advantage index proposed by Balassa, and the higher the value, the greater the comparative advantage that 'country a' has in the commodity k, whereas, the higher the RCA^k_m value, the more commodity k that 'country b' imports, and hence the larger the comparative disadvantage that 'country b' has in the commodity k. When 'country a' has a comparative advantage in commodity k and 'country b' has a comparative

disadvantage in commodity k, it indicates the two countries have trade complementarity in commodity k, which could also be quantified by their product C^k_{ab}. If $C^k_{ab} > 1$, it means the two countries have trade complementarity in commodity k, and the higher the value, the stronger the complementarity. If $C^k_a 1 <$ is 1, the complementarity is low, and the lower the value, the lower the degree of complementarity.

3.5.2 Export competitiveness and determinants of exports

The export competitiveness of a commodity exported from a country indicates whether the country has a competitive advantage in the export or import of that commodity, which is useful in determining commodity-specific production, export, and tariff policies. The competitive advantage is a more descriptive concept that provides "a fundamental explanation of the international pattern of specialization in production and trade" (UNIDO, 1986). Prescriptive (or normative) economics, on the other hand, relies heavily on providing rules for government resource allocation and trade policy. As a result, determining India's comparative advantage in exports of chilli could provide useful information for making decisions about resource allocation and trade. The Revealed Comparative Advantage (RCA), Policy Analysis Matrix (PAM) and competitiveness ratios such as Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), and Domestic Resource Cost Ratio (DRCR) (Gotsch *et al*., 2003) were used to evaluate the export competitiveness of Indian chilli. The determinants of chilli exports from India were analysed using a regression analysis.

3.5.2.1 Revealed Comparative Advantage (RCA)

The revealed comparative advantage (RCA) method is used to determine the relative importance of India and other chilli-producing countries in the international export markets of chilli. The revealed comparative advantage is a metric used in international economics to determine a country's relative advantage or disadvantage in a given class of commodities or services as indicated by the trade flows.

The RCA of country 'a' in commodity 'g' is defined as $RCA_{ag} = \frac{(X_{ag} \diagup X_a)}{\sum_a X_{ag} \diagup \sum_a X_a}$.

The value share of chilli 'g' in the overall export basket of country '*a*' is represented by the numerator of the RCA index. The value-share of 'g' in total world exports is represented by the denominator. If a commodity's RCA index is greater than 1, it means the country has a competitive advantage in that commodity (Balassa, 1965).

3.5.2.2 Policy Analysis Matrix (PAM)

The PAM was developed by Monke and Pearson in 1989 and is used as a tool for analysing the complete production system. This matrix aids in determining the efficacy of regulation in agricultural sector as well as the involvement of the government in this regulation. (Monke and Pearson, 1989). The PAM's primary concept is to compare private and social pricing for inputs in production as well as finished items. The private prices are those observed at present, but social prices are those that conform to the situation without government interference or market distortions (Yao, 1997).

A matrix is a collection of numbers (or symbols) that adheres to two accounting rules: one defines relationships across the columns of matrix, and the other defines relationships down the rows of the matrix. The profitability identity and the divergences' identity are the two accounting identities in the PAM matrix. The accounting relationship across the columns of the matrix is the profitability identity in PAM. Profit is calculated by subtracting revenues from costs. The divergences' identity in PAM is the relationship down the rows of the matrix.

The differences between the entries in the first row, measured in "private prices," and those in the second row, measured in "social prices," are thus equivalent to all the entries in the PAM matrix under the third row, described as "effects of divergences", which could be observed in Table 3.7.

Table 3.7 Policy Analysis Matrix

	Revenue	**Costs**		**Profits**
		Tradable Input	**Domestic Factor**	
Private	O	P	Q	R = O - (P+Q)
Social	S	T	U	V = S - (T+U)
Divergences	W	X	Y	Z = W - (X+Y)

The primary goals of the policy Analysis Matrix (PAM) methodology are to give information and analysis to policymakers in three key areas of agricultural policy, *viz*., private costs, returns, and profit. Firstly, constructing a PAM for agricultural systems allows for the

computation of private profitability, which is a measure of the system's competitiveness at current market pricing. The first or the top row, (R), is used to calculate the system's private profitability (competitiveness), which is defined as the difference between the observed income (O) and the costs (P+Q).

Secondly, the PAM allows for the calculation of social profitability in agricultural systems or social opportunity costs. The second or the middle row of the matrix is used to calculate social profitability, which is defined as S - (T+U). The efficiency and comparative advantage are measured by the social profits. A positive social profit suggests that a country is making optimal use of scarce resources and has a stable competitive advantage in the production of that commodity at the margin. Furthermore, negative social profits show that the sector is losing resources that may be better used elsewhere.

The third objective allows for the evaluation of the effects of policy transfer. One can explain the impact of a policy by contrasting revenues (first row) and costs (second row) before and after its implementation. So that, the difference between the private and social values of revenue, costs and profits could explained by intervention of policies. Hence, important indicators for policy analysis *viz*; Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC) and Domestic Resource Costs (DRC) could be calculated using the PAM framework.

3.5.2.3 Nominal Protection Coefficient (NPC)

The Nominal Protection Coefficient (NPC) is the most basic metric of export competitiveness and domestic protection, measuring the level of protection offered to domestically produced goods. The local price utilised in this calculation is wholesale price, whereas the world reference price is the international price adjusted for transportation, marketing, and processing costs to make the commodity comparable. NPC is defined mathematically as,

$$NPC_k = P_k^d / P_k \quad w = O / S$$

Where,

NPC_k = Nominal protection coefficient of commodity *k*

P_k^d = Domestic price of commodity *k*

P_k^w = World reference price of commodity *k*, adjusted for transportation, handling and marketing expenses.

If the NPC is greater than one, the commodity is safeguarded in comparison to the condition that would have existed if trade were free. The commodity, on the other hand, is not protected if the NPC is less than one. When the NPC is one, the domestic price is the same as the commodity's border price (CIF or FOB), and the commodity is not protected.

3.5.2.4 Effective Protection Coefficient (EPC)

The ratio of value added in private prices (O-P) to value added in social prices (S-P) is known as the Effective Protection Coefficient (S-T). EPC can be expressed mathematically as

$$EPC_k = \frac{Q_i(P_k^d - \sum_i A_{ki} * P_i^d)}{Q_i(P_k^w - \sum_i A_{ki} * P_i^w)}$$

Where,

EPC_k = Effective Protection Coefficient for Commodity k

Q_k = The quantity of the k^{th} commodity's output

A_{ki} = The quantity of i^{th} input required to create a unit of commodity k

P_k^d = k^{th} commodity's domestic price

P_k^w = k^{th} commodity's world reference price

P_i^d = i^{th} traded input's domestic price

P_i^w = World reference price of i^{th} traded input (Border equivalent), adjusted for transit, handling, and marketing costs.

The entire Qi expression can be cancelled and reduced to value added as:

$$EPC_k = \frac{V_k^d}{V_k^w}$$

Where,

V_k^d is value added at domestic prices

V_k^w is value added at world reference prices.

i.e., EPC = (O-P)/(S-T)

A greater than unity EPC value indicates that government policies give positive incentives to producers, whereas a value smaller than unity indicates that producers are not safeguarded by policy interventions.

3.5.2.5 Domestic Resource Cost Ratio (DRCR)

The most generally used and comprehensive indicator of resource efficiency in an economy is the domestic resource cost. It is defined as the shadow value/price of non-tradable factor inputs (land, labour, and non-traded capital) used in an activity, per unit of tradable value/price added and is used to analyse the relative efficiency or comparative advantage among agricultural commodities i.e., U/(S-T). It is the value of domestic resources required to earn or save a unit of foreign currency by producing or exporting the commodity in question. Symbolically,

$$DRCR = \frac{\sum A_{ij} P_j^s}{P_i^w - \sum A_{ij} P_j^w}$$

Where,

A_{ij} is the quantity of the j^{th} input that is necessary to produce one unit of the i^{th} output.

$P_i{}^s$ is the shadow price (opportunity cost or the social price) of j^{th} non-traded input;

P_i^w is world reference price of the commodity *i*, adjusted for handling, transportation and marketing expenses;

P_j^w is world reference price of j^{th} traded input, adjusted for transportation, handling and marketing expenses.

The non-traded inputs are the ones that aren't generally exchanged on a global scale. Human labour, farm yard manure, and bullock labour are all taken into account here. The exchanged inputs, on the other hand, are inputs that are traded on a worldwide level, such as seed, fertiliser, and chemicals. When the DRC value is smaller than unity, the input is efficiently employed and export competitive, according to the DRC decision rule. When the predicted DRC value exceeds unity, the input is being used inefficiently and so is not export competitive.

3.5.2.6 Determinants of chilli exports from India-Regression analysis

The factors affecting the exports of chilli from India were determined by estimating a log-log regression model (Benoit, 2011).

The regression function can be expressed algebraically as,

$$Y = a_0 X_1^{a1} X_2^{a2} X_3^{a3} X_4^{a4} \quad \text{..... (1)}$$

Y= Export quantity of chilli from India

X_1 = Domestic production

X_2= Domestic price

X_3= International price

X_4= Real exchange rate

On applying natural logarithm to equation 1 it is transformed as follows:

$$\ln Y = a_0 + a_1 \ln X_1 + a_2 \ln X_2 + a_3 \ln X_3 + a_4 \ln X_4$$

Since the equation is specified in logarithms, the constant a_0 and a_i (i= 1,2,……4) denotes elasticity of corresponding variables, domestic production, domestic price, international price and real exchange rate respectively. The coefficients of domestic production (a_1) and international price (a_3) are expected to have a positive sign, while that of a_2 i.e., coefficient of domestic price and a_4 i.e., real exchange rate is expected to be negative. That means, as the domestic production of chilli increases it will increase the exportable surplus and hence the exports. The increase in domestic price of chilli is expected to reduce the exports of chilli from India as it reduces the export competitiveness of the country in the commodity. The increase in international prices, is expected to increase the quantity of chilli exports from India. The coefficient of real exchange rate of the exporting country is expected to take a negative sign, as increase in the real exchange rate of the exporting country will make their exports expensive, reducing the exports from the country.

3.5.3 Value Chain Analysis

A value chain starts with the creation of a primary commodity and concludes with the consumption of the finished product, with all economic operations including such processing, delivery, wholesaling, and retailing. The value chain analysis provides valuable insights into policy formulation and implementation (Kaplinsky and Morris, 2002). Value Chain Analysis

(VCA) approach for policy analysis (Bellu, 2013) was used to undertake the value chain analysis of chilli in India and the analyses were conducted in the following domains of chilli value chain.

3.5.3.1 Socio-economic context of the value chain

This analytical domain describes the socio-economic elements, such as the country's geo-strategic, macro-economic indicators, and social circumstances, as well explains how these elements had influenced the value chain and vice versa (Kapuya *et al.,* 2010). It also explains existing policies and strategies impacting the value chain, particularly prices, factors and natural resource policies, specific incentives to producers and consumers, as well as macro-economic policies influencing the exchange rates and interest rates, credit policies and international trade policies.

3.5.3.2 Demand for value chain outputs

The demand for value chain outputs deals with the consumer side of the value chain and is used to evaluate the existing and projected demand for the various ultimate output or outputs, as well as the varied destinations and pricing trends of these products. The elements considered under this domain include price trends (domestic and international), determinants of demand, target group of clients (product diversification to different client groups) and present and, potential (future) demand for the value chain outputs.

Demand analysis can assist to determine whether or not capacities to meet various domestic or international requirements have to be expanded, as well as the amount to which current or projected demand can absorb potential supply expansion. The product innovation can also be driven by demand, and demand analysis helps to determine whether the features of the goods or services provided could be diversified to fulfill potentially more profitable market segments.

3.5.3.3 Analysis of the institutional set-up

The institutional analysis helps to identify and evaluate the institutional set-up, i.e., the set of interactions taking place among agents and the formal or informal norms governing them and addresses the issues connected to value chain governance. This implies to look at the institutions and associations among the different agents aiming at the functioning of both upstream and downstream linkages (synergies, actual or potential conflicts etc); an authority imposing set of rules for smooth functioning of the value chain, the public sector (public policies, investments) and private agents' role in value chain development (Zia *et al*., 2011).

3.5.3.4 Analysis of input and output markets

This domain is used to study market structure and close linkages between market setup, regulations, and agents' choices. The analysis could help getting a better understanding of the agents' behavior and further investigate the institutions that regulate the value chain by focusing on markets. The degree of competitiveness, the presence of monopoly, monopsony, oligopoly, market segmentation, the ability to discriminate some categories of consumers by charging different prices for the same goods, are all factors that influence the quantity and quality of outputs, the value added generated and its distribution among the various agents of the chain and the remuneration of production factors.

There are a number of markets for a single commodity throughout a value chain, each with its unique characteristics, such as: number of agents, availability of information to sellers and buyers at each level, entry/exit barriers for sellers and buyers, control binding the supply, nature of products and control over prices.

3.5.3.5 Functional analysis of the value chain

The functional analysis is used to describe a detailed profile of the industry structure and production technology. It also identifies related agents that carry the sequence of operations concerning commodity production, processing, marketing, and final consumption, as well as quantify physical flows. It particularly examines necessary technical processes from basic production to final consumption, at each stage of the chain, the inputs consumed and intermediate outputs created, economic agents involved at various phases, as well as associated functions, physical commodity flows among the various agents and bottlenecks including availability of inputs, logistic issues, etc.

Setting the boundaries of the value chain i.e., defining the part of the economic system that is intended to be analysed, is the first stage in assessing the functions of a value chain. After the value chain's boundaries have been identified, a functional analysis requires three more steps, *viz*., identifying activities, identifying agents, quantifying physical flows for characterising market structures as explained below.

3.5.3.1.1 Steps in functional analysis

I. Setting the boundaries

A value chain could be framed using a variety of criteria. The principal commodity used to identify agricultural value chains is usually the primary commodity (for example: chilli

value chain, turmeric value chain, etc.). Then the fundamental commodity is analysed downstream in the following phases:

a) All processing stages up to the finished commodity.

b) Intermediaries in the market.

c) By-products and/or joint products of various kinds

II. Identifying the activities

Understanding the way in which a value chain works entails to identifying the primary activities carried out at each stage of the chain, *viz*.,

a) Primary commodity production, which includes several technologies.

b) Processing level, including determination of sub-chain due to various processing methods.

b) Handling, storage, and transportation.

c) Distribution, both wholesale and retail.

e) Intermediation, which is the process of bringing two parties together

III. Identifying the agents

It is crucial to understand who are all the different types of agents in the value chain and after identifying them, it is important to know which are all the tasks that are performed by them in the value chain. In other words, activities must be linked with agents, and the responsibilities of such must be assessed, considering that some agents may perform multiple tasks. This stage comprises categorising agents into relevant and homogeneous groups.

IV. Quantifying the physical flows

The commodities can move through numerous phases of collection and processing in various distribution networks of the value chains before reaching the final consumers. The physical flow of a commodity happens down the value chain, from one agent to the next. Usually, it is shown in a typical flow chart comprising of the inputs and outputs in the process, as well as the activities and agents engaged. The physical flows of commodities must be quantified in order to better understand the value chain structure and the relative weight of the agents functioning within it. This could be done through input-output matrices of flows among agents, graphical representation of physical flows and Supply Utilization Accounts (SUA).

3.5.3.6 Economic analysis of the value chain

This analytical domain evaluates the value creation and distribution processes in quantitative terms. It is used to determine the value addition that is generated by the total value chain, the value contributed and margins for each economic agent at each level of the chilli value chain, and distribution of the value added among the factors. Generally, the Cost-Benefit Analyses (CBAs), marketing costs and marketing margin and price spread are used to carry out the economic analysis of the value chain.

3.5.3.6.1 Cost concepts

The costs were calculated using ABC cost concepts followed by the Commission on Agriculture Cost and Prices (CACP), Government of India. The following are the cost elements included in the current study:

i. Cost A1 consists of:

1. The cost of hired human labour
2. The cost of hired machine power
3. The cost of suckers
4. The cost of manures
5. The cost of manures of fertilizers
6. The coat of Plant Protection Chemicals
7. Cost of Weedicides
8. Cost of irrigation
9. Excise on land revenue
10. Depreciation on farm implements and buildings
11. Interest on capital
12. Miscellaneous expenses

ii. Cost A_2 = Cost A_1 + Rent paid for land that has been leased.

iii. Cost B_1 = Cost A_1 + Interest on the value of fixed capital assets that are owned (excluding land)

iv. Cost B_2 = Cost B_1 + Rent paid for leased in land and rental value of owned land (minus earnings from land)

v. Cost C_1 = Cost B_1 + Estimated value of family labour

vi. Cost C_2 (Cost of cultivation) = Cost B_2 + Estimated value of family labour

vii. Cost C_3 = Cost C_2 + 10% of the cost of C2 (to account for managerial input of the farmer)

3.5.3.6.2 Analysis of value chain performance

The methodologies described by Acharya and Agarwal (1987) were used for estimating the marketing cost, marketing margin, price spread and producer's share in consumer's rupee. The efficiency of marketing channels in the chilli value chain was analysed by using Shepherd's formula.

3.5.3.6.2.1 Marketing costs

The marketing costs are the costs incurred by the producers and other intermediaries in the marketing channels while executing various marketing functions.

3.5.3.6.2.2 Marketing margin

The profit earned by the intermediaries when the commodity is moved from producers to consumers by performing various marketing functions is known as the marketing margin.

3.5.3.6.2.3 Price spread

The difference between the price paid by the consumer and the price received by the producer for an equivalent quantity of the agricultural produce is called as the farm to retail price spread or price spread. It is calculated as

Price spread = Consumer price – Producer price

3.5.3.6.2.4 Producer's share in consumer's rupee

It is calculated using the formula as follows,

$P_s = (P_p \div C_p) \text{ X } 100$

Where,

P_s =Producer's share in consumers' rupee

P_p = Producer's price

C_p =Consumer's prices

3.5.3.6.2.5 **Marketing efficiency**

Shepherd's formula was employed to calculate the marketing efficiency as follows,

ME = V ÷ I

Where,

ME = Marketing efficiency

V = Consumer's price

I = Total Marketing Cost

3.5.3.7 Constraint analysis in the value chain

The Garrett ranking technique (Garret and Woodworth, 1971) was used to analyse constraints across the chilli value chain. The respondents were asked to rank the problems in chilli production, processing, and marketing. The following formula was used in the Garrett ranking technique to transform these ranks into per cent positions.

$$Percent\ position = \frac{100 \times (R_{ij} - 0.5)}{N_j}$$

Where,

R_{ij}= Ranking given to the i^{th} attribute by the j^{th} individual

N_j = Number of attributes ranked by the j^{th} individual.

The percent positions estimated were translated into scores by using Garrett table. Thus, the scores of the respondents were summed for each factor, and the mean values were estimated. The descending order of the mean values obtained for each of the attributes was used. The attributes with the greatest mean value were deemed the most essential, with the remaining attributes following in that order.

4. RESULTS AND DISCUSSION

In this chapter, the results of the analyses are presented and the findings from the study are discussed. The present study entitled "Export performance and value chain analysis of chilli in India," focused on the performance and dynamics of chilli exports from India, assessed the export competitiveness measures and factors affecting chilli exports from India and analysed the value chain of Indian chilli. The data for the study was collected from different sources and analysed using appropriate methodologies. The results from the analyses of the primary and secondary data are presented in this chapter under the following sub-headings.

4.1 Export performance of Indian chilli

4.2 Export competitiveness and determinants of chilli exports from India

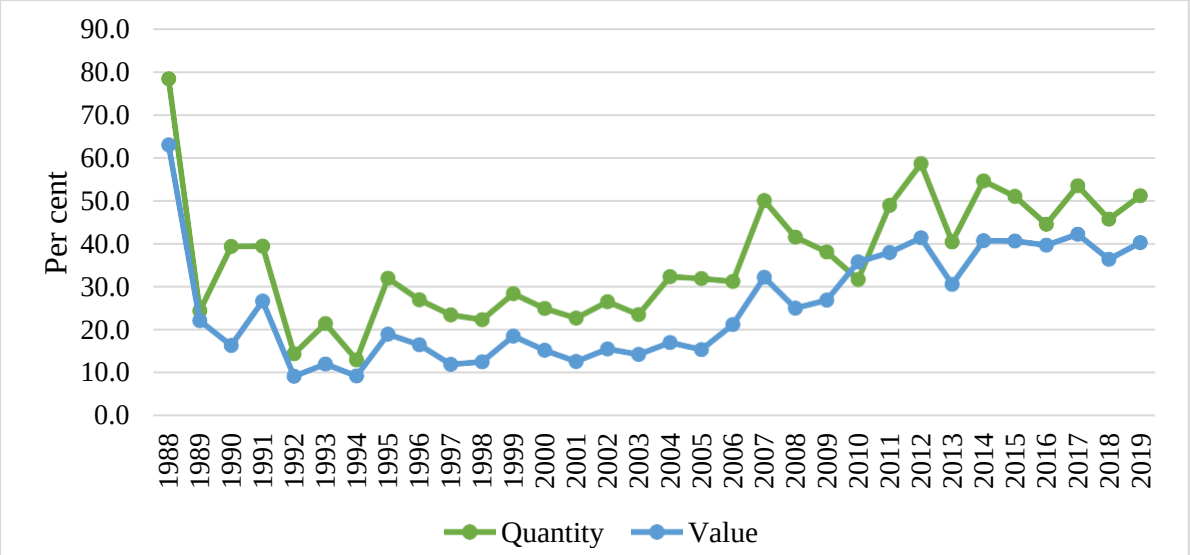
4.3 Value chain analysis of Indian chilli

4.1 EXPORT PERFORMANCE OF INDIAN CHILLI

The WTO-led global liberalization of agricultural trade was viewed as a prospect to boost agricultural exports (Gulati and Kelly, 1999). The major goal of the trade reform was to encourage trade by reducing various Quantitative Restrictions (QRs) and trade barriers (Chand, 2002). However, the significant fall in international prices during 1996; one year after the establishment of WTO, resulted in higher domestic prices for several crops as compared to the international prices. As a result, India became a destination for low-cost imports, and the fall in export competitiveness led to a decline in agricultural exports. The exports of spices from India, on the other hand, sustained its pace the domestic prices of major Indian spices had dropped dramatically after liberalization (Hema and Kumar, 2007).

Chilli and chilli products are the most important spices exported from India. India is the world's leading producer and also the largest exporter of chilli, accounting for almost half of global export volume of chilli in TE2019 (WITS, 2019). India’s global share in exports of chilli has decreased from 78.4 per cent in 1988 to 51.3 per cent in 2019 in terms of quantity, whereas the share in global export value has decreased from 63.1 per cent in 1988 to 40.3 per cent in 2019 (Figure 4).

Figure 4 Dynamics in share of chilli exports from India in world chilli exports

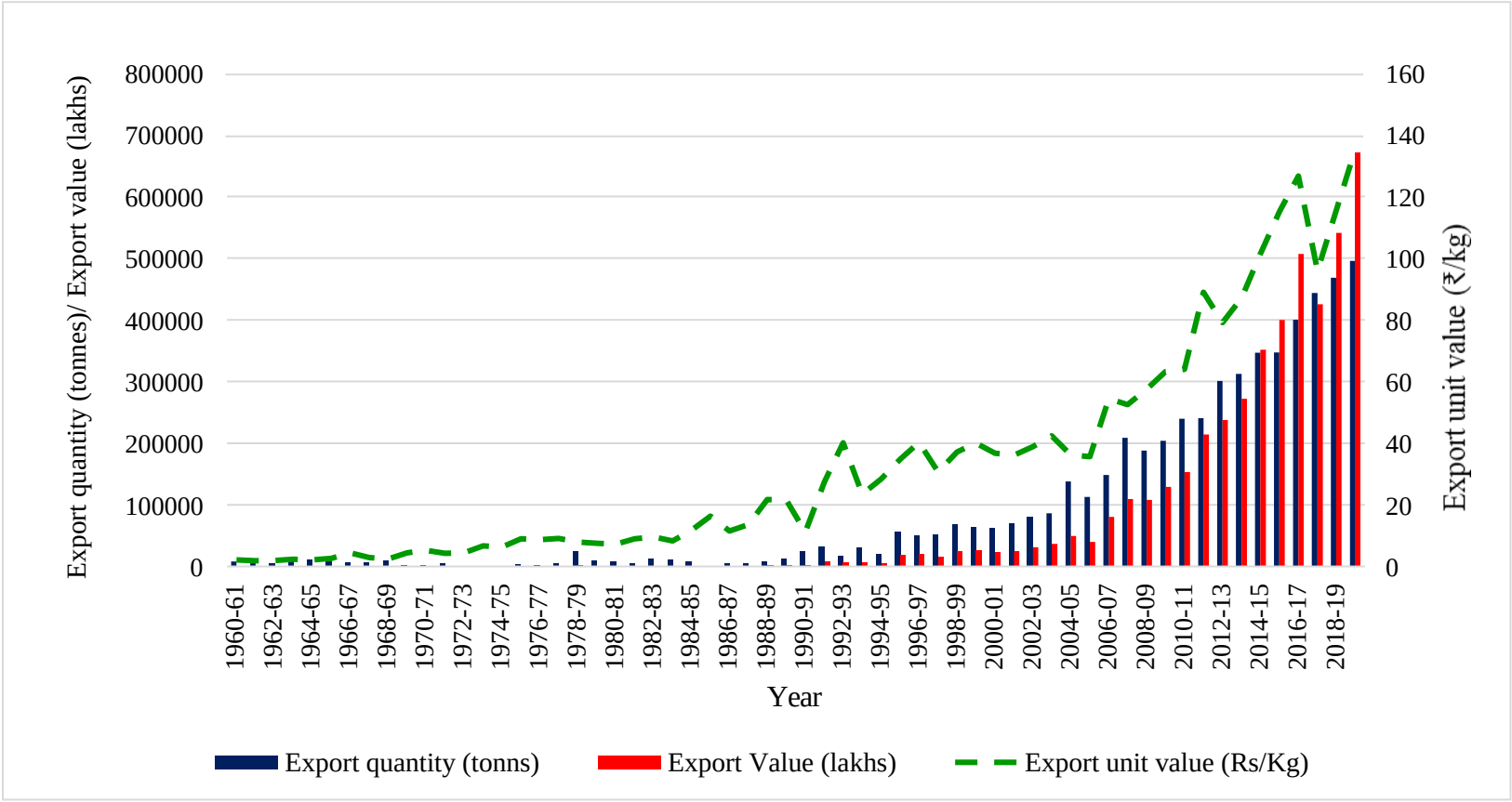


Note: Estimated using data from WITS

The exports of chilli from India in terms of quantity, value and unit value for the period from 1960-61 to 2019-20 are presented in Figure 5. It could be observed from the figure that India exported 8,364 tonnes of chilli valued at ₹176 lakhs in 1960-61. Over the past sixty years, the exports of chilli from India have grown substantially because of the increasing demand for Indian chillies in the international market. The total export of chilli from India in 2019-20 was 4.96 lakh tonnes, which was worth ₹6,71,040 lakhs.

Since 1991, the quantity, value and unit value of chilli exports from India have all increased substantially. After 2006, the export unit value of chilli started to show a discernably increasing trend and as a result, the value of exports from India was also quite high during these years. In 2006, the value of chilli exports from India surpassed ₹50 lakhs. This growth in exports could be attributed to the depreciation of Indian rupee, liberalisation policies and growing demand for chilli in the international market.

Figure 5 Export of chilli from India



Note: Estimated using data from Spices Board

The export, import and Balance of Trade (BoT) of Indian chilli during various time periods are presented in Table 4.1. The chilli exports from India have increased from 4,434.3 tonnes in TE1970 to 4,69,466.7 tonnes in TE2019. The value of chilli exports has increased from 142.1 lakh rupees in TE1970 to 5,45,930.1 lakh rupees in TE2019. Because the unit value of exports increased from ₹4.1/kg in TE1970 to ₹115.6/kg in TE2019, the export value of chilli has considerably grown. The imports of chilli to India have also increased from 4.3 tonnes in TE1970 to 1,320 tonnes in TE2019. Likewise, the value of imports also increased to 2,260.4 lakh rupees in TE2019 from 0.1 lakh rupees in TE1970. The trade balance in terms of quantity during TE1970 was 4,430 tonnes, which rose to 4,68,146.7 tonnes in TE2019. The trade balance in value terms was 142 lakh rupees in TE1970, which in turn became as high as 5,43,669.7 lakh rupees in TE2019. The balance of trade for chilli in quantity and value terms were found to be positive in all the trienniums under consideration.

Table 4.1 Export, import and Balance of Trade (BoT) of Indian chilli

Trienniums	Export			Import			BoT	
	Quantity (tonnes)	Value (Lakh rupees)	Unit Value (₹/kg)	Quantity (tonnes)	Value (Lakh rupees)	Unit Value (₹/kg)	Quantity (tonnes)	Value (Lakh rupees)
TE1970	4,434.3	142.1	4.1	4.3	0.1	3.1	4,430.0	142.0
TE1980	14,191.7	1,094.4	7.6	67.3	5.6	5.6	14,124.3	1,088.8
TE2000	64,686.0	24,577.4	38.0	721.7	445.0	72.8	63,964.3	24,132.4
TE2010	2,10,666.7	1,30,274.0	61.6	856.7	605.2	76.2	2,09,810.0	1,29,668.8
TE2019	4,69,466.7	54,5930.1	115.6	1,320.0	2,260.4	170.4	4,68,146.7	5,43,669.7

Source: Estimated using data from Spices Board

4.1.1 Determination of break points in time series data on chilli exports

The export performance of Indian chilli was examined for 60 years, from 1960 to 2019, and was further divided into sub-periods. The primary motivation for separating the 60-year period into sub-periods was to determine the disaggregated performance of chilli exports (quantity, value, and unit value terms) over time. Six decadal sub-periods (1960-1969, 1970-1979, 1980-1989, 1990-1999, 2000-2009, and 2010-2019) were considered for the study. The total period was also

separated into four sub-periods based on trend break analysis. The analysis was also carried out for the overall period.

The break points in the data and the significant shifts in India's chilli trade were identified by using structural break analysis (Bai and Perron, 1998). The changes in the mean or variability of the series within the timeframe cause the breaks. The single most significant year of break in exports was identified using structural break analysis of quantity, value, and unit value of chilli exports. The *strucchange* programme in *R Studio* software was used to compute the breakpoints, and the breakpoints were identified. The package was programmed to find the best breakpoints with either uniform or non-uniform break durations. A two-step validity test using the Residual Sum of Squares (RSS) and the Bayesian Information Criteria (BIC) was used to determine the best breakpoints. In the first step, the RSS with the lowest value was deemed ideal. If the optimal breakpoints discovered in step one matched with the lowest BIC, it was considered as the optimal breakpoint, and the lowest BIC had precedence on validity.

The projected number of break points for chilli exports from India are shown in Table 4.2. The ideal breakpoints for quantity and unit value of exports were m=5, with minimum BICs of 147.2 and 48.94, respectively, while for the value of exports, m=4 had a minimum BIC of 159.4. The five breakpoints for quantity of exports were recognized as 1968, 1977, 1989, 2002, and 2011, while the breakpoints for unit value of exports were identified as 1968, 1981, 1990, 2001, and 2010. For value of chilli exports from India, the four break points recognized were 1976, 1990, 2001, and 2010. Based on the above findings, 1990 and 2001were recognised as the years of significant breaks in chilli exports from India, which coincided with the initiation and implementation of trade liberalisation policies, including tariff reduction and removal of QRs on agricultural trade in 2001 respectively. As a result, the data on chilli exports from India in terms of quantity, value, and unit value were divided into four sub-periods: pre-1990 and post-1990, pre-2001 and post-2001 and six decadal periods from 1960 to 2019.

Table 4.2 Estimated numbers of breakpoints in quantity, value and unit value of chilli exports from India

Particulars	Quantity					Value					Unit Value				
	m=1	m=2	m=3	m=4	m=5	m=1	m=2	m=3	m=4	m=5	m=1	m=2	m=3	m=4	m=5
Breakpoints	1994	1989	1968	1968	1968	1990	1988	1976	1976	1968	1987	1972	1972	1968	1968
		2003	1989	1977	1977		2005	1990	1990	1977		1990	1990	1981	1981
			2003	1989	1989			2005	2001	1990			2008	1990	1990
				2003	2002				2010	2001				2008	2001
					2011					2010					2010
RSS	53.45	33.83	30.44	20.54	17.79	108.3	53.2	30.67	24.42	24.87	22.65	11.40	5.554	4.028	3.502
BIC	181.4	161.8	163.6	147.8	147.2	224.5	189.4	164.0	159.4	166.6	128.2	95.22	60.23	49.15	48.94

Note: Estimated using *strucchange* programme in *R Studio* software

4.1.2 Growth rates in export of Indian chilli

The CAGRs for the quantity, value, and unit value of chilli exports from India during the overall period from 1960 to 2019, different sub-periods and decades were estimated using exponential growth functions, and the results are provided in Table 4.3.

Table 4.3 Growth in export of chilli from India (CAGR in per cent per annum)

Periods	Export Quantity	Export Value	Export Unit Value
1960-1969	-8.47	-0.98	8.19
1970-1979	29.73	39.77	7.74
1980-1989	-0.35	11.83	12.22
1990-1999	14.10	24.24	8.89
2000-2009	15.47	22.97	6.50
2010-2019	8.77	16.11	6.75
Pre-1990	-0.02	8.15	8.18
Post-1990	11.93	19.00	6.32
Pre-2001	6.24	14.95	8.21
Post-2001	11.26	20.33	8.16
Overall (1960-2019)	9.62	17.68	7.35

Source: Estimated using data from Spices Board

The growth rates of chilli exports have reduced in magnitude in the latest decade, as could be observed for the growth rates of quantity and value of exports. The highest growth rates for chilli export quantity and value were observed between 1970 and 1979, while the highest growth in export unit value was observed between 1980 and 1989. After 1990, the quantum of chilli exported grew, resulting in an increase in the value of exports, which continued until 2000-09 period. When comparing the pre- and post-2001 periods, there was a substantial increase in quantity and value of chilli exports in the post-2001, while the export unit value growth was almost similar in both the periods. While in the pre-WTO period the major reason for growth in value of chilli exports was the growth in unit value, in the post-WTO period, the major contributor for export value growth was growth in export quantity rather than unit value. There are two possible reasons for this impressive contribution of export quantity in export value growth during the post-

WTO period are the shortage of supply from major producing countries during the early WTO period, and a restriction on chilli imports from Pakistan by the European Union (EU) due to the presence of aflatoxin in its produce during the subsequent period. Despite the low rate of growth in production, later India acquired the markets lost by Pakistan, resulting in growing chilli exports from India (Balaji and Paltasingh, 2014).

4.1.3 Instability in export of Indian chilli

The results of the Coppock's instability index-based assessments for the instability in quantity, value, and unit value of chilli exports from India are presented in Table 4.4. The findings revealed that during 2010s, the instabilities in the quantity and value of chilli exports have decreased as compared to the previous decades. The export unit values were found to be most volatile during 1990s. In the post-1990 period, instabilities in the quantity and value of chilli exports were considerably higher than the pre-1990 period, whereas instabilities in the unit value decreased after 1990. In the post-2001 period, instability in chilli export quantity, value, and unit value have significantly decreased.

Table 4.4 Instability in export of chilli from India (Coppok's instability index)

Year	Export Quantity	Export Value	Export Unit Value
1960-1969	63.47	55.58	50.60
1970-1979	128.95	148.26	48.80
1980-1989	73.00	76.71	54.03
1990-1999	60.55	77.65	54.26
2000-2009	57.80	70.11	46.02
2010-2019	47.61	58.49	46.29
Pre 1990	95.59	114.01	75.69
Post 1990	101.14	173.77	65.72
Pre 2001	127.72	254.86	97.15
Post 2001	67.90	105.51	58.11
Overall (1960-2019)	233.27	716.88	129.50

Note: Estimated using data from Spices Board

The major contributor to export value instability was found to be the instability in quantity of exports rather than that in export unit value. The instability in chilli exports is due to the factors like domestic demand, inadequate output, irregular monsoon, drought, and yield factor. The similar findings were observed by Sadeesh (2007) for chilli exports.

4.1.4 Decomposition of sources of export value growth in Indian chilli

To determine the sources of growth in the average export values of Indian chilli, decomposition analyses was performed. The sources of change in the export value of Indian chilli between two periods were decomposed into four components *viz*., mean export quantity, mean export unit value, change in mean export quantity and unit value covariance, and the interaction between mean export quantity and mean export unit value and the results are presented in Table 4.5. The results showed that among all the decomposed components of changes in the average export value of chilli, the contribution from the change in the mean export unit value was the highest in all the time periods.

Table 4.5 Decomposition analysis of components of change in average export value of chilli

Period/Commodity/ Components of change	Change in mean EUV	Change in mean EQ	Interaction between changes in mean EQ and mean EUV	Change in EQ-EUV covariance
1960-1969 &1970-1979	100.01	-0.013	-0.0049	0.0059
1970-1979 &1980-1989	99.90	0.110	-0.0040	-0.0070
1980-1989 &1990-1999	99.37	0.685	0.0007	-0.0539
1990-1999 & 2000-2009	100.00	0.004	-0.0003	-0.0024
2000-2009 & 2010-2019	100.01	-0.009	-0.00003	-0.0014
Pre-1990 & post-1900	99.95	0.059	-0.0002	-0.0069
Pre-2001 & post-2001	99.94	0.053	0.0007	0.0028

Source: Estimated using data from Spices Board

Note: EQ – Export quantity and EUV – Export unit value

The reason for the above results is that the export unit value has increased at a significantly faster rate across all the periods, even though the export quantity has grown, which recorded only slower rate of growth. The interaction between changes in mean export quantity and unit value, as

well as the change in export quantity-unit value covariance, had insignificant effects on increase in export value between different periods.

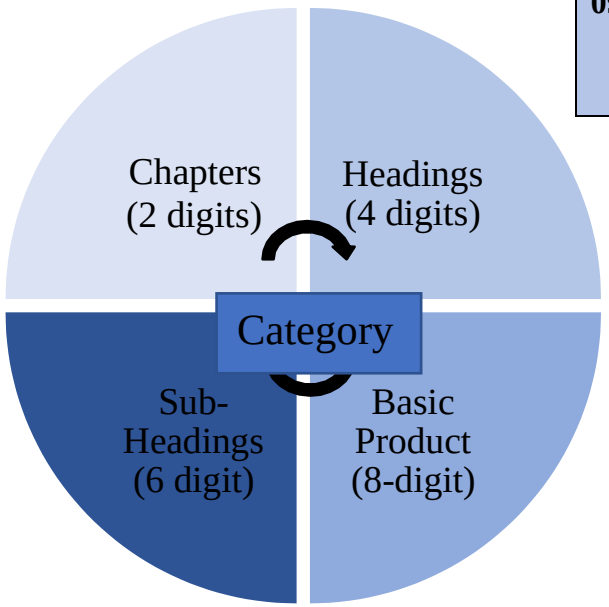
4.1.5 International trade classification of chilli

The countries make use of a standard trade classification for commodities in international trade, which is vital for several key government functions such as anti-dumping investigations, verification of rules of origin compliance etc. This is also important for industries for reviewing the tariff rates applied by an importing country on products from multiple partner countries. The Harmonized System (HS) is the most widely used code for classification of products in international trade. The World Customs Organization (WCO) formulated the Harmonized Commodity Description and Coding System, also known as the Harmonized System (HS), which is a multipurpose worldwide product nomenclature. The HS includes almost 5,000 commodity groups, each of which is identifiable by a six-digit code, which is organised in a legal and logical framework and backed by well-defined criteria to ensure uniform classification. More than 200 countries and economies utilise the system as the foundation for their customs tariffs and for the collection of international trade statistics. Over 98 percent of items traded internationally are classified using the HS system (WCO, 2019). The benefit of utilising the HS is that dealers from different nations may be assured that they are dealing with the same products.

The HS classifications are divided into two-digit (Chapters), four-digit (Heading), six-digit (Sub-Heading), and eight-digit or ten-digit categories (actual product at national tariff line). Upto the 6-digit level, the categories are unified throughout all countries in the world. Below that level, tariff lines are displayed in 8-digit format (for example, in India) in certain countries and 10-digit format (for example, in the United States) in others. The HS classification for chilli is shown in Figure 6. Chilli and its products are classified as 0904 Fruits of the genus *Capsicum* or of the genus *Pimenta*; dried, crushed, or ground in Chapter 09 (Coffee, tea, mate, and spices). Chilli is classified under two sub headings: either 090421, which is neither crushed nor ground chilli, or 090422, which is crushed or ground chilli. The trade data of chilli for the study was categorized up to this 6-digit level, i.e., up to sub-headings, using WITS software. The Ministry of Commerce and Industry, Government of India, provided yearly and monthly data on chilli exports and imports, which were categorized up to the 8-digit level.

Figure 6 Harmonised system (HS) of classification for chilli

Code	Description
09	Coffee, tea, mate and spices



Code	Description
0904	Pepper of the genus *Piper*; dried or crushed or ground fruits of the genus *Capsicum* or of the genus *Pimenta*

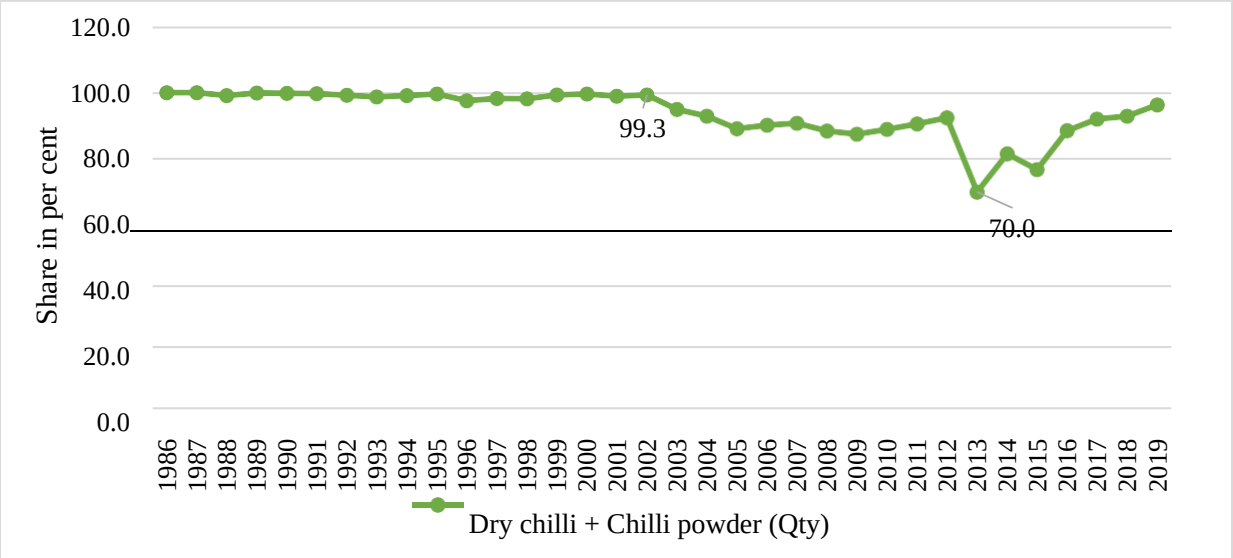
Code	Description
090421	Fruits of the genus *Capsicum* or of the genus *Pimenta*: dried, neither crushed nor ground
090422	Fruits of the genus *Capsicum* crushed or ground

Code	Description
09042110	Fruits of the genus *Capsicum*
09042120	Fruits of the genus *Pimenta*
09042211	Chilli powder
09042212	Chilli seeds
09042219	Others

4.1.6 Dynamics in pattern of Indian chilli exports

Chilli is internationally traded as *Capsicum* or *Pimenta,* neither crushed nor ground and crushed or ground *Capsicum*. Under the category of exports of *Capsicum* or *Pimenta* crushed or ground, different products such as chilli powder, chilli flakes, and chilli seeds are categorised. The details of different chilli products exported from India are shown in Table 4.6. It could be observed that dry chilli accounted for the largest share in total chilli exports from India in all the trienniums, both in terms of quantity and value of exports. Even though the share of dry chillies in total chilli exports has decreased from 74.5 per cent in TE1990-91 to 69.5 percent in quantity terms during TE2019-20, in terms of share in value, it has increased from 67.3 per cent to 68.8 per cent during the same period, which in turn could be attributed to the increased unit value of exports. In between, there was an increase in the share of dry chilli in both quantity and value terms during TE2000-01. Similarly, chilli powder accounted for the second largest share in total chilli exports across all trienniums, both in terms of quantity and value. The share of chilli powder had decreased from 25.2 per cent in TE1990-91 to 24 per cent in TE2019-20 in quantity terms and from 32.4 per cent to 28.1 per cent in value terms during the same period. Till 2002, the major share of chilli exported from India was accounted by dry chilli and chilli powder *i.e.,* accounted nearly for 100 per cent share in the total chilli exports from India (Figure 7). Later, it had come down and reduced to 70 per cent in 2013, meanwhile the shares of other ground or crushed products of chilli have increased.

Figure 7 Dynamics in share of dry chilli and chilli powder in total chilli exports from India



Note: Estimated using data from WITS

Table 4.6 Export of chilli and its products from India (TE1990-91 to TE2019-20)

Commodities	HS code	Quantity (tonnes)				Value (₹Lakh)			
		TE1990-91	TE2000-01	TE2010-11	TE2019-20	TE1990-91	TE2000-01	TE2010-11	TE2019-20
Chilli dry	09042110	11,038.9	51,155.4	1,53,360.6	3,33,585.1	1,582.6	18,551.7	94,007.6	3,78,721.7
		(74.5)	(79.1)	(72.8)	(69.8)	(67.3)	(75.5)	(72.2)	(68.8)
Chilli seed	09042212	-	424.4	310.0	2,089.4	-	94.0	135.4	1,342.3
			(0.7)	(0.1)	(0.4)		(0.4)	(0.1)	(0.2)
Chilli fresh	09041130	25.8	218.6	16,621.0	28,345.0	3.4	92.3	5,257.8	16,251.2
		(0.2)	(0.3)	(7.9)	(5.9)	(0.1)	(0.4)	(4.0)	(3.0)
Chilli powder	09042211	3730.7	12,887.5	32,618.8	1,14,483.5	762.7	5,839.4	23,729.8	1,54,543.6
		(25.2)	(19.9)	(15.5)	(24.0)	(32.4)	(23.8)	(18.2)	(28.1)
Chilli crushed	09042213	-	-	7,605.9	-	-	-	7,052.3	-
				(3.6)				(5.4)	
Chilli paste	09042217	-	-	19.4	501.2	-	-	6.1	327.3
				(0.0)	(0.1)			(0.0)	(0.1)
Chilli pickle	09042218	-	-	19.18	249.7	-	-	31.7	278.7
				(0.0)	(0.1)			(0.0)	(0.1)
Other chilli products	09042219	30.3	-	135.52	-	4.9	-	73.8	-
		(0.2)		(0.1)		(0.2)		(0.1)	
Total chilli		14,817.0	64,685.9	2,10,666.7	4,77,777.8	2,352.5	24,577.4	1,30,273.9	5,50,477.1
		(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

Source: Estimated using data from Export-Import data bank, GoI
Note: Values in parentheses denote shares in total chilli exports

4.1.7 Diversification of Indian chilli exports

The changes in the composition of a country's existing export product mix or export destinations are referred to as export diversification (Ali *et al*., 1991; Berthelemy and Chauvin, 2000). A more diverse export portfolio will generate a more consistent stream of export revenues (Samen, 2010). A country with a lower export concentration, or more diversified exports, has a larger number of products exported and trades with a larger number of trading partners (UNDP, 2011). The major contributing elements in the instability of export revenues were thought to be commodity concentration and geographic concentration of exports (Mohandas *et al*., 2018). The growth as well as higher stability in exports are possible with lower concentration or a larger range of export products.

The exports are diversified into two categories: commodity-wise and geographically Commodity diversification is achieved by altering or increasing the existing export commodity basket. Geographic diversification, on the other hand, is an increase in the number of markets accessed. Geographic diversification can be considered as a form of international diversification and can be defined as the development of a company's operations beyond the borders and countries into new geographic areas or markets (Hill *et al*., 1992). Developing countries can potentially acquire a more consistent revenue stream by diversifying their export portfolios rather than focusing on only a few products or customers. Demand shocks are typically and completely connected across sectors and countries, giving diversified economies the opportunity to offset revenue losses in one area with possible gains, or at the very least stability, in another (Shepherd, 2009).

4.1.7.1 Commodity diversification of Indian chilli exports

The commodity diversification indices for exports of Indian chilli were calculated using the Gini Concentration Index (GCI) and the results are presented in Table 4.7. The commodity diversification refers to increasing the value of a commodity by altering its original form through processing, as well as packaging, branding, and other measures to increase the product's worth (Jana, 2006; Singh *et al*., 2009). Countries with lower commodity concentration rates have more diverse exports, according to the commodity concentration index. The commodity diversification is higher in a country with an index value close to zero. Between 1986-87 and 2019-20, the average value of the commodity concentration index for chilli exports from India was 76.46.

Table 4.7 Commodity concentration for chilli exports from India (1986-87 to 2019-20)

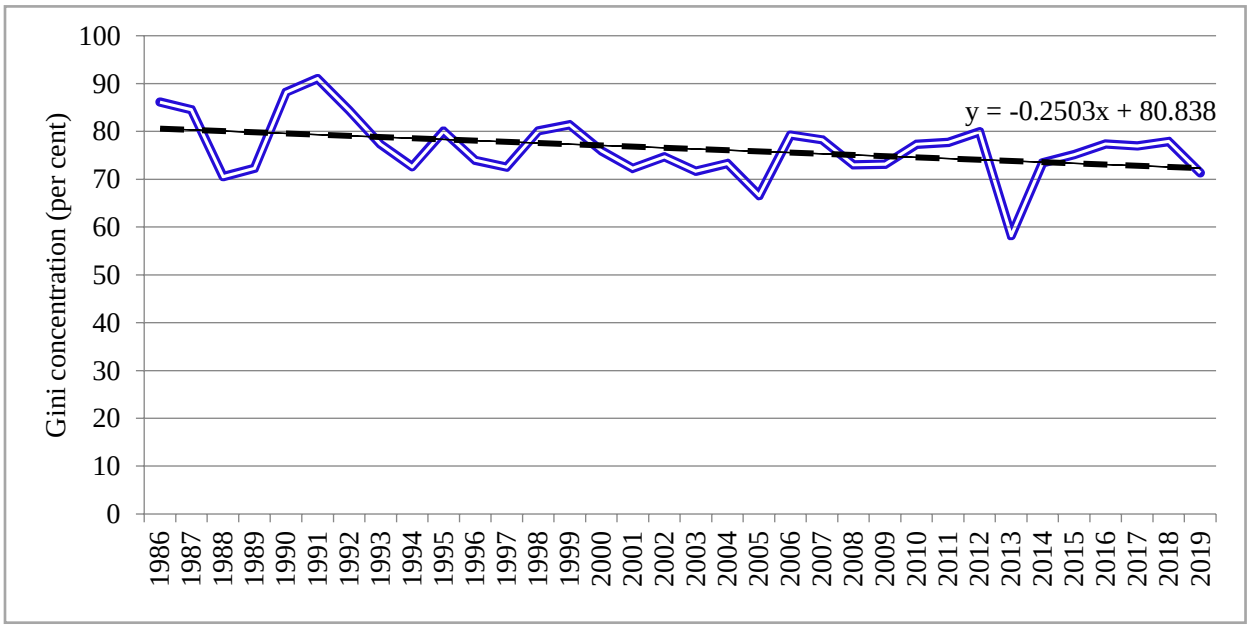
Year	Gini Concentration Index (GCI)
1986-87	86.15
1987-88	84.59
1988-89	70.56
1989-90	72.33
1990-91	88.21
1991-92	91.09
1992-93	84.40
1993-94	77.32
1994-95	72.63
1995-96	80.07
1996-97	73.96
1997-98	72.60
1998-99	80.13
1999-00	81.40
1990-91 to 1999-00	80.18
2000-01	76.02
2001-02	72.31
2002-03	74.74
2003-04	71.73
2004-05	73.29
2005-06	66.61
2006-07	79.27
2007-08	78.26
2008-09	73.06
2009-10	73.19
2000-01 to 2009-10	73.85
2010-11	77.33
2011-12	77.74
2012-13	79.95
2013-14	58.25
2014-15	73.48
2015-16	75.20
2016-17	77.43
2017-18	76.98
2018-19	77.95
2019-20	71.35
2010-11 to 2019-20	74.57
Pre 1990	78.40
Post 1990	76.20
Pre 2001	79.43
Post 2001	74.11
Overall	76.46

Note: Estimated using data from Export-Import data bank,

The average concentration index was 80.18 during the period from 1990-91 to 1999-2000, but it slightly declined to 74.57 during the period from 2010-11 to 2019-20. The decreasing commodity concentration index for chilli indicates that the export basket of chilli is becoming more diversified in terms of product composition. The fitted trend line for the commodity concentration indices (Figure 8) shows negative slope, which indicates declining trend over the years.

The average concentration index was 80.18 from 1990-91 to 1999-2000, but it dropped to 74.57 during the period from 2010-11 to 2019-20. The decreasing commodity concentration index for chilli indicates that the export basket of chilli is becoming more diversified in terms of products. The fitted trend line for the commodity concentration indices (Figure 8) shows negative slope, which indicates declining trend over the years.

Figure 8 Trend in commodity concentration of chilli exports from India



Note: Estimated using data from Export-Import data bank, GoI

The commodity diversification is primarily influenced by two forces: demand/consumption variables and production/supply factors. The changing consumption pattern is influenced by factors such as population growth, rising per capita income, urbanization, and trade liberalization (Joshi *et al*., 2007). Commodity price shocks are also linked to reliance on a small number of commodities (IMF, 2003).

4.1.7.2 Geographic diversification of Indian chilli exports

The Hirschman index which measures concentration, was used to measure the extent of geographic diversification of chilli exports from India. The Hirschman index was used to calculate the geographic concentration in chilli exports for each of the year from 1986 to 2019. An index value close to zero indicates that a country's exports are not concentrated in few nations, implying that the country's export structure is highly diversified (Kadyrova, 2011). An index value of 40 or above is considered to reflect a higher level of concentration (OECD, 2018; Mohandas *et al*., 2018). The estimated Hirschman indices for chilli exports from India are shown in Table 4.8. The average value of the concentration index for the overall period was 39.09, indicating India's reliance on a large number of countries or export markets for exporting chilli, which reduces the risk from price volatility in few concentrated markets. When domestic exports are highly dependent on a small number of trading partners, countries become vulnerable to potential domestic market volatility in those markets. When compared to the pre-2001, the geographic concentration indices for chilli exports from India after 2001 have decreased in absolute value indicating that the export markets markets for Indian chilli were more diversified. After 2010, the number of markets to which chilli was exported from India has considerably increased.

It could be observed from Figure 9 that the geographic concentration indices for chilli exports from India have exhibited a declining trend over the years. Before 2001, the geographic concentration was above 40 per cent, signifying a higher level of concentration and uneven distribution of shares in export markets which could result in higher instability and risk in export earnings. Later, India’s export of chilli was dispersed across different destinations, consequently the concentration index was valued less than 40 since 2010 and subsequently, the index value decreased to 32.86 per cent during 2016-17. An exporting country should reduce dependence on a few sources of demand through geographic diversification which will then mitigate future risks. These risks include economic risks like volatility and instability in foreign exchange earning which have adverse macroeconomic effects on growth, import and export capacity, foreign exchange cash flow and inflation. Being able to reduce vulnerability and mitigate risks, countries will then be able to achieve allocative efficiency with stable export earnings (Samen, 2010).

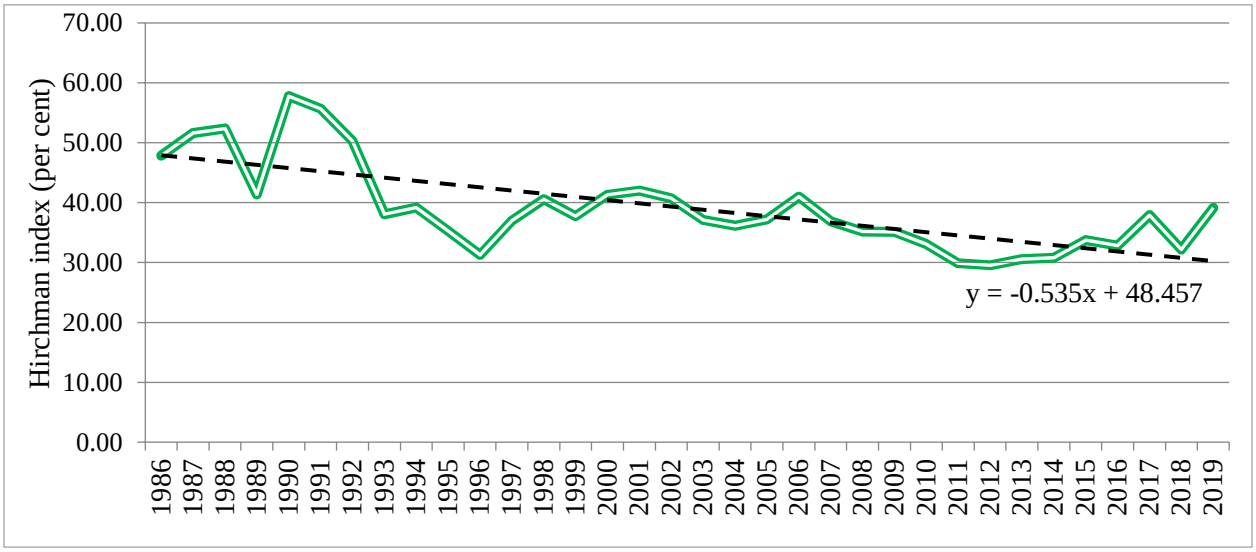
Table 4.8 Geographic concentration of Indian chilli exports (1986-87 to 2019-20)

Year	Hirschman index (HI)
1986-87	47.89
1987-88	51.63
1988-89	52.37
1989-90	41.37
1990-91	57.79
1991-92	55.73
1992-93	50.30
1993-94	38.10
1994-95	39.20
1995-96	35.29
1996-97	31.29
1997-98	37.02
1998-99	40.57
1999-00	37.77
1990-91 to 1999-00	42.31
2000-01	41.35
2001-02	42.02
2002-03	40.74
2003-04	37.14
2004-05	36.18
2005-06	37.24
2006-07	41.05
2007-08	36.91
2008-09	35.22
2009-10	35.16
2000-01 to 2009-10	38.30
2010-11	33.14
2011-12	29.90
2012-13	29.57
2013-14	30.59
2014-15	30.80
2015-16	33.74
2016-17	32.86
2017-18	37.91
2018-19	32.22
2019-20	39.16
2010-11 to 2019-20	32.99
Pre 1990	48.32
Post 1990	37.82
Pre 2001	43.85
Post 2001	35.34
Overall	39.09

Note: Estimated using data from Export-Import data bank,

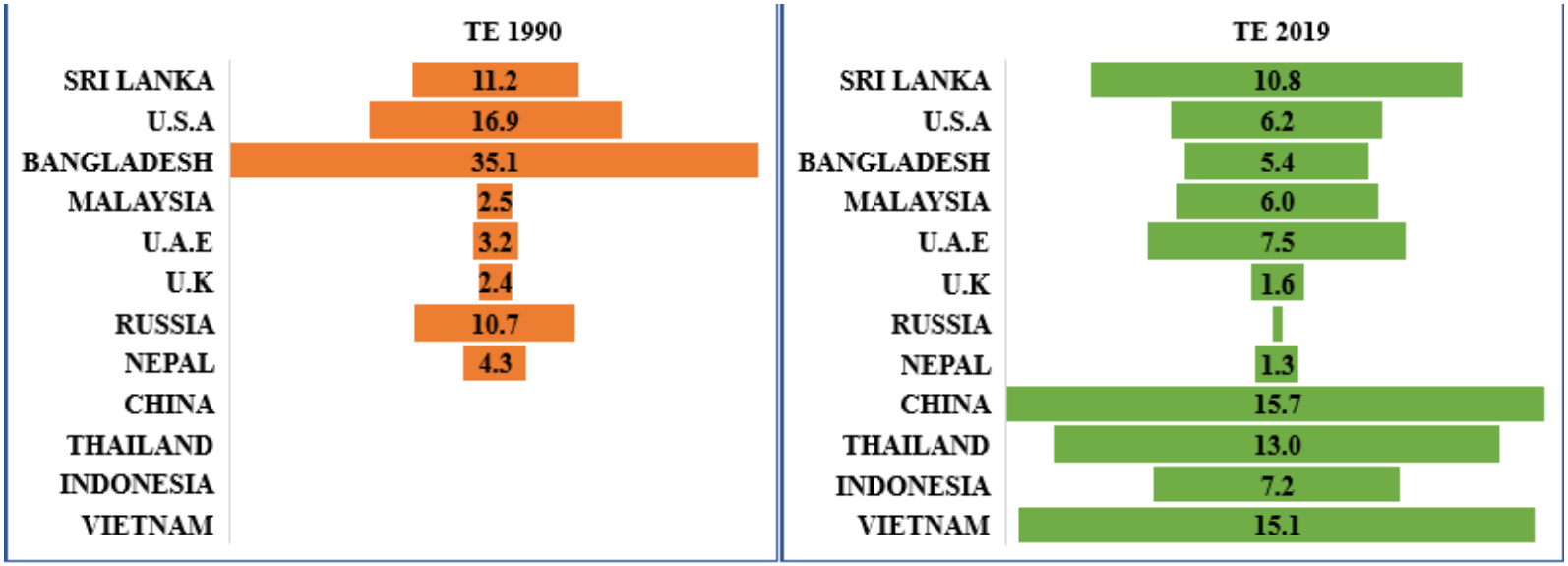
The declining trend in the Hirschman index showed that Indian chilli exports were getting increasingly diversified into a greater number of markets. While examining the country-wise exports from India, it could be observed from Figure 10 that in TE1990, about 63 per cent of the total exports was accounted by the three major importing countries *viz*., Bangladesh, USA and Sri Lanka, of which Bangladesh was accounting for more than 35 per cent of total chilli exports from India. In TE2019, China and Vietnam accounted for the highest share of 15 per cent each. In the latest triennium, while three countries accounted for more than 10 per cent share, five countries had for more than five per cent share in chilli exports from India, which showed that Indian chilli exports were getting increasingly diversified geographically.

Figure 9 Trend in geographic concentration in exports of in exports of chilli from India



Note: Estimated using data from Export-Import data bank,

Figure 10 Dynamics in share of different countries in exports of chilli from India



Note: Estimated using data from Export-Import data bank,

4.1.8 Dynamics in direction of chilli exports from India

The direction of chilli exports from India was studied by estimating the transition probability matrices from Markov chain analyses. The estimated transitional probability matrices were used to find out the structural changes in Indian chilli exports. The diagonal elements of the transition probability matrix depict the chances of retaining the market share from the preceding period.

The Markov chain analysis was carried out using data on export quantity of chilli from India to fifty-four export markets or countries and the rest of the export markets in the world was classified together as 'Others.' The diagonal elements of the transition probability matrix were used to identify the stable markets. In a transitional probability matrix, the row components represent the probability of retention of trade volume and the magnitude of trade loss due to competing regions/countries, while the column elements represent the chance of trade gains from other competing regions/countries.

4.1.8.1 Transition probabilities for quantity of chilli exports

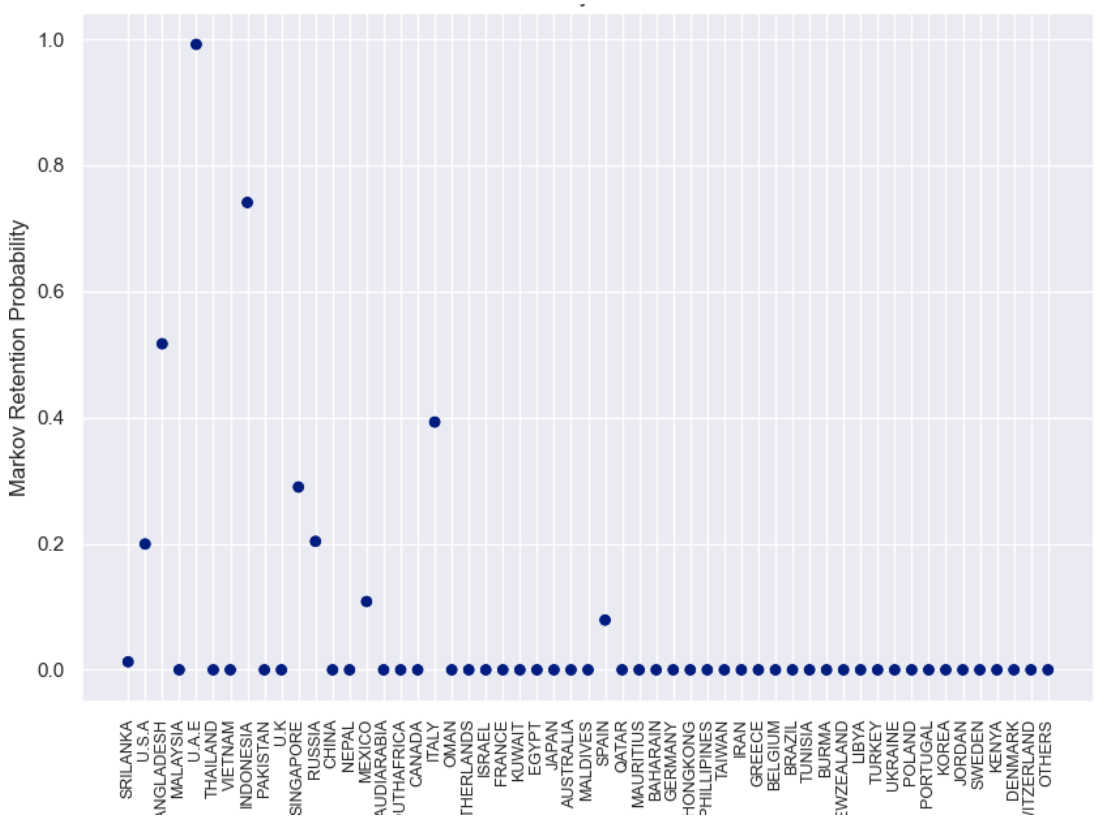
The Markov chain analysis was performed using data on country-wise exports of chilli from India for the following periods: pre-WTO (1986 to 1994), post-WTO (1995 to 2019), three decadal periods; 1990-1999, 2000-2009, and 2010-2019 and the overall period (1986 to 2019). The estimated transition probability matrices for chilli exports from India are presented from Table 4.9 to Table 4.14, which illustrate the net consequences of the switching pattern of the export markets for Indian chilli over time. The retention probabilities of distinct export markets or major importing countries are shown in the retention probability charts depicted from Figure 11 to Figure 16, for various time periods.

The transition probabilities for chilli exports from India to major export destinations in the pre-1994 period is presented in Table 4.9 and Figure 11, which give a broad picture of the changes in direction of chilli trade. The United Arab Emirates was the most stable market for Indian chilli exports, with a probability of 99.2 per cent retention. Indonesia was the second most stable market, with a probability of 74.1 per cent retention, followed by Bangladesh and Italy, with retention probabilities of 51.7 per cent and 39.3 per cent respectively.

Table 4.9 Transition probability matrix for chilli exports from India in pre-WTO period (1986 to 1994)

Country	SRILANKA	U.S.A	NGLADE	MALAYSIA	U.A.E	THAILAND	VIETNAM	NDONESI	PAKISTAN	U.K	INGAPOR	RUSSIA	CHINA	NEPAL	MEXICO	UDIARAB	UTHAFRI	CANADA	ITALY	OMAN	THERLAN	ISRAEL	FRANCE	KUWAIT	EGYPT	JAPAN	USTRALI	MALDIVES	SPAIN	QATAR	MAURITIU	BAHARAIN	GERMANY	ONGKON	HILLIPINE	TAIWAN	IRAN	GREECE	BELGIUM	BRAZIL	TUNISIA	BURMA	WZEALA	LIBYA	TURKEY	UKRAINE	POLAND	ORTUGA	KOREA	JORDAN	SWEDEN	KENYA	DENMARK	ITZERLA	OTHERS
SRILANKA	0.013	0.654	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.139	0.000	0.006	0.000	0.000	0.000	0.027	0.000	0.008	0.000	0.030	0.031	0.030	0.015	0.009	0.000	0.011	0.000	0.000	0.014	0.002	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001
U.S.A	0.620	0.200	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.059	0.000	0.011	0.013	0.002	0.000	0.004	0.000	0.000	0.007	0.021	0.009	0.000	0.000	0.004	0.018	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ANGLADE	0.234	0.050	0.517	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.076	0.000	0.000	0.000	0.015	0.000	0.000	0.007	0.029	0.007	0.000	0.009	0.010	0.000	0.000	0.004	0.003	0.000	0.000	0.000	0.017	0.001	0.000	0.002	0.001	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.012
MALAYSIA	0.000	0.675	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.284	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U.A.E	0.000	0.000	0.000	0.000	0.992	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THAILAND	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VIETNAM	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NDONESI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.741	0.073	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.173	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000
PAKISTAN	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U.K	0.940	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.000	0.000	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
INGAPOR	0.000	0.000	0.000	0.000	0.576	0.000	0.000	0.000	0.000	0.000	0.290	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	0.029	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.015
RUSSIA	0.000	0.412	0.000	0.043	0.016	0.000	0.000	0.000	0.000	0.007	0.000	0.204	0.000	0.100	0.000	0.078	0.000	0.000	0.000	0.060	0.020	0.000	0.000	0.034	0.000	0.000	0.001	0.005	0.000	0.003	0.000	0.012	0.000	0.000	0.002	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHINA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000
NEPAL	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MEXICO	0.000	0.000	0.723	0.000	0.000	0.000	0.000	0.132	0.000	0.000	0.000	0.000	0.000	0.000	0.108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.000	0.000	0.000	0.000	0.000
UDIARAB	0.000	0.000	0.994	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
UTHAFRI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CANADA	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITALY	0.000	0.000	0.000	0.000	0.399	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.393	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.048	0.000	0.000	0.077	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.022	0.042
OMAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.985	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000
THERLAN	0.000	0.000	0.000	0.000	0.098	0.000	0.000	0.000	0.000	0.000	0.286	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.051
ISRAEL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.812	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.188	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FRANCE	0.000	0.000	0.000	0.192	0.000	0.000	0.000	0.000	0.000	0.000	0.587	0.000	0.000	0.213	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000
KUWAIT	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EGYPT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JAPAN	0.684	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.227	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.021	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
USTRALI	0.952	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MALDIVES	0.000	0.000	0.000	0.199	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.582	0.000	0.219	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SPAIN	0.921	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.079	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QATAR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.046	0.000	0.068	0.000	0.082	0.000	0.320	0.000	0.000	0.389	0.000	0.000	0.000	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAURITIU	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.341	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.567	0.000	0.000	0.000	0.000	0.000	0.042	0.000	0.000	0.000	0.000	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BAHARAIN	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GERMANY	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ONGKON	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.371	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.611	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HILLIPINE	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TAIWAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IRAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GREECE	0.806	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.194	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BELGIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.339	0.000	0.620	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BRAZIL	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TUNISIA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.666	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.334	0.000	0.000	0.000	0.000	0.000
BURMA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WZEALA	0.000	0.000	0.349	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317	0.000	0.335	0.000	0.000	0.000	0.000	0.000
LIBYA	0.000	0.000	0.162	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.790	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000
TURKEY	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
UKRAINE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
POLAND	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ORTUGA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.268	0.000	0.000	0.000	0.000	0.000	0.000	0.732	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KOREA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JORDAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.686	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.314	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SWEDEN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.994	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KENYA	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DENMARK	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.680	0.000	0.320	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITZERLA	0.000	0.000	0.493	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.507	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OTHERS	0.000	0.000	0.923	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.064	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000

Figure 11 Retention probability chart for chilli exports from India in pre-WTO period (1986-1994)



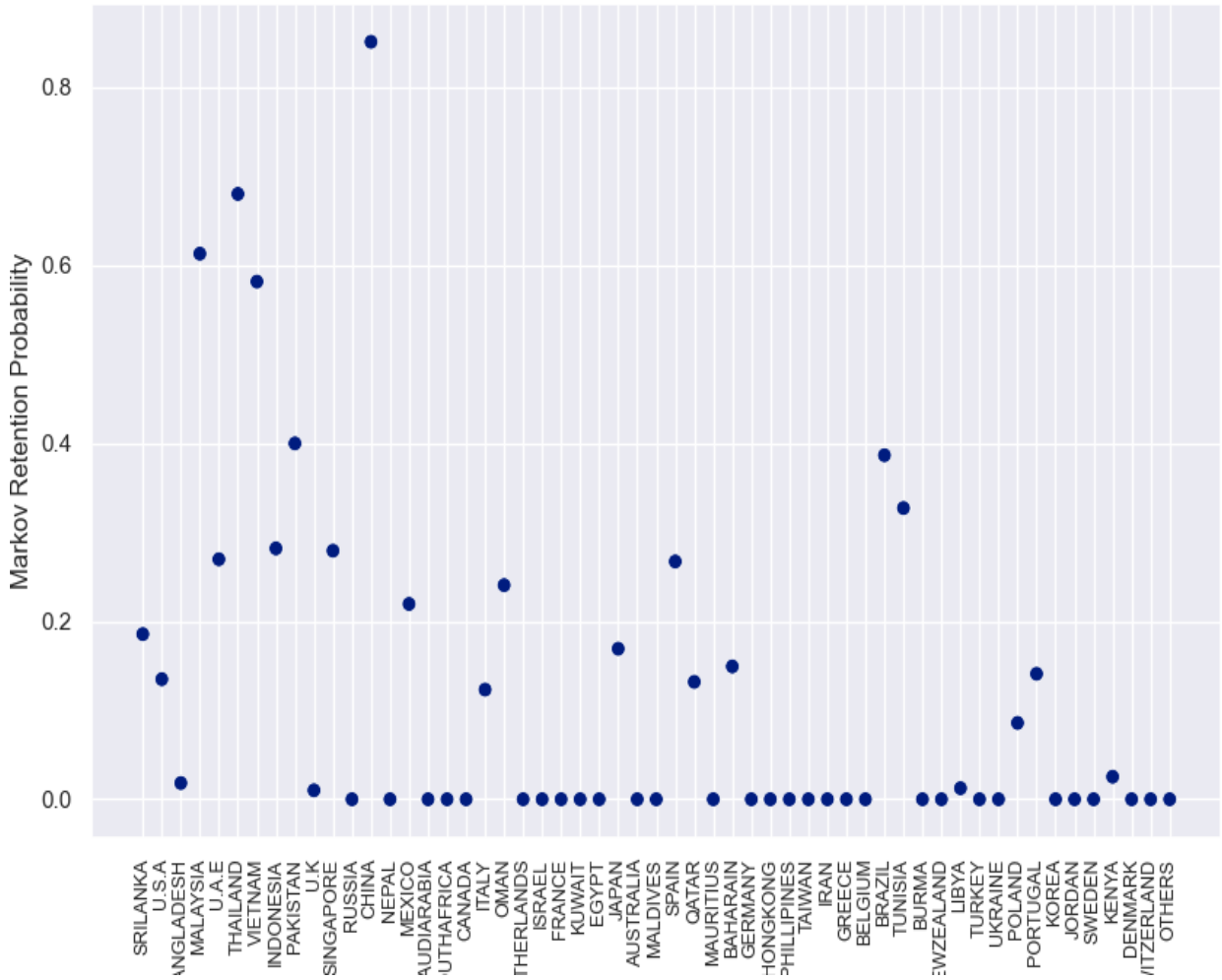
When comparing the pre-1994 period and the post-1994 period, a greater number of stable markets were observed for export of chilli from India in the latter period, as could be observed in Figure 12 and Table 4.10. During the post-1994 period, the transition probability matrix (Table 4.10) and retention probability chart (Figure 12) proved that India retained 85.1 per cent of the previous year's export share in the case of China. The chances of China gaining the market shares from Oman and Iran were 63.7 per cent and 56.5 per cent respectively. Thailand was next in line, retaining 68 per cent of its share from the previous year in the current year, gaining primarily from Vietnam and Bangladesh with16.3 per cent and 3.7 per cent probabilities. Malaysia, on the other hand, maintained 61.3 percent of its share from the previous year in the present period, gaining primarily from Belgium and Bangladesh with 100 per cent and 25 per cent respectively. Furthermore, Thailand and Malaysia were the markets gained after 1994, whereas these countries had zero retention probabilities in the pre-WTO period. In the post-WTO period, India gained a greater number of export markets for chilli, which could be attributed to increased openness in the international market as a result of the removal of QRs and reduction of tariff barriers.

Table 4.10 Transition probability matrix for chilli exports from India in post-WTO period (1995 to 2019)

Country	SRILANKA	U.S.A	NGLADE	MALAYSIA	U.A.E	THAILAND	VIETNAM	NDONESI	PAKISTAN	U.K	INGAPOR	RUSSIA	CHINA	NEPAL	MEXICO	UDIARAB	UTHAFRI	CANADA	ITALY	OMAN	THERLAN	ISRAEL	FRANCE	KUWAIT	EGYPT	JAPAN	USTRALI	MALDIVES
SRILANKA	0.185	0.377	0.214	0.017	0.019	0.000	0.000	0.004	0.000	0.008	0.000	0.018	0.000	0.069	0.000	0.001	0.028	0.007	0.010	0.000	0.013	0.000	0.000	0.000	0.008	0.000	0.011	0.008
U.S.A	0.734	0.135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.051	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.017	0.009	0.000	0.000	0.000	0.007	0.001	0.000	0.000	0.000	0.000
ANGLADE	0.218	0.000	0.018	0.250	0.068	0.037	0.000	0.049	0.084	0.049	0.031	0.001	0.000	0.042	0.021	0.032	0.019	0.012	0.010	0.002	0.000	0.000	0.003	0.009	0.002	0.004	0.002	0.000
MALAYSIA	0.000	0.000	0.177	0.613	0.107	0.001	0.000	0.077	0.000	0.000	0.000	0.003	0.000	0.008	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.001	0.000	0.002	0.000
U.A.E	0.046	0.000	0.000	0.217	0.270	0.032	0.000	0.073	0.000	0.101	0.036	0.006	0.000	0.000	0.018	0.045	0.000	0.008	0.000	0.005	0.003	0.006	0.000	0.002	0.036	0.001	0.011	0.000
THAILAND	0.000	0.000	0.000	0.000	0.000	0.680	0.318	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VIETNAM	0.000	0.000	0.000	0.000	0.000	0.163	0.581	0.101	0.000	0.000	0.000	0.000	0.042	0.012	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
NDONESI	0.000	0.000	0.000	0.000	0.488	0.000	0.087	0.282	0.000	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000
PAKISTAN	0.318	0.153	0.000	0.000	0.000	0.000	0.000	0.027	0.400	0.001	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.003	0.001	0.007	0.012	0.005	0.000	0.011	0.000	0.001	0.000
U.K	0.947	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.000
INGAPOR	0.000	0.691	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.279	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.000	0.000	0.000	0.000	0.000
RUSSIA	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHINA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.095	0.000	0.000	0.000	0.000	0.851	0.000	0.000	0.015	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000
NEPAL	0.000	0.000	0.979	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MEXICO	0.041	0.000	0.071	0.000	0.169	0.000	0.000	0.091	0.319	0.000	0.008	0.008	0.000	0.000	0.219	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.002	0.000
UDIARAB	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.990	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
UTHAFRI	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CANADA	0.926	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITALY	0.000	0.562	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.054	0.123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OMAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.637	0.000	0.000	0.000	0.000	0.000	0.000	0.240	0.000	0.000	0.000	0.000	0.000	0.000	0.037	0.000
THERLAN	0.000	0.722	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.105	0.000	0.067	0.000	0.000	0.000	0.000	0.040	0.000	0.000	0.000	0.000	0.000
ISRAEL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.466	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FRANCE	0.000	0.536	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.453	0.000	0.000	0.000	0.000	0.000	0.000
KUWAIT	0.000	0.000	0.000	0.000	0.963	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EGYPT	0.000	0.000	0.940	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JAPAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032	0.149	0.000	0.000	0.169	0.000	0.000
USTRALI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.225	0.000	0.000	0.000	0.328	0.000	0.000	0.000	0.000
MALDIVES	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.130	0.000	0.000	0.000	0.000	0.035	0.000	0.000	0.000	0.000	0.000	0.267	0.000	0.000	0.000	0.000	0.000
SPAIN	0.000	0.000	0.440	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.044	0.000	0.000
QATAR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.805	0.000	0.000	0.000	0.000	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAURITIU	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.925	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.000	0.000	0.000
BAHARAIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.367	0.000	0.000	0.000	0.000	0.000	0.000	0.457	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GERMANY	0.687	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ONGKON	0.000	0.901	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.039	0.048	0.000	0.000	0.000	0.000	0.000	0.000
HILLIPINE	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TAIWAN	0.000	0.095	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.164	0.568	0.000	0.161	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IRAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.565	0.000	0.000	0.364	0.000	0.000	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000
GREECE	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BELGIUM	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BRAZIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.386	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.168	0.000
TUNISIA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.563	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.048	0.000
BURMA	0.000	0.323	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.371	0.000	0.000	0.000	0.000	0.000	0.048	0.000	0.000	0.000	0.043	0.000	0.000	0.081	0.000	0.000	0.000	0.000	0.000
WZEALA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.920	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080
LIBYA	0.000	0.000	0.000	0.000	0.000	0.000	0.860	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TURKEY	0.000	0.000	0.381	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.363	0.005	0.000	0.103	0.000	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.000
UKRAINE	0.000	0.000	0.163	0.000	0.531	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
POLAND	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.189	0.000	0.000	0.271	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.122	0.053	0.000	0.028	0.000	0.000
ORTUGA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.421	0.000	0.000
KOREA	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JORDAN	0.000	0.000	0.516	0.000	0.461	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SWEDEN	0.000	0.000	0.000	0.969	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KENYA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.926	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DENMARK	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITZERLA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.867	0.000	0.000	0.000	0.000	0.000	0.000
OTHERS	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Country	SPAIN	QATAR	MAURITIU	BAHARAIN	GERMANY	ONGKON	HILLIPINE	TAIWAN	IRAN	GREECE	BELGIUM	BRAZIL	TUNISIA	BURMA	WZEALA	LIBYA	TURKEY	UKRAINE	POLAND	ORTUGA	KOREA	JORDAN	SWEDEN	KENYA	DENMARK	ITZERLA	OTHERS
SRILANKA	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
U.S.A	0.000	0.000	0.000	0.000	0.007	0.003	0.004	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ANGLADE	0.000	0.003	0.001	0.004	0.000	0.003	0.002	0.000	0.000	0.002	0.002	0.002	0.000	0.000	0.001	0.000	0.000	0.004	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.012
MALAYSIA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U.A.E	0.008	0.005	0.004	0.002	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.012	0.000	0.002	0.000	0.008	0.004	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.028
THAILAND	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VIETNAM	0.000	0.027	0.000	0.002	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.009	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.009
NDONESI	0.000	0.030	0.000	0.019	0.000	0.000	0.000	0.000	0.057	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
PAKISTAN	0.000	0.000	0.010	0.000	0.000	0.004	0.000	0.005	0.000	0.004	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U.K	0.000	0.000	0.000	0.000	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
INGAPOR	0.002	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
RUSSIA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHINA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
NEPAL	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000
MEXICO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.004	0.000	0.000	0.002	0.000	0.020	0.006	0.000	0.001	0.000	0.000	0.013
UDIARAB	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.000	0.000
UTHAFRI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CANADA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.074	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITALY	0.000	0.000	0.163	0.000	0.000	0.000	0.000	0.000	0.000	0.098	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OMAN	0.007	0.000	0.000	0.000	0.000	0.000	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.048
THERLAN	0.000	0.000	0.000	0.000	0.032	0.017	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISRAEL	0.470	0.000	0.000	0.000	0.000	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FRANCE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KUWAIT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.032	0.000	0.000
EGYPT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
JAPAN	0.000	0.000	0.000	0.000	0.146	0.001	0.000	0.407	0.000	0.074	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000
USTRALI	0.000	0.000	0.000	0.293	0.000	0.000	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MALDIVES	0.000	0.000	0.000	0.000	0.018	0.081	0.000	0.464	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SPAIN	0.267	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.129	0.000	0.000	0.000	0.000	0.000	0.044	0.000	0.002	0.000
QATAR	0.000	0.132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAURITIU	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BAHARAIN	0.000	0.026	0.000	0.149	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GERMANY	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.313
ONGKON	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HILLIPINE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TAIWAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IRAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.001	0.000	0.000	0.000
GREECE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BELGIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BRAZIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.386	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.000	0.000	0.000	0.000
TUNISIA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.327	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.040
BURMA	0.070	0.000	0.000	0.000	0.008	0.000	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WZEALA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LIBYA	0.000	0.000	0.000	0.128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TURKEY	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.011	0.000	0.000
UKRAINE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.076	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.086	0.000	0.000	0.134
POLAND	0.000	0.000	0.000	0.000	0.000	0.074	0.099	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.000	0.000	0.000	0.086	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0.000
ORTUGA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.270	0.168	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.141	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KOREA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JORDAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.000	0.000	0.000
SWEDEN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KENYA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.000	0.000	0.000
DENMARK	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITZERLA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.057	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.076	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OTHERS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Figure 12 Retention probability chart for chilli exports from India in post-WTO period (1995-2019)



For the overall study period from 1986 to 2019, China, Malaysia and Thailand were the most stable markets for exports of Indian chilli, with 88.3 percent, 80.8 per cent, and 59.5 per cent probabilities of retention respectively (Table 4.11 and Figure 13). In the overall period, the most stable market, China, gained from Vietnam and Indonesia, while Malaysia gained from Sweden and Belgium. Other stable markets identified in the overall period included the United Arab Emirates, Vietnam, Pakistan with 50 per cent, 49.2 per cent and 42 per cent probabilities of retention.

Table 4.11 Transition probability matrix for chilli exports from India in overall period (1986 to 2019)

Country	SRILANK	U.S.A	BANGLAI	MALAYSI	U.A.E	THAILAN	VIETNAM	INDONES	PAKISTA	U.K	SINGAPO	RUSSIA	CHINA	NEPAL	MEXICO	SAUDIAR	SOUTHAI	CANADA	ITALY	OMAN	NETHERI	ISRAEL	FRANCE	KUWAIT	EGYPT	JAPAN	AUSTRAI	MALDIV	SPAIN	QATAR	MAURITI	BAHARA	GERMAN	HONGKO	PHILLIP	TAIWAN	IRAN	GREECE	BELGIUM	BRAZIL	TUNISIA	BURMA	NEWZEA	LIBYA	TURKEY	UKRAINE	POLAND	PORTUG	KOREA	JORDAN	SWEDEN	KENYA	DENMAR	SWITZEI	OTHERS
SRILANK	0.387	0.381	0.000	0.034	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.076	0.000	0.000	0.038	0.009	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.008	0.001	0.000	0.000	0.003	0.003	0.002	0.003	0.003	0.002	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
U.S.A	0.552	0.184	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.069	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.021	0.023	0.000	0.002	0.000	0.013	0.000	0.000	0.000	0.003	0.000	0.009	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BANGLAI	0.197	0.115	0.330	0.000	0.019	0.000	0.000	0.003	0.000	0.051	0.056	0.001	0.000	0.000	0.087	0.018	0.013	0.011	0.029	0.005	0.000	0.004	0.006	0.006	0.001	0.005	0.001	0.002	0.001	0.001	0.006	0.003	0.002	0.002	0.002	0.000	0.000	0.001	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.016
MALAYSI	0.000	0.000	0.000	0.808	0.029	0.026	0.000	0.073	0.000	0.000	0.000	0.001	0.000	0.024	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.015	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
U.A.E	0.000	0.000	0.159	0.110	0.500	0.022	0.000	0.000	0.038	0.039	0.023	0.005	0.004	0.000	0.025	0.026	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.005	0.001	0.000	0.012	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.003	0.002	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000
THAILAN	0.000	0.000	0.000	0.000	0.000	0.595	0.392	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VIETNAM	0.000	0.000	0.000	0.000	0.000	0.231	0.492	0.107	0.000	0.000	0.000	0.000	0.066	0.013	0.000	0.000	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.034	0.000	0.004	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.001	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.009
INDONES	0.000	0.000	0.000	0.000	0.261	0.000	0.103	0.327	0.000	0.000	0.000	0.000	0.042	0.000	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.037	0.000	0.012	0.000	0.000	0.006	0.000	0.052	0.000	0.000	0.010	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.001	0.000	0.000	0.031
PAKISTA	0.243	0.113	0.000	0.000	0.000	0.000	0.000	0.078	0.420	0.004	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.012	0.000	0.000	0.019	0.006	0.005	0.000	0.046	0.000	0.003	0.000	0.000	0.000	0.005	0.000	0.000	0.007	0.000	0.015	0.000	0.003	0.000	0.005	0.001	0.000	0.001	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U.K	0.366	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.096	0.000	0.019	0.000	0.076	0.088	0.099	0.000	0.086	0.000	0.011	0.011	0.069	0.000	0.000	0.000	0.000	0.060	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000
SINGAPO	0.000	0.354	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.154	0.212	0.000	0.000	0.000	0.000	0.006	0.000	0.020	0.035	0.000	0.007	0.012	0.040	0.000	0.000	0.024	0.000	0.000	0.061	0.000	0.010	0.000	0.019	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.010	0.000	0.005	0.000	0.000	0.000	0.000	0.008	0.000	0.002	0.000	0.000	0.000	0.000	0.015
RUSSIA	0.000	0.508	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.051	0.000	0.184	0.000	0.000	0.000	0.073	0.000	0.018	0.000	0.057	0.015	0.000	0.000	0.035	0.000	0.000	0.004	0.017	0.000	0.005	0.000	0.014	0.005	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
CHINA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.883	0.000	0.000	0.007	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NEPAL	0.000	0.000	0.992	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008
MEXICO	0.164	0.000	0.407	0.000	0.000	0.000	0.000	0.196	0.000	0.000	0.000	0.001	0.000	0.000	0.140	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.000	0.004	0.001	0.012	0.002	0.000	0.016	0.001	0.004	0.003	0.000	0.000	0.021
SAUDIAR	0.000	0.000	0.976	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SOUTHAF	0.000	0.000	0.331	0.000	0.000	0.000	0.000	0.000	0.630	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.030	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CANADA	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITALY	0.000	0.000	0.000	0.000	0.722	0.000	0.000	0.000	0.000	0.000	0.153	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000
OMAN	0.000	0.000	0.000	0.000	0.097	0.000	0.000	0.000	0.000	0.534	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.176	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.011	0.000	0.000
NETHERL	0.000	0.722	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.252	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISRAEL	0.000	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.629	0.000	0.000	0.000	0.000	0.273	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FRANCE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.763	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.215	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.000	0.000	0.000	0.000	0.000
KUWAIT	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EGYPT	0.000	0.000	0.819	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.154	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017
JAPAN	0.000	0.894	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.035	0.000	0.000	0.000	0.000	0.000	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AUSTRAL	0.766	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.105	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.121	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MALDIVE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.735	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.134	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SPAIN	0.947	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QATAR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAURITI	0.000	0.000	0.000	0.000	0.433	0.000	0.000	0.000	0.000	0.000	0.193	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.000	0.035	0.000	0.000	0.000	0.093	0.000	0.000	0.181	0.000	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000
BAHARAI	0.000	0.000	0.578	0.000	0.422	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GERMAN	0.545	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.331	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.124
HONGKO	0.000	0.635	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.277	0.078	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PHILLIPI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TAIWAN	0.967	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IRAN	0.000	0.000	0.983	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.007
GREECE	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BELGIUM	0.000	0.000	0.000	0.818	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.182	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BRAZIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.924	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.000
TUNISIA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.980	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BURMA	0.489	0.000	0.000	0.000	0.000	0.000	0.000	0.108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.092	0.000	0.070	0.000	0.000	0.001	0.000	0.000	0.000	0.015	0.000	0.101	0.000	0.000	0.000	0.000	0.000	0.075	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025
NEWZEAI	0.000	0.000	0.642	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.358	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LIBYA	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TURKEY	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.066	0.000	0.000	0.213	0.477	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.000	0.000	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.109	0.000	0.000	0.000	0.026	0.000	0.059	0.000	0.000	0.000	0.001	0.000	0.000	0.015	0.002	0.000
UKRAINE	0.345	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.035	0.010	0.000	0.172	0.000	0.000	0.000	0.000	0.100	0.000	0.000	0.337
POLAND	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.124	0.345	0.034	0.000	0.000	0.000	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.293	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PORTUG	0.000	0.880	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.085	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KOREA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JORDAN	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SWEDEN	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KENYA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.483	0.000	0.000	0.000	0.000	0.517	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DENMAR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.489	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.511	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SWITZER	0.000	0.000	0.997	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OTHERS	0.000	0.000	0.000	0.000	0.985	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Figure 13 Retention probability chart for chilli exports from India in overall period (1986-2019)

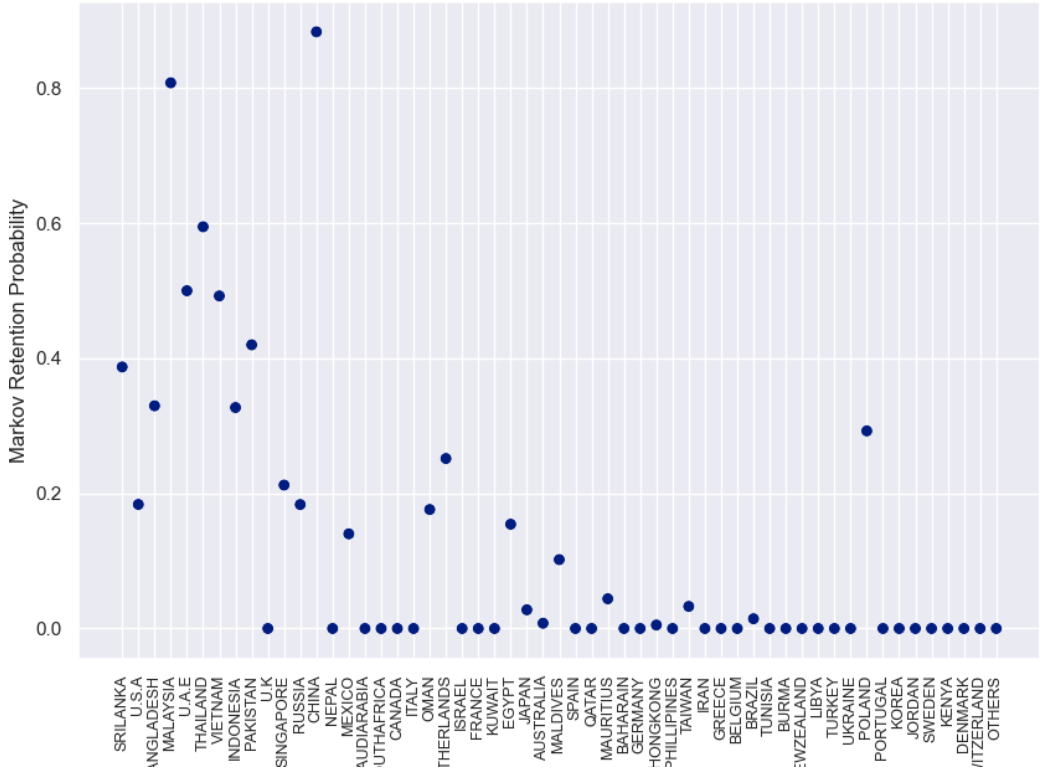


Figure 14 Retention probability chart for chilli exports from India (1990-1999)

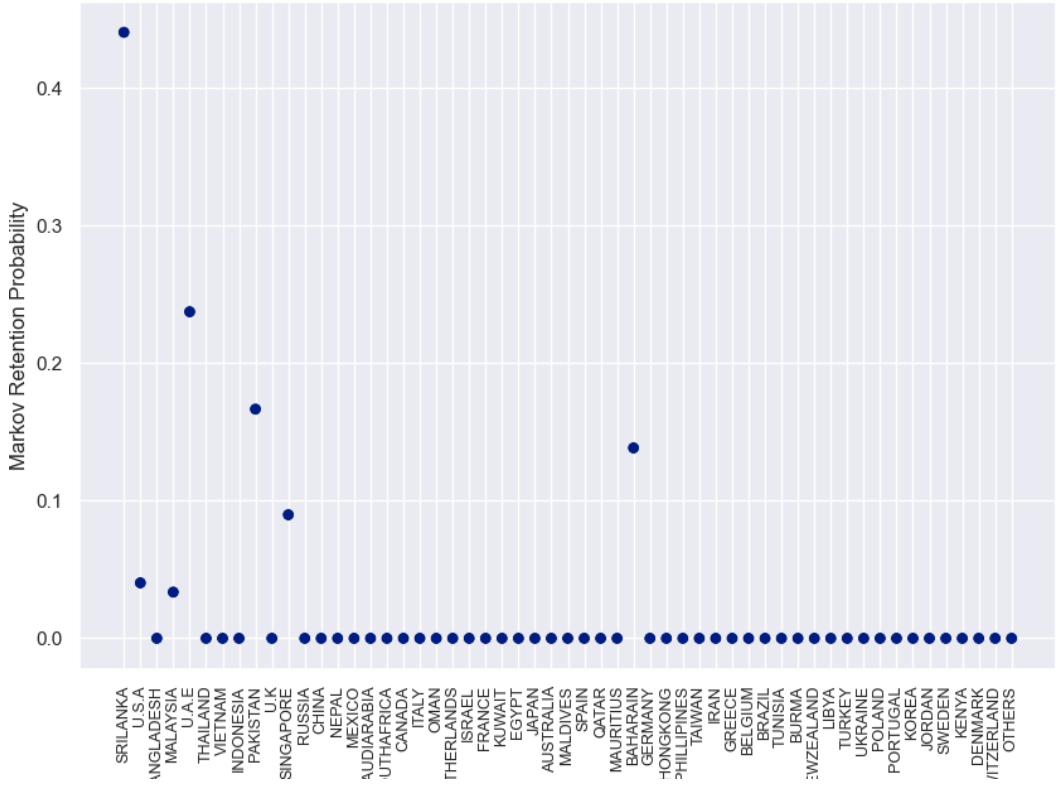


Table 4.12 Transition probability matrix for chilli exports from India (1990-1999)

Country	SRILANKA	U.S.A	NGLADE	MALAYSIA	U.A.E	THAILAND	VIETNAM	NDONESI	PAKISTAN	U.K	INGAPOR	RUSSIA	CHINA	NEPAL	MEXICO	UDIARAB	UTHAFRI	CANADA	ITALY	OMAN	THERLAN	ISRAEL	FRANCE	KUWAIT	EGYPT	JAPAN	USTRALI	MALDIVES	SPAIN	QATAR	MAURITIU	BAHARAIN	GERMANY	ONGKON	HILLIPINE	TAIWAN	IRAN	GREECE	BELGIUM	BRAZIL	TUNISIA	BURMA	WZEALA	LIBYA	TURKEY	UKRAINE	POLAND	ORTUGA	KOREA	JORDAN	SWEDEN	KENYA	DENMARK	ITZERLA	OTHERS
SRILANKA	0.441	0.314	0.000	0.000	0.026	0.000	0.000	0.000	0.109	0.000	0.000	0.005	0.000	0.000	0.000	0.002	0.000	0.019	0.014	0.000	0.018	0.000	0.000	0.005	0.000	0.000	0.011	0.009	0.000	0.000	0.000	0.007	0.010	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
U.S.A	0.000	0.040	0.576	0.015	0.024	0.000	0.000	0.021	0.000	0.086	0.027	0.007	0.000	0.000	0.000	0.036	0.000	0.018	0.029	0.026	0.004	0.007	0.018	0.008	0.000	0.004	0.000	0.000	0.012	0.006	0.016	0.005	0.001	0.000	0.000	0.000	0.000	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.004	0.000	0.000	0.000	0.001	0.000
ANGLADE	0.220	0.449	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.056	0.078	0.009	0.000	0.004	0.012	0.018	0.000	0.009	0.026	0.019	0.006	0.019	0.014	0.002	0.001	0.005	0.000	0.005	0.003	0.000	0.021	0.000	0.001	0.003	0.001	0.000	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.012
MALAYSIA	0.251	0.000	0.000	0.034	0.000	0.000	0.000	0.013	0.000	0.002	0.000	0.000	0.000	0.000	0.137	0.000	0.163	0.059	0.011	0.000	0.034	0.000	0.000	0.015	0.069	0.000	0.001	0.000	0.058	0.000	0.000	0.000	0.051	0.000	0.000	0.010	0.000	0.016	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.043	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.031
U.A.E	0.000	0.000	0.000	0.171	0.237	0.023	0.000	0.000	0.000	0.028	0.349	0.000	0.008	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.005	0.001	0.030	0.002	0.000	0.013	0.009	0.000	0.018	0.000	0.000	0.001	0.020	0.038	0.000	0.010	0.000	0.003	0.000	0.000	0.000	0.009	0.001	0.000	0.001	0.004	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THAILAND	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.000	0.930	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.055	0.000	0.000	0.000	0.000	0.000
VIETNAM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
NDONESI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PAKISTAN	0.231	0.000	0.000	0.336	0.000	0.000	0.000	0.041	0.167	0.000	0.000	0.000	0.000	0.143	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.035	0.000	0.008	0.000	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U.K	0.842	0.000	0.000	0.000	0.000	0.000	0.000	0.110	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.034	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
INGAPOR	0.000	0.470	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.150	0.090	0.000	0.000	0.000	0.047	0.060	0.000	0.000	0.000	0.000	0.090	0.002	0.019	0.000	0.000	0.021	0.000	0.000	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.011	0.000	0.006	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RUSSIA	0.008	0.000	0.992	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHINA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.608	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.392	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NEPAL	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MEXICO	0.660	0.221	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.029
UDIARAB	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
UTHAFRI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CANADA	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITALY	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OMAN	0.000	0.000	0.000	0.000	0.992	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000
THERLAN	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISRAEL	0.000	0.000	0.000	0.000	0.961	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.039	0.000	0.000	0.000	0.000
FRANCE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.808	0.000	0.000	0.000	0.000	0.185	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KUWAIT	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EGYPT	0.765	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.118	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.000	0.000	0.071
JAPAN	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
USTRALI	0.624	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.230	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.146	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MALDIVES	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SPAIN	0.959	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.014
QATAR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.714	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.286	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAURITIU	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BAHARAIN	0.000	0.000	0.000	0.000	0.862	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.138	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GERMANY	0.728	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.164
ONGKON	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.000	0.000	0.950	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HILLIPINE	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TAIWAN	0.950	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IRAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.814	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.186	0.000	0.000	0.000
GREECE	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BELGIUM	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BRAZIL	0.646	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.054	0.000	0.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TUNISIA	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BURMA	0.000	0.227	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.676	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.098	0.000	0.000	0.000	0.000	0.000
WZEALA	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LIBYA	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TURKEY	0.815	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.185	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
UKRAINE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.519	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.308	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.172	0.000	0.000	0.000
POLAND	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ORTUGA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.758	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.149	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.058	0.000	0.000
KOREA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.911	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.089	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JORDAN	0.773	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.227	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SWEDEN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KENYA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DENMARK	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITZERLA	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OTHERS	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The probability matrix revealed India was able to retain 44.1 percent of its original share in chilli exports to Sri Lanka and it was one of the most stable importers of chilli from India, as shown in Table 4.12 and Figure 14. Sri Lanka gained its share from Saudi Arabia, Canada, the Netherlands, the Philippines, Greece, Tunisia and others.

The transition probabilities shown in Table 4.13 and Figure 15 represent the dynamics in the direction of chilli exports from India during the period from 2000 to 2009. Malaysia and Thailand were the most stable export markets for the Indian chilli during that period, with retention probabilities of 77.6 per cent and 67.2 per cent respectively. Malaysia gained from Nepal, Saudi Arabia, Japan, Qatar, Ukraine, Portugal, Korea, and Kenya, while Thailand gained market share in Indian exports from Vietnam.

Figure 15 Retention probability chart for chilli exports from India (2000-2009)

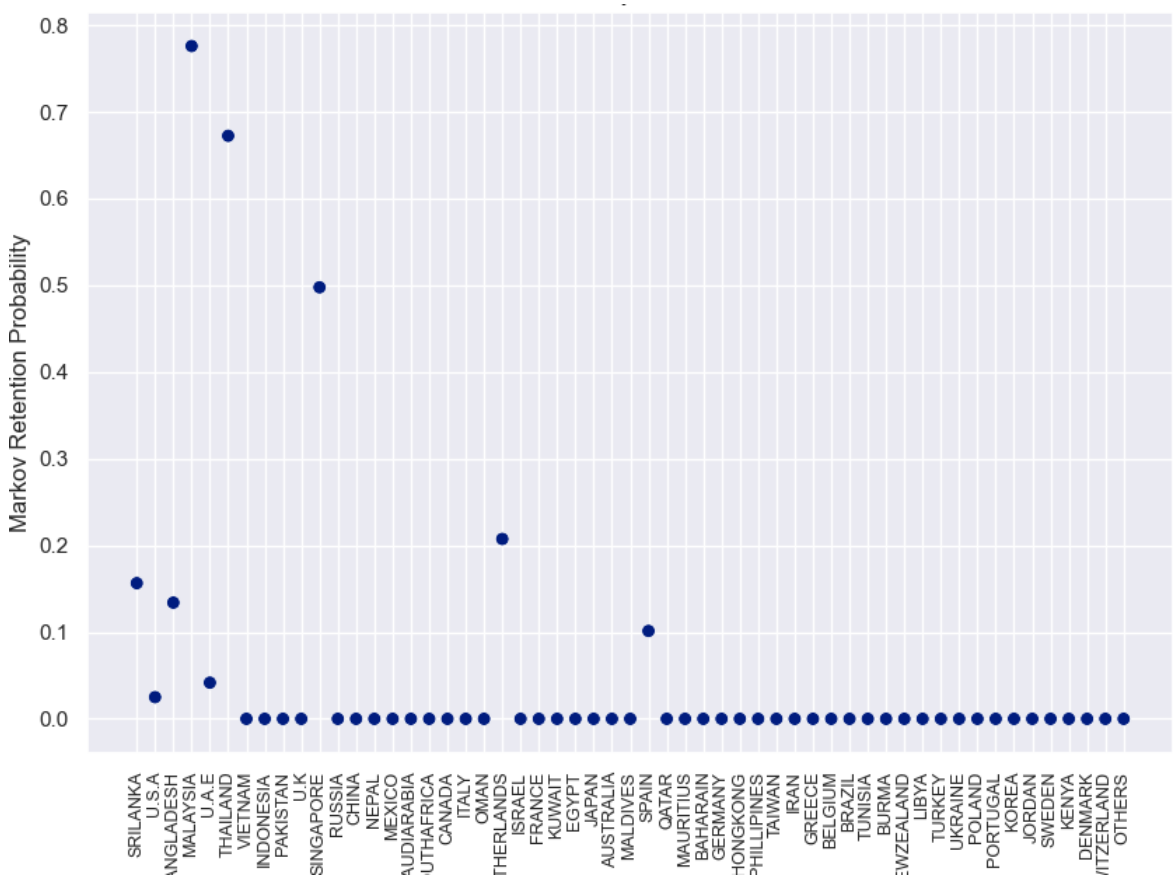


Table 4.13 Transition probability matrix for chilli exports from India (2000-2009)

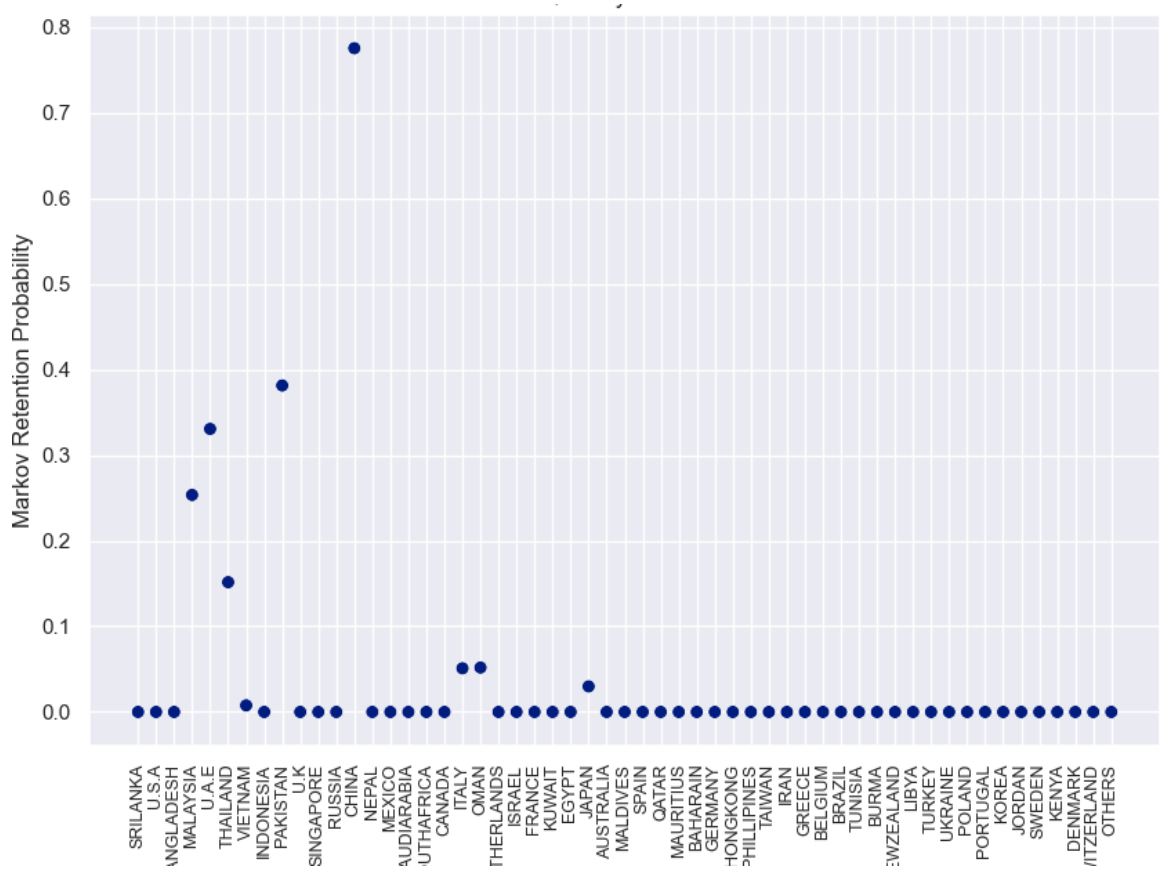
Country	SRILANKA	U.S.A	NGLADE	MALAYSIA	U.A.E	THAILAND	VIETNAM	NDONESI	PAKISTAN	U.K	INGAPOR	RUSSIA	CHINA	NEPAL	MEXICO	UDIARAB	UTHAFRI	CANADA	ITALY	OMAN	THERLAN	ISRAEL	FRANCE	KUWAIT	EGYPT	JAPAN	USTRALI	MALDIVES	SPAIN	QATAR	MAURITIU	BAHARAIN	GERMANY	ONGKON	HILLIPINE	TAIWAN	IRAN	GREECE	BELGIUM	BRAZIL	TUNISIA	BURMA	WZEALA	LIBYA	TURKEY	UKRAINE	POLAND	ORTUGA	KOREA	JORDAN	SWEDEN	KENYA	DENMARK	ITZERLA	OTHERS
SRILANKA	0.156	0.421	0.274	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.018	0.000	0.036	0.000	0.000	0.030	0.016	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.015	0.004	0.001	0.000	0.004	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.004
U.S.A	0.853	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.052	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.013	0.025	0.000	0.001	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.003	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ANGLADE	0.304	0.055	0.134	0.000	0.079	0.004	0.000	0.019	0.097	0.031	0.019	0.003	0.000	0.049	0.007	0.017	0.059	0.004	0.009	0.000	0.000	0.001	0.002	0.012	0.034	0.004	0.000	0.001	0.000	0.005	0.001	0.000	0.000	0.002	0.005	0.004	0.000	0.001	0.006	0.000	0.000	0.000	0.001	0.000	0.001	0.006	0.000	0.000	0.000	0.002	0.002	0.001	0.000	0.000	0.016
MALAYSIA	0.000	0.000	0.000	0.776	0.109	0.010	0.000	0.067	0.000	0.000	0.000	0.000	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.002	0.000	0.000	0.002	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U.A.E	0.000	0.000	0.577	0.000	0.042	0.000	0.000	0.235	0.000	0.000	0.009	0.000	0.031	0.000	0.042	0.000	0.000	0.000	0.000	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.005	0.001	0.000	0.009	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THAILAND	0.000	0.000	0.000	0.000	0.059	0.672	0.152	0.000	0.000	0.000	0.000	0.000	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.055	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VIETNAM	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NDONESI	0.000	0.000	0.000	0.000	0.998	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PAKISTAN	0.541	0.000	0.000	0.000	0.163	0.000	0.000	0.038	0.000	0.060	0.007	0.010	0.000	0.000	0.000	0.031	0.000	0.000	0.000	0.012	0.000	0.000	0.004	0.000	0.085	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.025	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020
U.K	0.000	0.000	0.868	0.000	0.000	0.000	0.000	0.061	0.000	0.000	0.011	0.000	0.000	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000
INGAPOR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.204	0.000	0.000	0.498	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.081	0.000	0.000	0.000	0.039	0.000	0.000	0.000	0.000	0.000	0.000	0.059	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000
RUSSIA	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHINA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.579	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.159	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.241
NEPAL	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MEXICO	0.000	0.981	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
UDIARAB	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
UTHAFRI	0.000	0.000	0.000	0.965	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CANADA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.232	0.000	0.000	0.000	0.000	0.274	0.000	0.225	0.000	0.000	0.000	0.000	0.014	0.000	0.000	0.000	0.000	0.094	0.000	0.000	0.000	0.126	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.001	0.000	0.000	0.000	0.000	0.000
ITALY	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.308	0.000	0.000	0.000	0.238	0.453	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OMAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THERLAN	0.000	0.743	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.207	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ISRAEL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.585	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.415	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FRANCE	0.000	0.975	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KUWAIT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EGYPT	0.000	0.000	0.000	0.000	0.504	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.445	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JAPAN	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
USTRALI	0.000	0.000	0.198	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.212	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.289	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.295	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MALDIVES	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.843	0.000	0.000	0.000	0.000	0.000	0.000	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.085	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SPAIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.169	0.000	0.000	0.000	0.035	0.077	0.000	0.000	0.000	0.000	0.000	0.101	0.000	0.000	0.000	0.279	0.000	0.000	0.000	0.000	0.234	0.000	0.000	0.000	0.000	0.014	0.000	0.000	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QATAR	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MAURITIU	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BAHARAIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.996	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GERMANY	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ONGKON	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.675	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.315	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HILLIPINE	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TAIWAN	0.222	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.281	0.000	0.000	0.000	0.000	0.000	0.000	0.443	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IRAN	0.000	0.000	0.085	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.650	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.115	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.019	0.000	0.016	0.000	0.000	0.026	0.000	0.000	0.005
GREECE	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BELGIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.626	0.000	0.000	0.374	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BRAZIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.835	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.129	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000
TUNISIA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BURMA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WZEALA	0.000	0.567	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.433	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LIBYA	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TURKEY	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.351	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.123	0.000	0.000	0.000	0.229	0.000	0.000	0.000	0.000	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.000	0.024	0.000	0.000	0.000	0.092	0.000	0.000	0.014	0.000	0.000
UKRAINE	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
POLAND	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.731	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.095	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.104	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.000
ORTUGA	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KOREA	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JORDAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.767	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.233	0.000	0.000	0.000	0.000
SWEDEN	0.000	0.000	0.000	0.898	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
KENYA	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DENMARK	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.679	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.321	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ITZERLA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.604	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.396	0.000	0.000
OTHERS	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 4.14 Transition probability matrix for chilli exports from India (2010-2019)

Country	SRILANKA	U.S.A	NGLADE	MALAYSIA	U.A.E	THAILAND	VIETNAM	NDONESI	PAKISTAN	U.K	INGAPOR	RUSSIA	CHINA	NEPAL	MEXICO	UDIARAB	UTHAFRI	CANADA	ITALY	OMAN	THERLAN	ISRAEL	FRANCE	KUWAIT	EGYPT	JAPAN	USTRALI	MALDIVES	SPAIN	QATAR	MAURITIU	BAHARAIN	GERMANY	ONGKON	HILLIPINE	TAIWAN	IRAN	GREECE	BELGIUM	BRAZIL	TUNISIA	BURMA	WZEALA	LIBYA	TURKEY	UKRAINE	POLAND	ORTUGA	KOREA	JORDAN	SWEDEN	KENYA	DENMARK	ITZERLA	OTHERS
SRILANKA	0.0000	0.3761	0.0000	0.0620	0.0000	0.4265	0.0000	0.0000	0.0000	0.0377	0.0209	0.0216	0.0000	0.0000	0.0000	0.0000	0.0064	0.0146	0.0026	0.0000	0.0000	0.0020	0.0000	0.0000	0.0000	0.0000	0.0171	0.0031	0.0032	0.0000	0.0000	0.0000	0.0008	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0033
U.S.A	0.0000	0.0000	0.5552	0.3327	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1121	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ANGLADE	0.3286	0.0080	0.0000	0.0000	0.3583	0.0076	0.0000	0.1129	0.0594	0.0150	0.0000	0.0000	0.0000	0.0000	0.0426	0.0013	0.0000	0.0032	0.0000	0.0000	0.0042	0.0000	0.0038	0.0000	0.0000	0.0018	0.0043	0.0000	0.0000	0.0019	0.0004	0.0055	0.0000	0.0003	0.0071	0.0000	0.0000	0.0015	0.0062	0.0017	0.0020	0.0000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0004	0.0171	0.0000	0.0033	0.0003	0.0006	0.0000	0.0000
MALAYSIA	0.5403	0.0000	0.1041	0.2535	0.0000	0.0000	0.0000	0.0299	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0205	0.0153	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0045	0.0169	0.0000	0.0000	0.0000	0.0000	0.0000	0.0056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0078	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
U.A.E	0.0952	0.0000	0.0000	0.0000	0.3305	0.0000	0.2912	0.2370	0.0000	0.0129	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0018	0.0000	0.0000	0.0000	0.0000	0.0091	0.0000	0.0029	0.0000	0.0000	0.0005	0.0036	0.0000	0.0000	0.0000	0.0117	0.0001	0.0000	0.0000	0.0026	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000	0.0000	0.0000
THAILAND	0.0000	0.0000	0.1255	0.0000	0.0000	0.1516	0.4500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1060	0.1357	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0102	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0054	0.0035	0.0000	0.0006	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0060	0.0000	0.0001	0.0018	0.0000	0.0000	0.0026	0.0000	0.0000	0.0000	0.0001	0.0000
VIETNAM	0.1547	0.0352	0.0000	0.0192	0.0927	0.2749	0.0077	0.1286	0.0000	0.0510	0.0019	0.0025	0.0920	0.0000	0.0000	0.0000	0.0000	0.0061	0.0038	0.0291	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000	0.0028	0.0370	0.0016	0.0112	0.0000	0.0014	0.0053	0.0000	0.0000	0.0004	0.0002	0.0000	0.0000	0.0239	0.0003	0.0059	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0071
NDONESI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9171	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0120	0.0040	0.0000	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0042	0.0058	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0192	0.0006	0.0000	0.0000	0.0084	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0257
PAKISTAN	0.0000	0.0000	0.0000	0.4106	0.0000	0.0000	0.0000	0.0000	0.3813	0.0000	0.0000	0.0030	0.0000	0.0000	0.1049	0.0000	0.0244	0.0075	0.0172	0.0000	0.0113	0.0139	0.0000	0.0074	0.0113	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0034	0.0000	0.0030	0.0000	0.0000	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
U.K	0.9029	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0971	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
INGAPOR	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
RUSSIA	0.7778	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2222	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CHINA	0.0000	0.0321	0.0977	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0158	0.0000	0.0000	0.7751	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0272	0.0004	0.0000	0.0026	0.0000	0.0000	0.0000	0.0026	0.0000	0.0039	0.0300	0.0000	0.0000	0.0013	0.0000	0.0021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0076	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NEPAL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0764	0.3460	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1064	0.0000	0.0000	0.0695	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1040	0.0000	0.0355	0.0000	0.0000	0.0000	0.0000	0.0745	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0096	0.0314	0.0000	0.0000	0.0101	0.0000	0.0075	0.0000	0.0000	0.0014	0.1267
MEXICO	0.0000	0.0000	0.0000	0.1808	0.0000	0.2386	0.3923	0.0000	0.0000	0.0000	0.0217	0.0212	0.0000	0.0210	0.0000	0.0000	0.0300	0.0122	0.0000	0.0000	0.0000	0.0037	0.0000	0.0080	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0000	0.0170	0.0000	0.0000	0.0000	0.0000	0.0352	0.0085	0.0016	0.0000	0.0000	0.0036	0.0000	0.0014	0.0016	0.0000	0.0000
UDIARAB	0.0000	0.0000	0.2360	0.1219	0.0000	0.4094	0.0000	0.0000	0.0000	0.0000	0.1089	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0145	0.0000	0.0000	0.0000	0.0092	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0916	0.0000	0.0000	0.0000	0.0046	0.0000	0.0000	0.0033	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000
UTHAFRI	0.0000	0.0000	0.0000	0.8322	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1263	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0358	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CANADA	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ITALY	0.0000	0.8374	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0719	0.0000	0.0000	0.0510	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0397	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
OMAN	0.0000	0.0000	0.0000	0.0000	0.8387	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0518	0.0377	0.0000	0.0189	0.0000	0.0000	0.0151	0.0092	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0278	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
THERLAN	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5576	0.0000	0.0276	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1832	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0766	0.0612	0.0000	0.0000	0.0000	0.0000	0.0000	0.0195	0.0000	0.0515	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0229	0.0000	0.0000	0.0000
ISRAEL	0.0000	0.0000	0.0000	0.6907	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0319	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2774	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FRANCE	0.0000	0.7581	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2047	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0372	0.0000	0.0000	0.0000
KUWAIT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EGYPT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
JAPAN	0.9702	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0298	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
USTRALI	0.0000	0.9305	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0695	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MALDIVES	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SPAIN	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5055	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.3864	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0381	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0692	0.0000	0.0000	0.0000	0.0000
QATAR	0.0000	0.0000	0.0000	0.0000	0.9888	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0112	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
MAURITIU	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1629	0.0000	0.0000	0.0000	0.0000	0.0149	0.0000	0.0000	0.0000	0.0000	0.1235	0.0974	0.0000	0.0000	0.0000	0.0118	0.0000	0.0000	0.1353	0.0000	0.0000	0.0000	0.0030	0.0000	0.0000	0.0000	0.0000	0.0204	0.0076	0.0113	0.1614	0.0503	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1350	0.0000	0.0000	0.0000	0.0000	0.0124	0.0000	0.0120	0.0087	0.0000	0.0320
BAHARAIN	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GERMANY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6186	0.2181	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1633	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ONGKON	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HILLIPINE	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TAIWAN	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
IRAN	0.0000	0.0000	0.0000	0.9708	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0086	0.0000	0.0000	0.0000	0.0000	0.0168	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0039	0.0000	0.0000
GREECE	0.0000	0.0000	0.0000	0.2525	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7475	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
BELGIUM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2406	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7594	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
BRAZIL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9713	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0287	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TUNISIA	0.0000	0.8057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0294	0.0000	0.0000	0.1649
BURMA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
WZEALA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LIBYA	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TURKEY	0.0000	0.0000	0.0000	0.8220	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1081	0.0000	0.0000	0.0000	0.0000	0.0699	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
UKRAINE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
POLAND	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ORTUGA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
KOREA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
JORDAN	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3424	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5398	0.0000	0.0983	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0195	0.0000	0.0000
SWEDEN	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4393	0.0000	0.0000	0.0000	0.5607	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
KENYA	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DENMARK	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ITZERLA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
OTHERS	0.1187	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8768	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

China and Pakistan were the other steady markets during the decade from 2010 to 2019 (Table 4.14 and Figure 16), with retention probabilities of 77.5 percent and 38.1 percent respectively. In the preceding decade, China was an unstable market, but in the last decade, it gained market shares in Indian exports from Burma and Vietnam.

Figure 16 Retention probability chart for chilli exports from India (2010-2019)



The summary of stable markets for Indian chilli exports as well as markets gained and lost in terms of quantity of exports are presented in Table 4.15. It could be observed from the table that UAE was the most stable export market for chilli from India during the pre-WTO period, while in the post-WTO period, a greater number of stable markets for Indian chilli exports were identified. China, Thailand, Malaysia, Vietnam, Pakistan, Brazil and Indonesia were the major stable export markets for Indian chilli in the post-WTO period. China was an unstable export market for Indian chilli in pre-WTO period, but became a stable market after WTO due to high demand for chilli in China.

Table 4.15 Dynamics in export markets for Indian chilli

Periods	Stable markets	Markets gained	Markets lost
1990-1999	Sri Lanka		
2000-2009	Malaysia and Thailand		
2010-2019	China and Pakistan		
Pre-WTO period (1986 to 1994)	UAE, Indonesia, Bangladesh, Italy		
Post-WTO period (1995 to 2019)	China, Thailand, Malaysia, Vietnam, Pakistan, Brazil, Indonesia	China, Indonesia, Thailand, Malaysia, Vietnam, Pakistan, Brazil	UAE, Bangladesh, Italy
Overall period (1986 to 2019)	China, Malaysia, Thailand, UAE, Vietnam		

4.1.9 Trade complementarity of India with other countries in chilli exports

The extent of trade complementarity between two countries is a measurement of a country's export performance in proportion to its trading partner's import needs. A trade complementarity index has been used to determine the level of trade complementarity that exists between two countries. In order to determine whether improved trade cooperation between trading partners is possible, trade complementarity indices for India with different nations in chilli trade were calculated. The results of the estimations of complementarity indices for chilli are reported in Table 4.16. If the trade complementarity index is greater than one, it means that the trade in chilli between India and another country, say X, is complementary. The higher the index value, the greater would be the degree of complementarity between countries. If the trade complementarity index is less than one, the complementarity is low, and the lower the index value, the lower will be the degree of complementarity. As a result, higher index values suggest a better chance of a successful trade agreement between countries.

From the trade complementarity indices of Indian chilli with each country presented in Table 4.16, it could be observed that India has complementarity in chilli trade with 15 of the selected Indian export markets. Because of tariff reductions and the removal of non-tariff barriers as a result of liberalisation policies and free trade agreements, the Indian economy has opened up its trade in commodities, particularly agricultural commodities. Since 2001, India's trade complementarity indices with all selected countries were significantly higher when compared to the values of the indices before 2001. Countries such as UAE, Vietnam, China, Pakistan, Singapore and Nepal are having indices of less than one during some of the years, which showed lower trade complementarity with those countries. An index value of zero for some of the countries in few years indicated that no trade has transpired between Indian and that country in the year under consideration. A high degree of trade complementarity with India could be observed for countries *viz*., Sri Lanka, Bangladesh, Malaysia, Nepal, Thailand and Pakistan. Sri Lanka was having the highest trade complementarity index value of 1499.27, whereas Pakistan had the lowest value of 0.06.

Table 4.16 Trade complementarity indices of India with selected partners in export of chilli (1988 to 2019)

Year	USA	SLK	MLS	BAN	UAE	VNM	THA	UK	INS	RUS	PAK	CHI	MEX	SNP	NPL
1988	-	-	-	-	-	-	42.32	-	-	-	-	-	-	-	-
1989	-	-	118.74	3.55	-	-	14.69	-	22.55	-	-	-	-	75.76	-
1990	-	207.49	62.97	23.30	-	-	8.13	-	9.17	-	-	-	8.64	29.76	-
1991	23.06	934.16	109.00	793.47	102.00	-	9.41	-	8.78	-	-	-	25.05	90.11	-
1992	10.12	270.36	42.31	530.82	27.26	-	2.31	-	2.42	-	-	9.24	23.78	37.38	-
1993	13.78	47.00	83.13	113.75	58.58	-	5.75	6.94	12.93	-	-	0.39	14.59	48.35	-
1994	12.11	253.65	51.25	-	-	-	11.84	6.87	20.28	-	-	0.82	20.34	26.67	113.72
1995	28.20	-	104.43	64.28	-	-	7.80	12.73	13.04	-	-	2.72	17.61	97.39	-
1996	27.66	-	116.25	455.88	-	-	9.29	11.79	12.58	9.02	-	3.97	12.87	74.29	-
1997	20.11	-	88.42	1.65	-	-	10.15	12.14	19.35	8.23	-	0.46	15.52	42.14	-
1998	26.72	-	106.94	2.18	-	-	14.88	14.27	19.16	8.73	-	0.51	31.20	25.15	0
1999	33.74	1363.78	215.15	-	0	-	20.01	14.60	40.06	8.76	-	1.19	19.90	35.68	55.04
2000	27.20	1028.18	143.48	2.92	0	0	27.15	11.71	32.06	14.14	-	0.98	30.94	23.31	0
2001	20.12	785.91	101.65	3.51	0	1.68	23.49	9.75	31.49	11.67	-	1.06	35.13	13.73	-
2002	28.05	782.21	109.79	225.70	0	0.14	38.17	10.24	36.08	11.82	-	1.06	36.38	13.26	-
2003	25.35	926.96	84.80	202.45	0	0.82	39.78	8.54	24.85	11.72	0.82	0.48	35.99	0	336.25
2004	27.21	630.11	164.14	397.58	0	0.46	48.68	9.94	19.30	14.27	4.65	0.66	60.53	11.21	-
2005	21.63	476.23	95.32	34.63	12.28	0.44	35.75	8.94	14.90	9.09	0.06	0.82	62.28	0	-
2006	31.13	983.99	198.82	295.11	0	2.04	55.87	11.68	42.43	11.21	0.40	0.37	45.10	0	-
2007	41.62	1499.27	370.84	515.25	24.76	2.87	88.47	15.62	55.81	12.49	20.71	2.06	93.43	0	-
2008	34.51	1051.11	181.28	2.36	19.35	0.92	38.13	12.43	32.15	13.32	159.60	0.59	107.92	0	-
2009	31.16	1118.61	189.26	25.81	0	1.61	48.12	10.31	30.94	16.54	4.65	0.57	66.50	0	156.69
2010	39.61	1251.35	261.90	149.96	0	3.53	53.57	15.70	37.53	22.06	135.00	2.78	63.76	0	194.67
2011	37.90	1289.82	222.66	57.89	0	3.06	34.12	15.52	31.61	15.33	85.47	2.86	48.47	0	199.25
2012	49.09	818.37	198.02	26.01	4.69	6.92	55.90	18.09	38.02	19.60	72.47	6.53	27.74	9.18	296.87
2013	32.13	736.09	110.81	19.77	8.64	3.98	44.29	14.58	34.00	11.72	0.66	0.75	31.54	6.75	120.92
2014	41.05	1092.95	145.44	-	16.33	4.80	82.67	18.81	54.11	17.78	67.48	1.04	46.56	11.33	310.42
2015	38.46	1167.79	136.20	288.00	15.13	2.88	99.79	19.28	66.48	20.54	56.06	1.07	59.14	11.63	224.69
2016	34.14	1191.15	154.00	-	16.61	3.61	191.95	16.61	73.27	22.22	11.73	0.83	51.67	11.11	206.52
2017	36.89	719.33	124.52	-	19.94	7.84	226.36	19.73	99.62	19.63	4.56	1.79	46.70	9.92	242.26
2018	31.26	-	93.83	-	18.79	31.24	171.55	17.04	78.70	19.14	2.91	14.01	55.62	7.68	171.65
2019	29.42	909.62	92.97	-	14.47	15.01	188.05	13.98	89.97	17.87	15.55	31.91	33.41	6.85	171.83

Note: USA – United States of America, SLK – Sri Lanka, MLS- Malaysia, BAN- Bangladesh, UAE – United Arab Emirates, VNM – Vietnam, THA – Thailand, UK – United Kingdom, INS-Indonesia, RUS- Russia, PAK- Pakistan, CHI- China, MEX – Mexico, SNP – Singapore, NPL – Nepal

Source: Estimated using data from WITS

4.2 Export competitiveness and determinants of chilli exports from India

4.2.1. Estimation of determinants of Indian chilli exports using log-log model

The factors determining the export supply of Indian chilli were estimated using a log-log model. The analysis was carried out to assess the influence of domestic production, domestic and international prices and real exchange rate on export supply of chilli using the time series data from 1985-86 to 2019-20. The mean, minimum and maximum values of the variables used in the analysis are presented in Table 4.17. The determinants of exports of Indian chilli were estimated and the results are presented in Table 4.18.

Table 4.17 Mean values of variables used in analysis of determinants on Indian chilli exports

Variable	Mean value	Minimum value	Maximum value
Export quantity (tonnes)	1,52,703	1,241	4,96,000
Domestic production (tonnes)	11,43,603	5,79,800	24,11,150
Domestic price (₹/ kg)	40.31	5.25	116.16
International price (₹/ kg)	96.38	16.91	261.07
Real exchange rate (₹/US$)	72.77	57.86	100

Note: Analysis was conducted for the period from 1985-86 to 2019-20

Table 4.18 Estimates of Log-log model on determinants of Indian chilli exports

Variable	Coefficient	Std. Error	t-ratio	p-value	
Intercept	-10.0879	7.4421	-1.3555	0.1854	
Domestic production	1.5518	0.6370	2.4360	0.0210	**
Domestic price	-0.2509	0.6023	-0.4166	0.6799	
International price	1.4417	0.6971	2.0682	0.0473	**
Real exchange rate	-1.3147	0.6823	-1.9269	0.0635	***
R^2	0.8859		$\bar{R}^2$	0.8706	
Dependent variable - chilli exports from India					

Note: *Significant at one per cent level, **Significant at five per cent level and ***Significant at 10 per cent level

The results of the log-log model on the determinants of Indian chilli exports showed that 88 per cent of the variation in the chilli exports could be explained by all the variables

included in the model. The domestic production in India and the international price were statistically significant and having positive effect on exports of chilli from India. This means that India's chilli exports will increase with the increase in the domestic production and international price *i.e.,* one per cent increase in domestic production and international prices from the mean level will increase the chilli exports from India by 1.6 per cent and 1.4 per cent respectively from the mean level. On the other hand, an increase in the domestic prices and real exchange rate would result in a decrease in the export of Indian chilli. The elasticity estimate for real exchange rate showed that, one percent increase in real exchange rate from the mean level would decrease the chilli exports by 1.3 per cent, because the increase in real exchange rate *ceteris paribus,* will make the country's export expensive in the international market and imports become relatively cheaper.

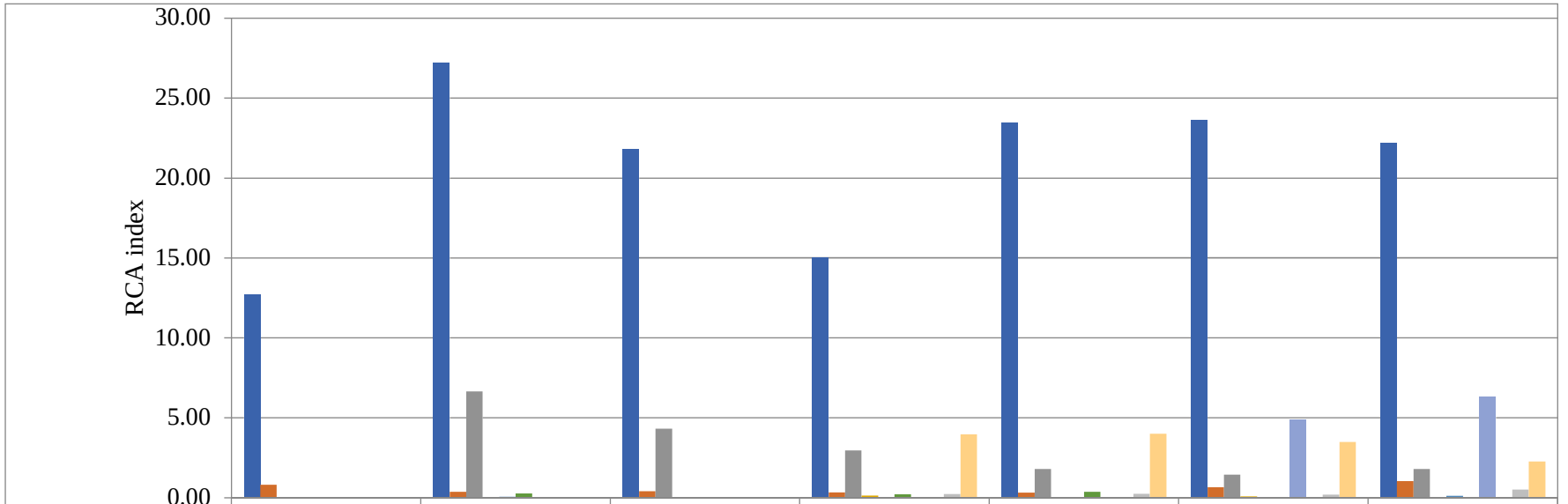
4.2.2 Export competitiveness of chilli exports from India

The export competitiveness refers to a commodity's ability to enter and survive in international markets, implying that if a product has competitiveness, it means that the product is in high demand by a large number of consumers (Tatakomara, 2004). The concept of competitiveness has two aspects: comparative advantage and competitive advantage. The export competitiveness of Indian chilli was assessed in terms of comparative and competitive advantages. The Revealed Comparative Advantage (RCA) Index was used to calculate the comparative advantage of Indian chilli, while Policy Analysis Matrix (PAM) was used to determine the competitive advantage of the same.

4.2.2.1 Revealed Comparative Advantage (RCA)

The findings of the RCA analysis conducted for major chilli producing countries are illustrated in Figure 17. A higher RCA index shows a country's international competitiveness, while a lower number reflects a country's relatively unfavorable position with respect to chilli exports. When a country has a revealed comparative advantage (RCA >1) for a given product, it is assumed that it is a competitive producer and exporter of that commodity when compared to a country producing and exporting that commodity at or below the world average price. The greater the value of a country's RCA for chilli, the stronger the country's strength in chilli exports. The differential rates of changes in accumulation of factors of production and growing trade integration with other nations could affect a country's comparative advantage in international commerce.

Figure17 RCA indices for major chilli producing countries (1990-2019)



	1990	1995	2000	2005	2010	2015	2019
India	12.73	27.20	21.79	15.01	23.44	23.62	22.17
Thailand	0.81	0.37	0.40	0.33	0.32	0.66	1.03
China	0	6.66	4.32	2.97	1.80	1.44	1.79
Ethiopia	0	0	0	0.13	0	0.0922	0.0057
Cote d'ivoire	0	0.0640	0.0164	0.0068	0.0067	0.0019	0.1149
Bangladesh	0	0.2535	0.0085	0.20	0.4	0.0394	0
Myanmar	0		0		0	4.84	6.30
Ghana	0		0	0.0018	0	0.0142	0.0003
Vietnam	0		0	0.23	0.24	0.20	0.51
Pakistan	0		0	3.97	3.99	3.48	2.28

Source: Estimated using data from WITS

The corresponding table for Figure 17 shows the comparative advantage in chilli exports for major chilli-producing countries. Out of the 10 major chilli producing countries, India and China had shown comparative advantage in chilli exports, while Thailand, Ethiopia, Coted'ivoire, even though were competitive in the international markets, because of high domestic demand they were not able to export at the fullest potential. In 1995, India had the highest RCA score of 27.20, however Bangladesh, Myanmar, Ghana, Vietnam, and Pakistan had RCA indices of less than one indicating lower comparative advantages. The RCA index for India has increased with time, increasing from 12.73 in 1990 to 22.17 in 2019. These observations were in line with the findings reported by Kumar and Gummagolmath (2021). China's RCA index dropped from 6.66 in 1995 to 1.79 in 2019. In the last decade, Myanmar became competitive as shown by the RCA indices of 4.84 and 6.30 in 2015 and 2019 respectively. The comparative advantage of Pakistan improved after 2005. The results of the RCA analysis of the 10 competing countries cannot provide a complete picture of a country's ability to compete in the worldwide market and there are still other elements that affect chilli trade competitiveness (Amorita *et al*., 2021). Hence the Policy Analysis Matrix was estimated.

4.2.2.2 Policy Analysis Matrix (PAM)

The Policy Analysis Matrix (PAM), an analytical methodology created by Monke and Pearson (1989), was used to examine the comparative advantage and policy distortions in the worldwide export of Indian chilli. Private and social budgets based on private and social prices were originally devised for the construction of the PAM. Different indicators were developed from the PAM, including the Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), and Domestic Resource Cost Ratio (DRCR), which reflect the extent of protection and trade competitiveness of Indian chilli. Depending on the commodity of trade under discussion, it is classified as an exportable or importable item. These indices are commonly calculated under the exportable hypothesis, on the assumption that the domestic commodity would compete at a foreign port under the exportable hypothesis. The Free on Board (FOB) price is the border price under the exportable hypothesis, net of the transportation costs (both domestic and international), port clearance charges, marketing costs, margin of traders, and processing fees, all of which are required to make the commodity marketable.

The PAM has two accounting identities, one as the difference between revenues and costs which define the profitability of a commodity, and the other measuring the effects of divergences (distorting policies and market failures) as the difference between observed

parameters and those that would exist if the divergences were removed. The PAM is based on budget estimation using both market and societal prices (Monke and Pearson, 1989).

The values in the first row of the PAM give the measure of private profitability, which is difference between observed revenue and costs. By evaluating the values of outputs and inputs using private prices, which are the actual prices for products and services purchased or sold by farmers, merchants, or processors in the agricultural system. The underlying economic costs and values, as well as the consequences of all policies and market failures, are all included in the private or actual market prices. Given the technologies, output and input prices and, policy transfers, the private profitability indicates the competitiveness of agricultural system (Monke and Pearson, 1989; Masters and Nelson 1995;). The social profits, which reflect social opportunity costs, are measured in the second row of the matrix. The social profits measure the resource use efficiency or inefficiency and provide an indicator of comparative advantage. Social prices, which reflect the underlying scarcity and consequently the optimal allocation of resources, are used to value inputs and outputs in the second row of the matrix. The social price provides a comparable policy environment because they are those that would ideally occur in a free market without any government interference (Monke and Pearson, 1989; Masters and Nelson, 1995).

PAM analysis for chilli was conducted under the exportable hypothesis in order to determine the competitive advantage of Indian chilli in an export scenario. The first stage in creating the PAM under the exportable hypothesis is to assess the returns from the commodity as well as the cost of production. The returns from and costs for growing chilli per hectare were obtained through a primary survey carried out in Andhra Pradesh and Telangana in 2021 The private and social budgets per hectare of chilli were calculated using this information. The PAM framework was created using the private and social budgets, and the results are reported in Table 4.19.

4.19 PAM for Indian chilli under exportable hypothesis

Basis	Output(₹/ha)	Input (₹/ha)		Profit (₹/ha)
	Tradable	Tradable	Non-tradable	
Private prices	6,98,659.6	1,08,327	3,05,614.94	2,84,7177
Social prices	9,53,243.2	2,08,139.8	5,87,209.49	1,57,8934
Divergence	-2,54,584	-99,812.8	-2,81,594.5	1,26,8234

Under export parity prices, the social profit from chilli production was ₹1,57,8934 per hectare, which was larger than zero. This value indicated that under free trade, chilli production would benefit the producers. The output transfer (difference between private and social revenue) was -2,54,584, as shown in Table 4.19. The negative value of output transfer suggested the protective policies implemented by the government negatively influenced the producer incentives.

The net policy transfers, on the other hand, were estimated as Rs. 1,26,824 which is the difference between private and social profits or social income minus social cost of tradable and non-tradable inputs. This positive value illustrated that chilli producer could earn more profit with government intervention, which means that under free trade, producers will make less profit in contrast to the existing policy situation. It can be concluded that chilli producers could earn high profit under the current policy orientation of free trade in exports.

The protection coefficients computed using the PAM framework are presented in Table 4.20. With NPC equal to 0.73, the domestic price of Indian chilli is -27% [(NPC-1)100] less than the international price of chilli under the exportable hypothesis. The results showed that the Indian chilli was unprotected and competitive and the export of chilli from India will be profitable. The EPC (0.79) was also less than one and exceeded NPC, which means that producers are not protected through the policy interventions. The NPC and EPC values suggested a lower chilli price in the domestic market compared to the foreign market, indicating the efficiency of Indian chilli as an export competitive crop. The DRCR value of less than one means that the cost of domestic resources to produce a unit quantity of chilli was less than the net foreign exchange received from its export.

Table 4.20 Trade indicators derived from PAM analysis under exportable hypothesis

Trade indicators	Coefficients
Nominal Protection Coefficient (NPC)	0.73
Effective Protection Coefficient (EPC)	0.79
Domestic Resource Cost Ratio (DRCR)	0.78

According to the PAM analysis, Indian chilli was a competitive crop as an export commodity under the exportable hypothesis. The findings revealed that chilli was an efficient exportable item, demonstrating international competitiveness of Indian chilli.

4.3 Value chain analysis of chilli

A value chain is the whole spectrum of operations through which the products flow through each of the processes in a sequence and gaining value at each step. It is described as the series of actions required to bring a product from conception to delivery for final consumption, which includes physical transformation and the input of diverse producer services (Kaplinsky and Morris, 2000). Therefore, as the product goes from one actor in the chain to the next, it would gain a higher value). Farmers, traders, wholesalers, processors, retailers and consumers are the key players in a typical agricultural value chain (Aksoy, 2005). The Value Chain Analysis (VCA) approach for policy analysis by Bellu (2013) was used to undertake the value chain analysis of chilli in India. The analyses were conducted in the following domains of the chilli value chain.

4.3.1 Socio-economic context of the value chain

The socio-economic context in which the chilli value chain has developed in India is analysed in this domain. Chilli is one of the important horticultural commodities with growing demand in domestic and international markets.

Table 4.21 Dynamics in share of chilli exports in total agricultural exports from India (1960-2019)

Year	Agricultural exports		Spices Exports		Chilli Exports	
	value (₹ crores)		Value (₹ crores)		Value (₹ crores)	
1960-61	284	(100)	17	(5.99)	2	(0.70)
1970-71	487	(100)	39	(8.01)	1	(0.21)
1980-81	2057	(100)	11	(0.53)	6	(0.29)
1990-91	6317	(100)	239	(3.78)	28	(0.44)
2000-01	28582	(100)	1619	(5.66)	230	(0.80)
2010-11	111393	(100)	8043	(7.22)	1536	(1.38)
2019-20	271354	(100)	21515	(7.93)	6710	(2.47)

Source: Estimated using data from Spices Board and Economic Survey
Note: Values in parentheses denote share in value of agricultural exports in per cent

The dynamics in the share of chilli exports in the value of total agricultural export from India for the period from 1960 to 2019 is presented in Table 4.21. In 1960-61, the share of chilli exports in total agricultural exports from India was 0.7 per cent and it has increased to 2.4 per cent in 2019-20. It could be observed that spices accounted for around 8 per cent of

total agricultural export earnings during 2019-20, in which the contribution of chilli was 2.47 per cent. The value of output of chilli in India has increased from ₹15,61,812 lakhs in TE2014-15 to ₹20,42,133 lakhs in TE2018-19, at current prices. The share of the Andhra Pradesh and Telangana in value of chilli output in India has also increased from 26.7 per cent to 37 per cent and from 26.7 per cent to 38 per cent respectively during the same period (Table 4.22).

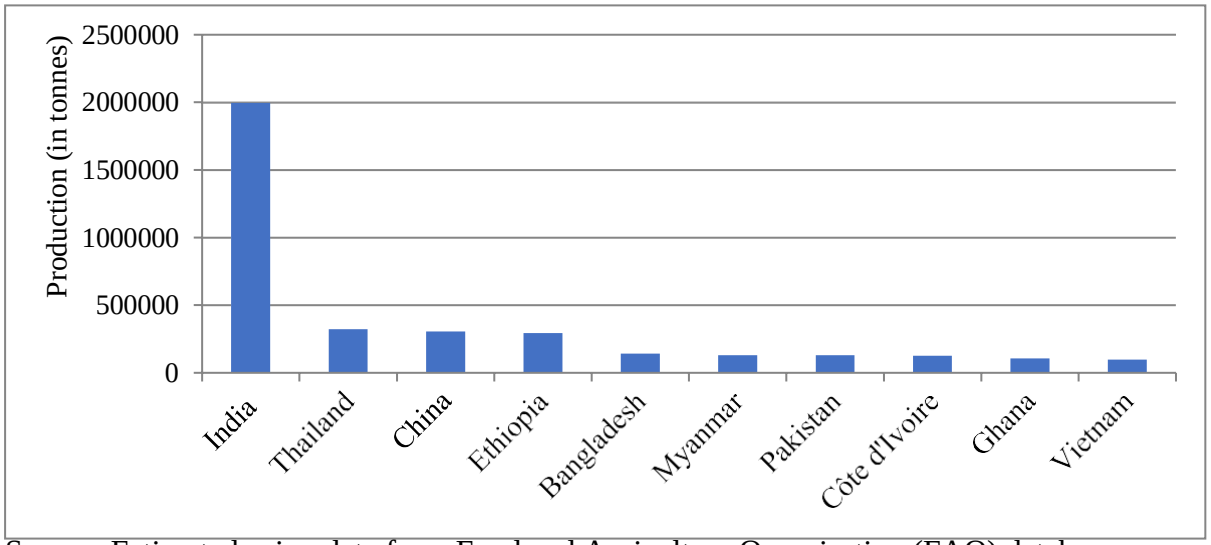
Table 4.22 Dynamics in shares of states in value of output of chilli in India

Trienniums	At current prices			At constant prices (2011-12)		
	India	Andhra Pradesh	Telangana	India	Andhra Pradesh	Telangana
TE2014	15,61,812	4,14,445	1,93,856	13,68,006	3,64,569	2,11,395
	(100)	(26.54)	(12.41)	(100)	(26.65)	(15.45)
TE2017	20,42,133	7,55,250	3,33,066	13,87,544	5,26,643	2,61,258
	(100)	(37.0)	(16.30)	(100)	(37.96)	(18.83)

Source: Estimated using State-wise estimates of value of output from agriculture and allied activities, CSO, Government of India
Note: Values in parentheses denote per cent share in value of output of Indian chilli

India is the world's largest producers of chilli. It accounted for 54.5 per cent of global production during TE2019 (Figure 18); followed by Thailand, China, Ethiopia and Bangladesh accounting for 8.82, 8.40, 8.06 and 3.89 per cent respectively. The area, production and productivity of chilli in India during TE2019 are shown in Figure 19.

Figure 18 Share of major producing countries to global chilli production (TE2019)

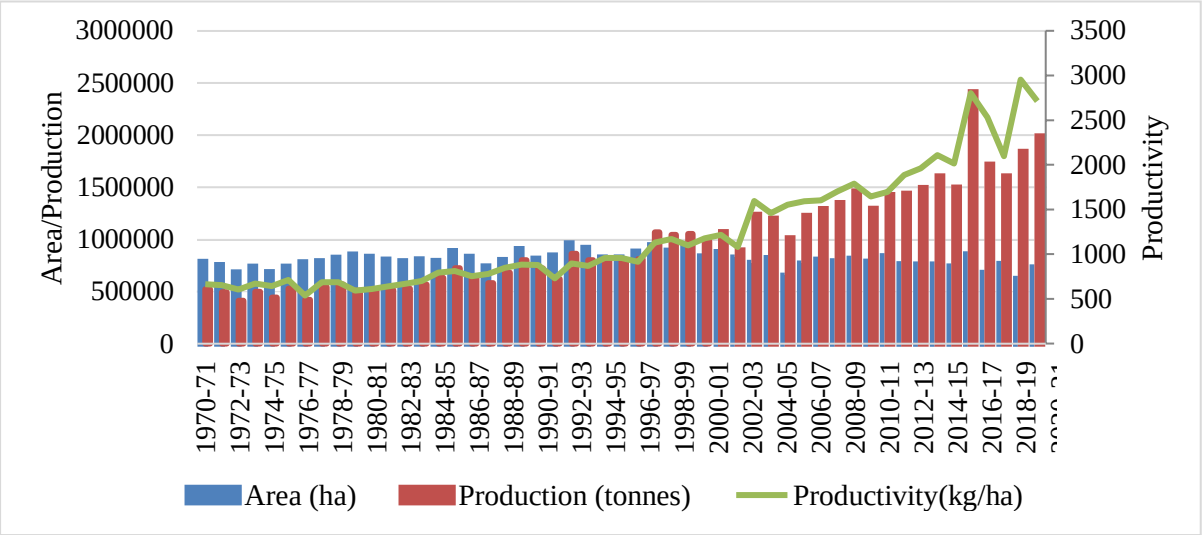


Source: Estimated using data from Food and Agriculture Organisation (FAO) database

It could be observed from Figure18 that even though there was a decrease in the area under chilli in India, the production in the country has increased significantly over the past 50

years. Chilli is mainly cultivated in Andhra Pradesh and Telangana and, these states produced 6,60,000 tonnes and 3,01,000 tonnes respectively during 2019-20 (Spice Board, 2020), which together accounted for more than 50 per cent of the Indian production.

Figure 19 Area, production and productivity of chilli in India (1970-71 to 2020-21)



Source: Estimated using data from Spices Board

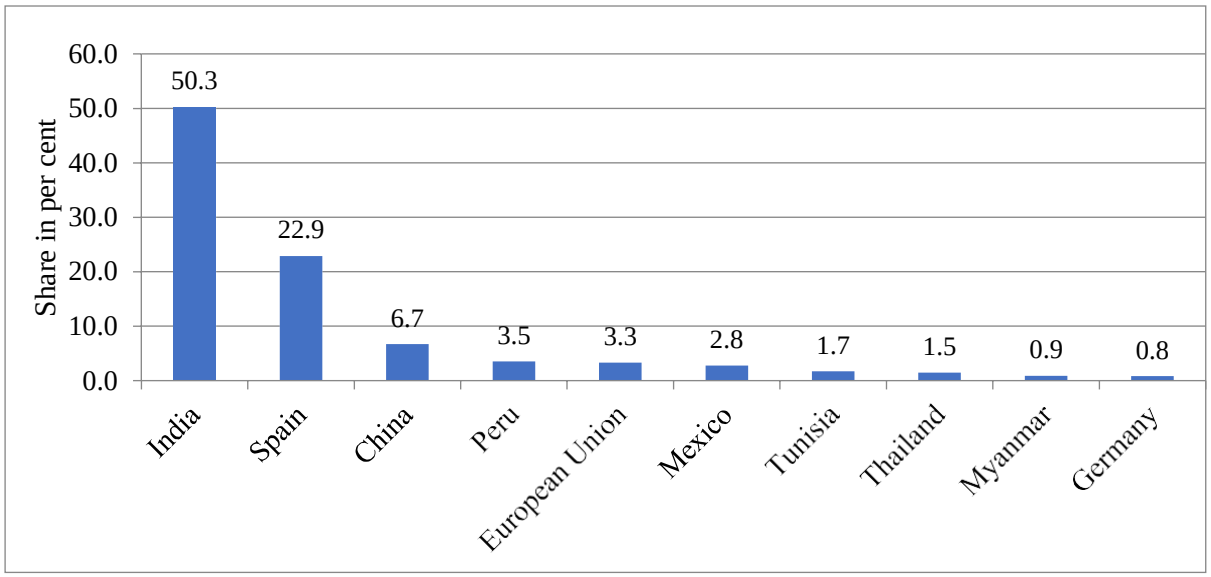
4.3.2 Demand for value chain outputs

The demand analysis for value chain outputs considers several destination markets of the finished product, while focusing at the consumer side of the value chain. The demand for the value chain outputs considers current and potential domestic and foreign demand, domestic and international output price trends, socio-economic features of current and potential customers and other factors affecting demand.

4.3.2.1 Demand analysis of Indian chilli

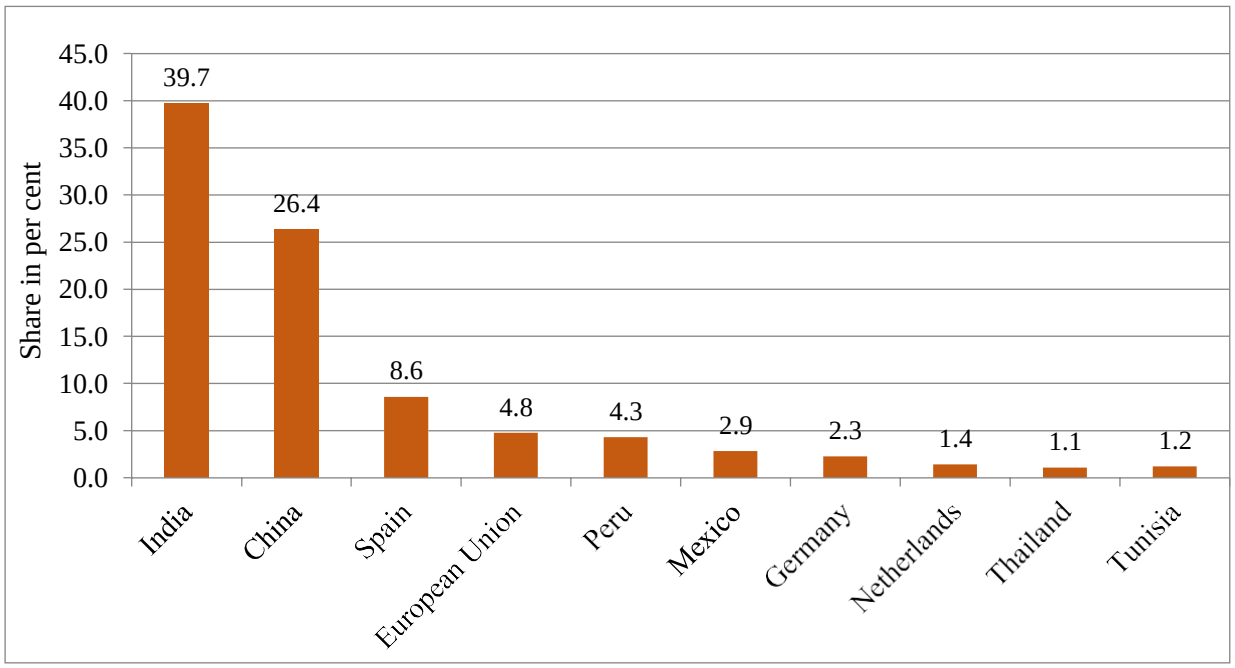
Indian chilli is increasingly demanded globally owing to its unique aroma and pungency, as the rest of the countries deals with low pungent variety, Paprika. India has already established a strong position as a global leader in chilli production and became the largest exporter, meeting 47 per cent of global demand for chilli during TE2019 (WITS, 2019). Indian chilli exports accounted for about 50 per cent and 40 per cent of the global chilli exports in terms of quantity and value respectively during TE2019. Other countries competing in global chilli market are China, Spain Peru, European Union, Mexico, Tunisia, Thailand, Myanmar and Germany, and together they accounted for nearly 44 per cent and 53 per cent global exports in quantity and value terms respectively (Figure 20 and 21).

Figure 20 Share of major producing countries in global chilli demand in quantity terms during TE2019



Source: Estimated using data collected from WITS

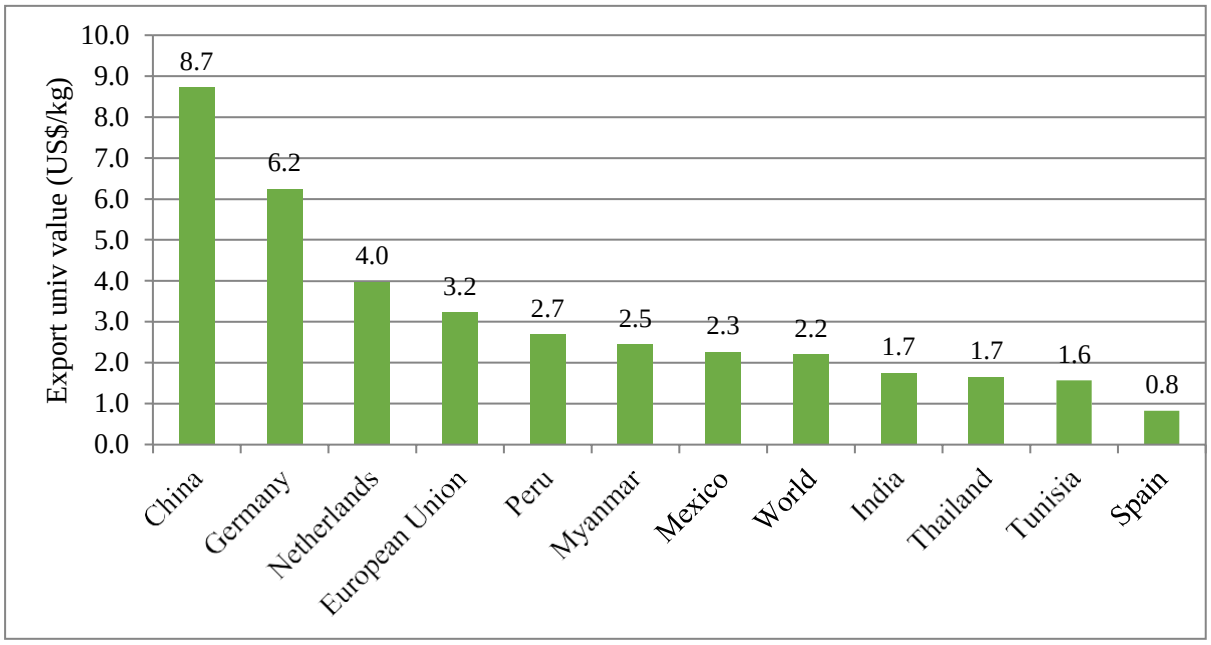
Figure 21 Share of major producing countries in global chilli demand in value terms during TE2019



Source: Estimated using data collected from WITS

Even though India had dominant shares in production and export of chilli in the world, the export unit value was found to be comparatively low as compared to other competing countries (Figure 22).

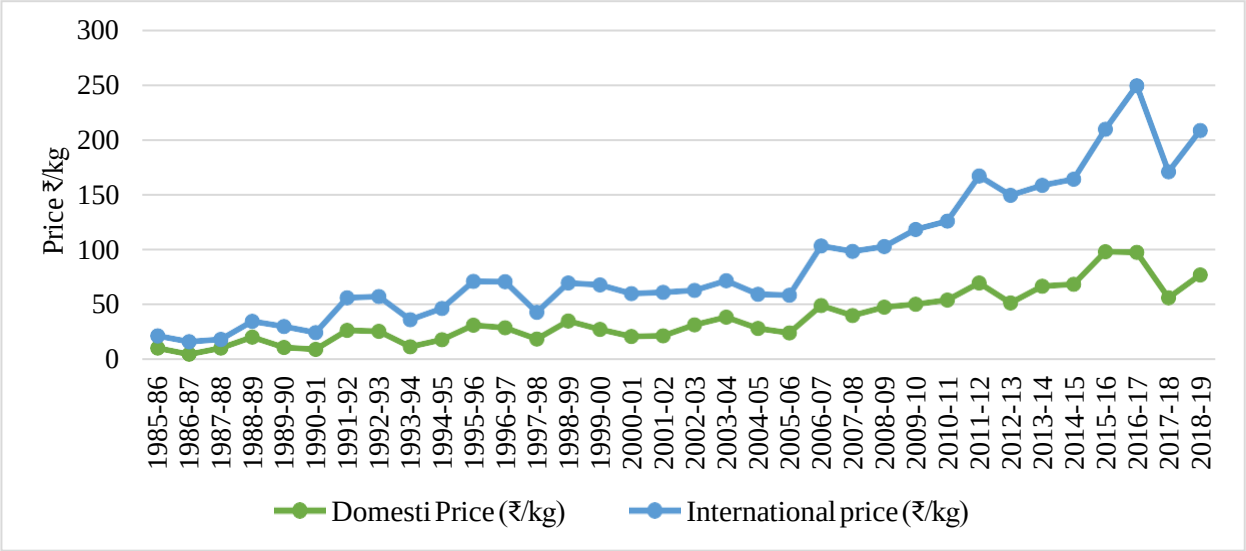
Figure 22 Export unit values of chilli for major exporting countries (TE2019)



Source: Estimated using data collected from WITS

It is evident from the figure that the export unit value of Indian chilli was 1.7 US$/kg and was less than that of other small exporting countries as well as the global chilli export unit value of 2.2 US$/kg. This could be attributed to the export of fewer value-added chilli products from India. In the total chilli exports from India during TE2019, whole dry chilli accounted for 75.7 per cent, whereas the rest only was accounted by value added products (Table 4.6). The dynamics in chilli prices in domestic and international markets from 1985-86 to 2019-20 are presented in Figure 23.

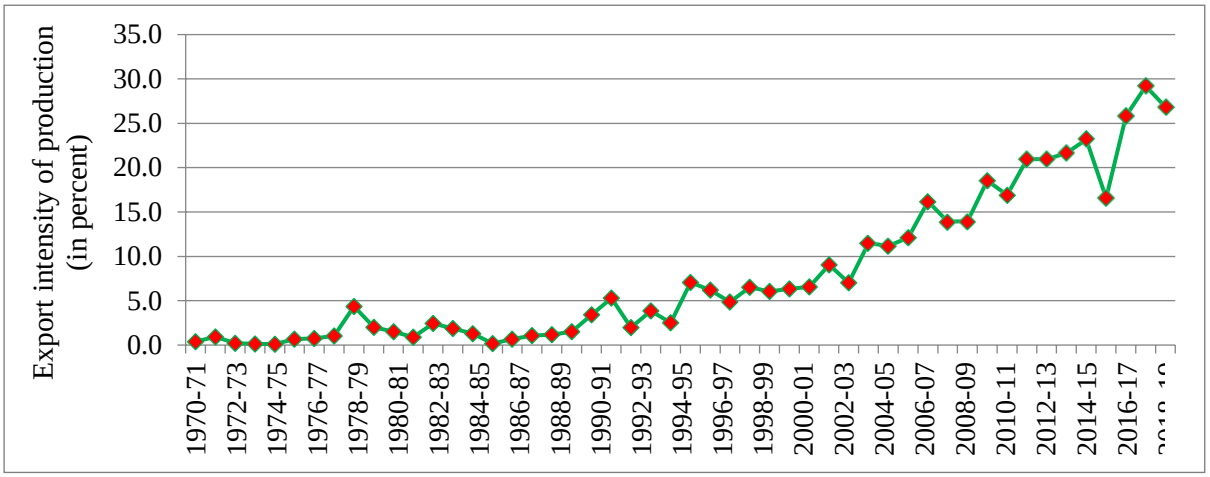
Figure 23 Dynamics in chilli prices in domestic and international markets (1985-86 to 2019-20)



Source: Estimated using data from Spices Board

It could be observed from the figure that international prices were always higher than domestic prices of chilli and the wedge between Indian and international prices has increased over the years. As a result, the volume of chilli exports to the international markets has increased gradually as indicated by the increase in export intensity of production for chilli in India from 0.4 per cent in 1970-71 to 26.8 in 2019-20 (Figure 24).

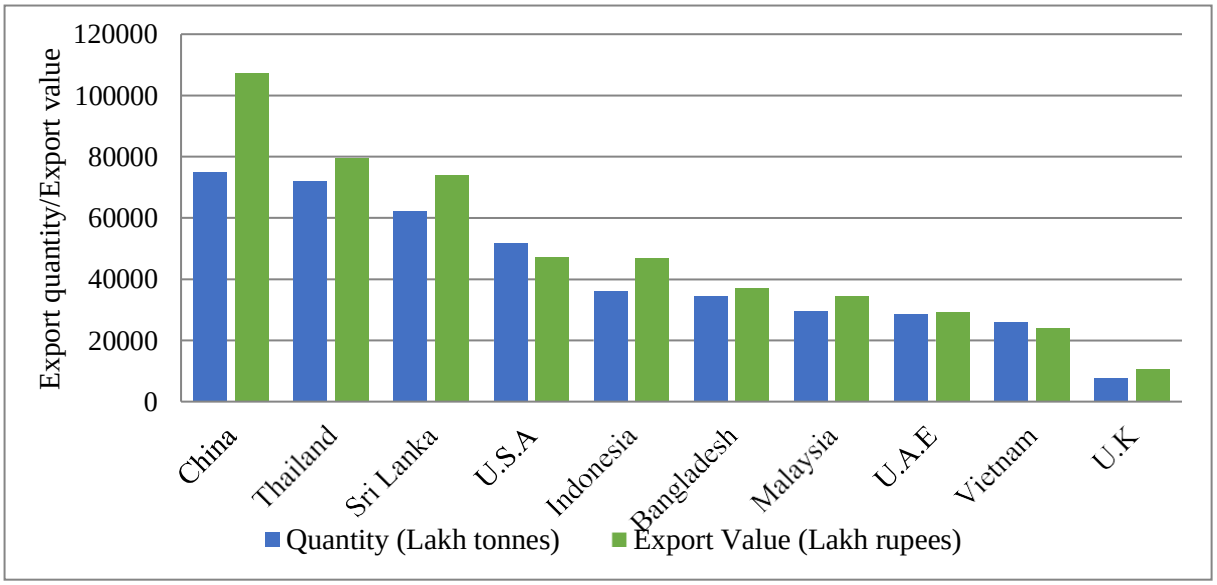
Figure 24 Dynamics in export intensity of production of chilli in India (1970-71 to 2019-20)



Source: Estimated using data from Spices Board

The major destinations for chilli exports from India in TE2019 are presented in Figure 25. It could be observed from the figure that China is the largest importer of Indian chilli, followed by Thailand, Sri Lanka, USA, Indonesia, Malaysia and Vietnam. Nearly 88 per cent of India's chilli exports were concentrated in 10 countries.

Figure 25 Major trade partners for chilli exports from India (TE2019-20)

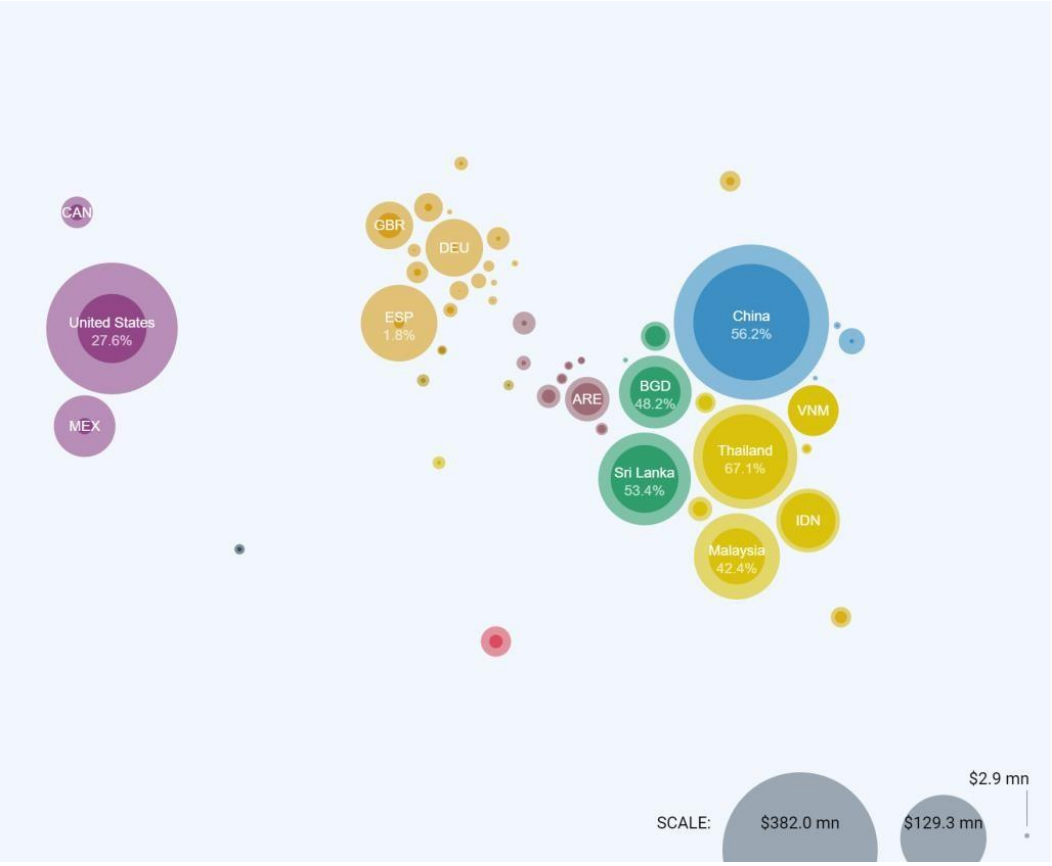


Source: Estimated using data collected from WITS

4.3.2.2 Export potential of Indian chilli

The export potential of Indian chilli was visualized using the Market Analysis Tool developed by the International Trade Centre (ITC), Geneva. This methodology identifies the potential export value for an individual exporting country in a given product and target markets based on an economic model that combines the supply capacity of exporter with the target market's demand, market access conditions and the bilateral links between the two countries (ITC, 2020). It is based on decomposition of a country's potential exports of a product to a given target market into three factors: supply, demand and ease of trade (Decreux and Spies, 2016). The potential export value means the potential value at which a country can export chilli to a certain target market given its current supply capacities, and the target market's demand and market access conditions. The untapped potential is the gap between actual and potential exports, if any. The reasons for unrealized potentials include lack of information about or difficulties in meeting consumer preferences in the target market, lack of information about or difficulties in meeting market regulations, lack of business contacts or of knowledge about distribution channels, and mismatch of supplied and demanded varieties (ITC, 2020)

Figure 26 Export potential of chilli from India



Source: Estimated using ITC Market Analysis Tool

The export potential for Indian chilli was estimated and the results are presented in Table 4.23 and Figure 26. It could be observed that the countries with greatest potential for export of Chilli from India are China, USA, Thailand and Sri Lanka. China has realised an export potential of 382 million US$, leaving an untapped potential of 134.6 million US$.

Table 4.23 Export potential for Indian chilli in major export markets (in US$ million)

Countries	Export potential	Actual exports	Untapped potential
China	382	214.7	167.3
US	279.6	77.2	202.5
Thailand	181.6	121.9	59.7
Sri Lanka	146.9	78.4	68.5
Malaysia	128.7.0	54.6	74.1
Spain	104.4	1.9	102.5
Germany	63.3	1.1	62.2
Bangladesh	95.2	45.8	49.3

Source: Estimated using ITC Market Analysis Tool

Figure 27 Export potential and ease of trade for Indian chilli

Source: Estimated using ITC Market Analysis Tool

USA showed the largest absolute difference between the potential and actual exports of chilli from India in value terms, leaving scope for realising an additional export worth 202.5 million US$. Along with the potential for chilli exports from India, which could be observed from the diameter of the circles in the export potential map (Figure 27), India has closest export links and ease of trade with Nepal, Sri Lanka, Bangladesh and United Arab Emirates, as indicated by the width of the lines in the figure.

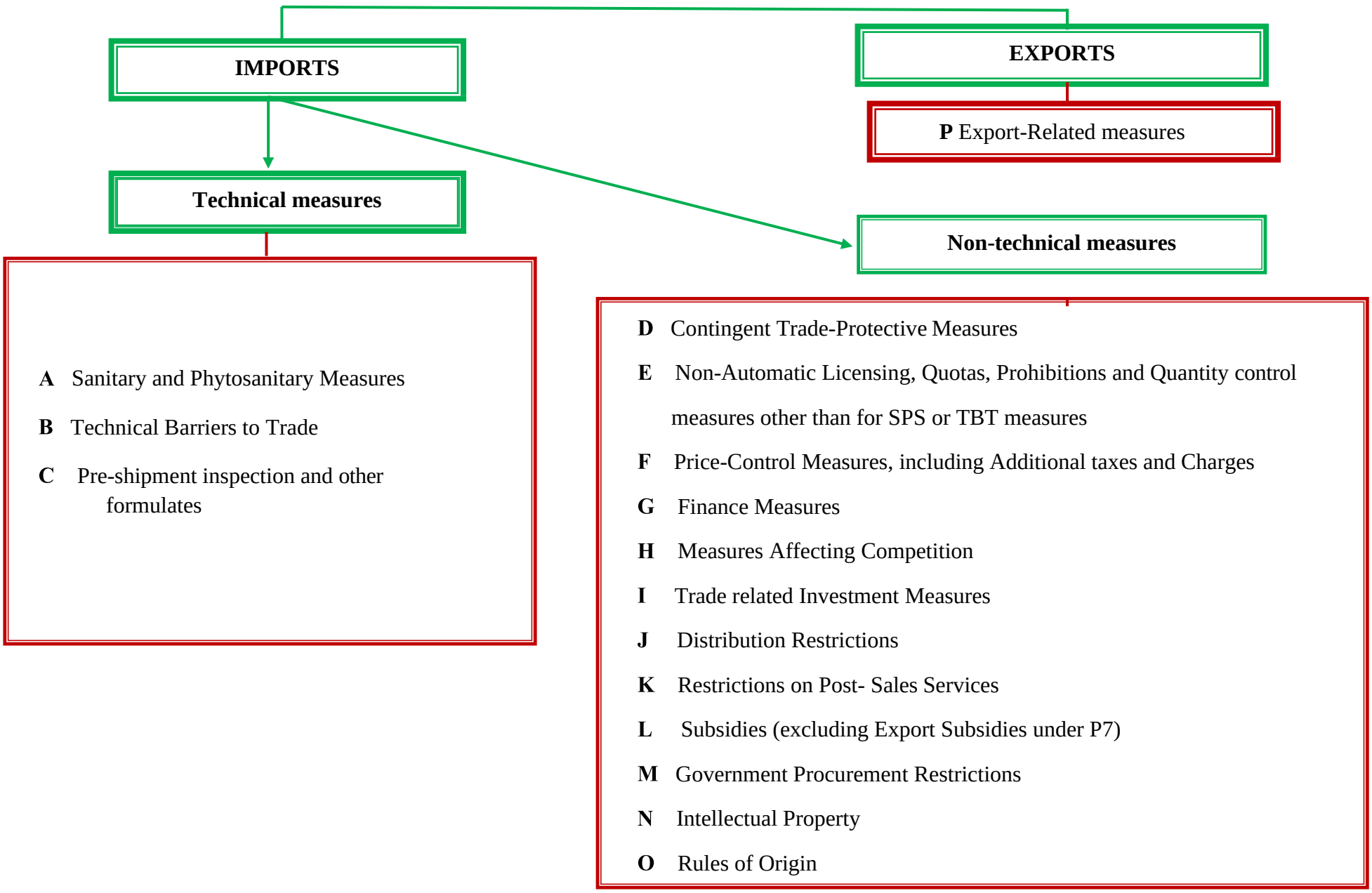
4.3.2.3 Non-Tariff Measures (NTMs) affecting chilli exports from India

The Non-Tariff Measures (NTMs) are policy measures, other than ordinary customs tariffs, that can potentially have an economic effect on the international trade in goods, causing either change in price or quantity or both (UNCTAD, 2010). The NTMs in goods range from technical regulations, aiming to protect food and beverage supply, consumers, workers, and the environment to more trade-related measures traditionally used as instruments of commercial policy, such as quotas, trade remedies, or rules of origin. The concept of NTM is thus broad and these measures are highly prevalent in the day-to-day conduct of international trade businesses. However, NTMs raise costs of trading and hence the exporters are facing problems in meeting the regulations and remaining competitive. Therefore, it is very important to understand the NTMs applied to chilli and how it affects the trade.

4.3.2.3.1 Classification of NTMs

The UNCTAD classifies NTMs into chapters, depending on their scope. Then each chapter is further differentiated into several subgroups to allow a finer classification of the regulations affecting trade. The classification of NTMs as 16 chapters from A to P and the sub-groupings are presented in Figure28. Among the different types of NTMs, Sanitary and Phyto Sanitary (SPS) measures and Technical Barriers to Trade (TBTs) cover more products and trade value than price and quantity-control measures. Moreover, SPS measures are much prevalent than TBT in the trade of agriculture and food products (WTO, 2012)

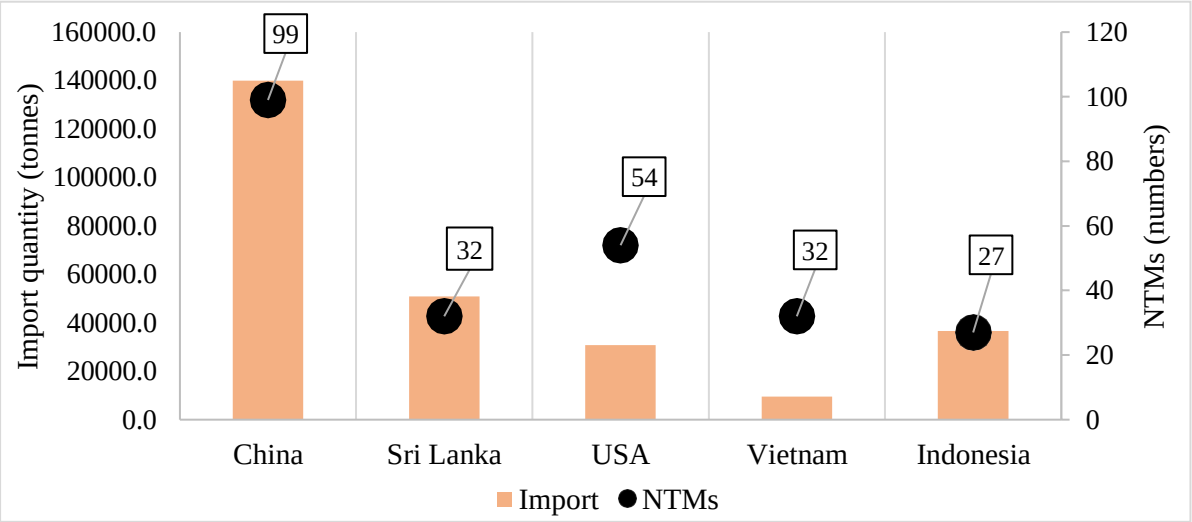
Figure 28 Classification of Non-Tariff Measures



4.3.2.3.2 NTMs affecting Indian chilli

The countries *viz.*, China, Sri Lanka, Indonesia, USA and Vietnam were the major importers of Indian chilli and they also imposed the highest number on NTMs on chilli exported from India (Figure 29).

Figure 29 Imports and import requirements for Indian chilli in major importing countries (2020)



Source: Estimated using data from ITC Market Access Map

Table 4.24 NTMs affecting Indian chilli exports by types and countries (2020)

Countries	SPS	TBT	Others	Total
USA	37 (68.5)	15 (27.8)	2 (3.7)	54 (100.0)
China	43 (43.4)	53 (53.5)	3 (3.0)	99 (100.0)
Vietnam	34 (73.9)	11 (23.9)	1 (2.2)	46 (100.0)
Sri Lanka	19 (59.4)	12 (37.5)	1 (3.1)	32 (100.0)
Indonesia	24 (88.9)	2 (7.4)	1 (3.7)	27 (100.0)

Note: Figures in the parentheses denote per cent to row total

Even though the import requirements for Indian chilli in the form of NTMs were the highest in number for China, India exported the highest quantity of chilli to China in 2020, which showed that the Indian exports were able to meet the import requirements of that country. The exports to Vietnam were the least and this could be attributed to the higher number of NTMs imposed by Vietnam on imports from India. In all the importing countries with the exception of China, the major category of the NTMS imposed on Indian chilli were under the

SPS measures. In the case of China, about 54 per cent of the NTMS were under the category of TBT (Table 4.24).

4.3.3 Analysis of the institutional set up

Identifying and evaluating the institutional set-up, i.e., the interactions that take place among agents and, the formal as well as the informal rules that govern them are critical while formulating policies for value chains. This necessitates investigating the organisations and interactions among the various agents, focusing on the forward and backward linkages including synergies and conflicts. The set of rules that allows the value chain actors to operate also needs to be explored. In this regard, the Value Chain Analysis (VCA) looks into the role of the government as well as other institutions, in regulating the value chain and establishing the legal framework for its operation.

4.3.3.1 Governance and Control

The governance has a crucial role in improving the performance of the value chain and maintaining its competitive edge. It is a dynamic component of the value chain that defines the links or linkages between the stakeholders or role players and indicates the ability of role players to determine, control as well as coordinate the activities of other actors in the value chain. To promote consumer safety and create transparent market places, government agencies regulate product design, processing and packaging. The government also define product standards that are mandatory and have legal implications. The Indian government has enacted laws to guarantee the quality of seeds and planting supplies *viz*., Essential Commodities Act, 1955; Seed Act, 1966; Seed Rules, 1968; Seed Control Order, 1983; Seed Development Policy, 1988; PPV & FR Act, 2001; National Seed Policy, 2002 and Seed Bill, 2004. All of these regulations range from manufacturing through marketing, labelling, grading, and marketing of seeds, for ensuring that the quality criteria are satisfied. The Fertilizer Control Order (1985) ensures that farmers across the country have access to quality fertilisers.

4.3.3.2 Institutions in chilli value chain

The major institutions involved in the value chain of chilli are presented in Table 4.25

Table 4.25 institutional framework in chilli value chain

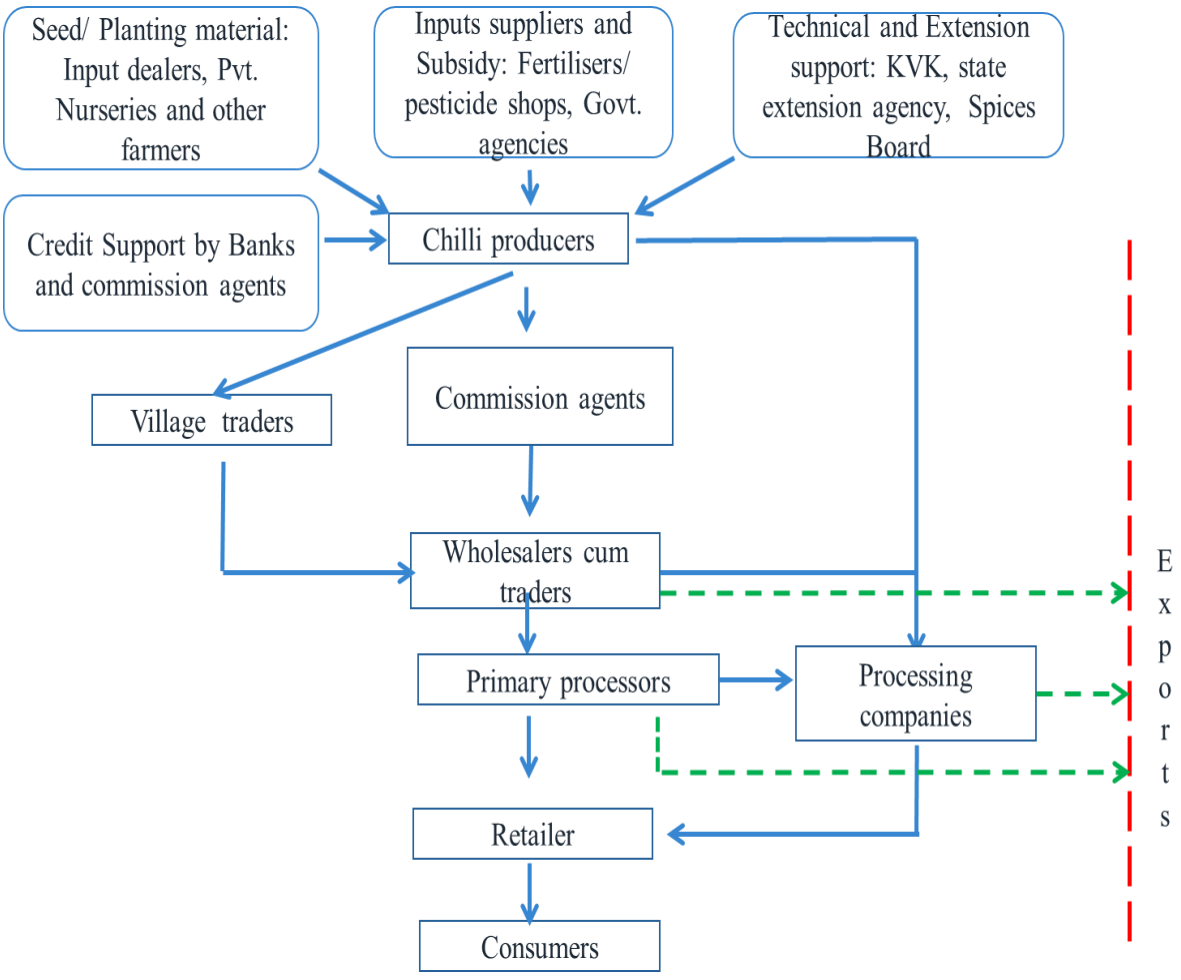
Sl. No	Name of the institution	Sectors Governed	Salient features
01	Spices Board	Production, marketing, research and development	• Promotion of spices and related exports • Maintenance of the export quality and timely monitoring • Improvements in production process by conducting research through scientific and technological methods • Advice to producers on getting high quality produce utilizing scientific agricultural practices • Encouragement of organic spice production and export • Enabling infrastructure facilities for processing and value addition • Registration and licensing of exporters of spices
03	Directorate of Marketing and Inspection (DMI)	Market information	• Development of a nationwide information network for timely collection and dissemination of market data in order to make it more efficient and reliable • Ensure a steady flow of accurate data to producers, traders, and consumers for making informed decisions in marketing process
04	National Horticulture Board	Infrastructure and marketing	• Development of infrastructure for post-harvest management • Strengthening the producer-consumer linkages through coordinated marketing • Establishment of an integrated horticultural marketing network
05	Agricultural and Processed Food Products Export Development Authority (APEDA)	Export promotion	• Design and development of packaging standards • Creation of common infrastructure facilities • Providing assistance to producers/growers/Cooperative organisations for promoting mechanisation in harvesting and for facilitating pre-shipment treatment in exporting.

06	State Agricultural Marketing Board (SAMBs)	Marketing and infrastructure	• Regulating the market for agricultural and allied commodities • Providing infrastructure for the marketing of notified products
07	Department of Agriculture/ Department of Horticulture	Extension	• Undertaking measures for crop insurance, subsidies and assistance to farmers for receiving fair prices for their produce • Conducting training programmes for farmers to achieve better yields through minimal use of pesticides with the adoption of Integrated Pest Management
08	Commercial banks and cooperatives	Institutional credit	• Providing credit (short, medium and long term) to meet cultivation expenses
09	Agricultural Produce Market Committees (APMC)	Marketing, infrastructure and credit	• Providing market information on current prices, arrivals and sales • Providing financial assistance to farmers through APMC Pledge loans • Establishment of storage facilities

4.3.4 Analysis of input and output markets

Analysing the markets for inputs and output provide important insights on the working of the value chain and possible policies to improve its performance. The degree of competition and imperfections in the markets determine the quantity of output and prices of the commodity as well as the remuneration for the factors of production. The structural analysis of chilli value chain in India is presented in Figure 30.

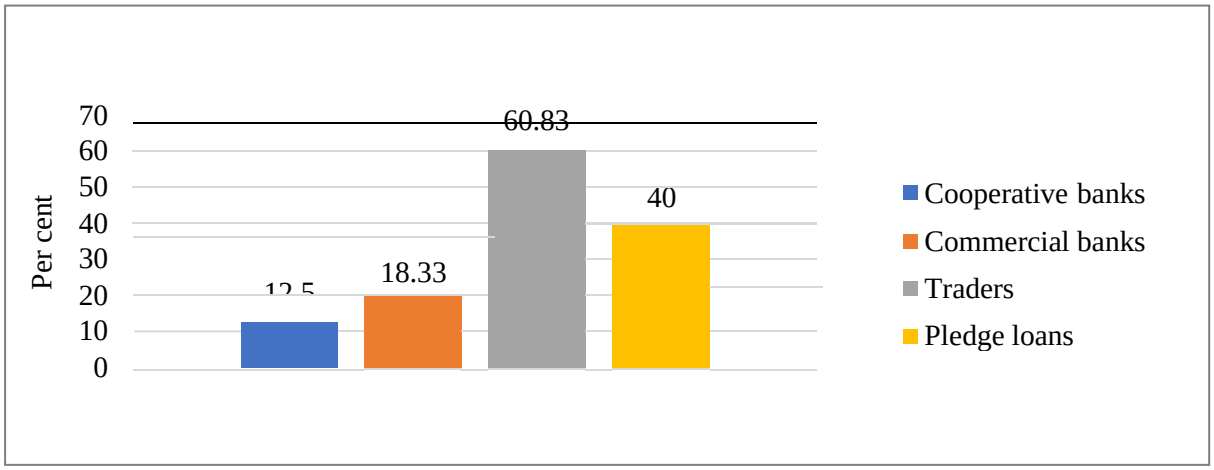
Figure 30 Structural analysis of chilli value chain in India



While analysing the input markets, the focus should also be on the financing institutions. The interactions between the institutional set-up and the structure of the financial sector will determine the extent to which agents are able to obtain financial resources both for investment as well as working capital. The primary survey of chilli farmers revealed that sample farmers have borrowed from different agencies for chilli cultivation as presented in Figure 31. Some of the farmers have also borrowed from multiple credit sources. Out of the

120 sample farmers, 60.83 per cent of the farmers were indebted to traders (non-institutional credit agency), and the farmers who have borrowed from commercial banks, Cooperatives and APMCs (pledge loans) were 18.33, 12.5 and 40 per cent respectively.

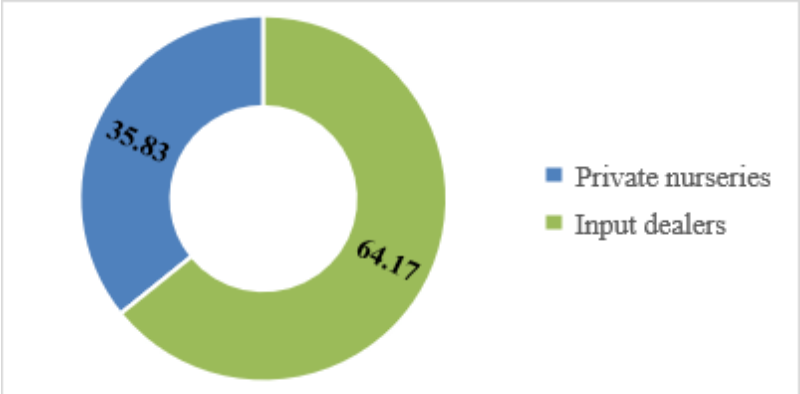
Figure 31 Distribution of sample farmers based on sources of credit



Note: Some farmers have borrowed from more than one source of credit

The major input suppliers for chilli farmers were fertilizer and pesticide shops owned by input dealers. The farmers get access to seed and planting materials through input dealers and private nurseries. Based on source of procurement of seed, the distribution of the sample farmers showed that around 64 per cent of sample farmers procured their seed through the input dealers (Figure 32).

Figure 32 Distribution of sample farmers based on sources of inputs



Majority of the farmers were growing the chilli variety “Teja”, while the rest of the farmers were growing others varieties like Byadagi, Wonder heart, Armur, DD44 and US341, mostly grown along with Teja. The technical and extension support were being provided by

Spices Board, Regional Agricultural Research Station (RARS), Department of Agriculture and Krishi Vigyan Kendra (KVK).

The chilli value chain in India is characterized by a large number of producers and few buyers, who benefit from better information regarding market prices and opportunities as compared to producers. The chilli markets in the study area were found to be oligopsony markets with few buyers. The farmers dry, grade and pack the harvested chilli and bring it to the markets for selling. The large farmers transport chilli to markets using own transportation facilities, while the small and marginal farmers join together and transport using hired vehicles. After arrivals in the market, the bags are stacked into lots at the authorised commission agent's shops. The commission agents arrange labourers or hamali, who in turn assist the farmers in stacking their produce into separate lots based on different grade standards and weighment of the produce. The commission agents also assist the farmers in finding prospective buyers.

The open auction method is the most common method of sales followed in chilli markets. When a group of merchants gather at the commission agent's shop, the auction will be initiated by the commission agent. The base price for the auction is determined by the commission agents on the basis of the market arrivals and previous day's closing price. The individual traders or buyers quote the highest price they are willing to pay after considering the demand, supply and quality of chilli. If any quantity of chilli is left unsold after the auction, the farmers who have the capacity will store in cold storages until the prices become remunerative. The traders who purchase chilli from auctions will either export or sell to processing companies after grading and packing the product, which is processed as well as retailed according to the domestic and export demands from different consumer segments. In the case of farmers practicing contract farming, the contracting companies which are mostly processing companies were the sole buyers and hence a monopsony market structure was found to be prevalent in such cases.

4.3.5 Functional analysis of value chain

The functional analysis provides a detailed profile of value chain structure through the identification, description and quantification of the sequence of operations concerning production, processing, marketing and final consumption of the commodity.

4.3.5.1 Identifying the activities

Each of the actor in the value chain plays an important role and the actors are also interlinked with one another. Before the final product reaches to the ultimate consumers, the members of the value chain perform various functions related to production, processing, marketing and distribution of the product. The functional analysis map of the chilli value chain in Andhra Pradesh and Telangana is depicted in Figure 33.

4.3.5.2 Identifying the value chain actors

The roles played by various actors of value chain are as follows:

4.3.5.2.1 Input suppliers

During chilli production, various actors are involved in the supply of inputs and services. The provision of high-quality seeds and planting materials is critical for higher as well as better quality output. Majority of the farmers were using both varietal and hybrid seeds that were available with the local input suppliers. The farmers also procured seedlings from private nursery growers. The input shops and the fertliser depots also played crucial roles in supplying necessary fertilisers and pesticides to chilli farmers.

4.3.5.2.2 Service providers

The Spices Board, Regional Agricultural Research Stations (RARS), Krishi Vigyan Kendras (KVK), State Agricultural Universities (SAU), Departments of Agriculture and other government organisations in the respective states offered technical and extension supports to chilli growers. Farmers were given credit by commission agents, private money lenders and institutional agencies including commercial banks and cooperatives. The exclusive regulated markets for chilli are the major institutional entities established under the state APMC Act, which facilitate efficient marketing by providing necessary market infrastructure and preventing malpractices during the marketing process.

4.3.5.2.3 Producers

Farmers carry out the important tasks such as production, harvesting, drying, cleaning and packing of chilli. Majority of the farmers in the study area were found to be small and marginal.

Figure 33 Functional analysis map of chilli value chain

Chilli value chain map	Input supplies	Supporting services	Production process	Aggregation and logistics	Processing	Exporting / Domestic sales
Activities	Supply and distribution of inputs	Credit support, extension and advisories	Production of chilli	Grading, packaging, transport, storage and sale of chilli	Processing of chilli into different value- added products	Domestic sales and exports
Output	Planting material, fertilizers, pesticides	Credit and training	Dry chilli	Sorted and graded Chilli	Chilli powder, flakes, pickles, pastes, oils and oleoresins	Export of packaged, processed and unprocessed chilli
Key players	Bayer, Syngenta, IFFCO, UPL, Kaveri	Commercial banks, Cooperatives, Money lenders, Spices Board, Regional Agricultural Research Station, Krishi Vigyan Kendra	Small and marginal farmers	Village traders, Commission Agents, Traders, Processors, Retailers and Exporters	ITC, AVT natural, Priya foods and MTR	Olam spices, CCGB, Synthite and JABS international

4.3.5.2.4 Commission agents

The commission agents are licensed agents in the regulated markets, who facilitate selling process by bringing the producers and traders in contact with each other by creating a competitive environment. Although commission agents are not directly involved in the trade process, they assist it by organising weighing, hamali, transportation, and credit to farmers. The commission agents collect two per cent of the value of commodity traded as commission from farmers.

4.3.5.2.5 Traders cum wholesalers

The traders act as buyers as well as sellers in the marketing process. They procure chilli from the producers and sell it to exporters, processors and retailers. They are inevitable in chilli trade as trading takes place throughout the year. Traders also store chilli in cold storages and sell it to processors and exporters based on demand.

4.3.5.2.6 Processors

The processors play an essential role in the chilli value chain since they perform various value-addition activities such as production of chilli powder, extraction of oleoresin and pigments, pickling etc. The majority of processors in the study area were small, and the principal value-addition activity was the production of chilli powder. Renowned companies such as Priya Foods Ltd, ITC, Olam international, MTR etc., were also present, which maintained direct business relationships with farmers. These companies also procured from the regulated markets. Some of the processors in remote locations also relied on village traders, who procured chilli of required quality on their behalf, arranged for cleaning, grading, and transportation to the location of the processors. Some of the local processors, ground chilli into powder and packed it as per the specifications provided by the exporters.

4.3.5.2.7 Retailers

Retailers purchase chilli and chilli powder from wholesalers and processors and sell to consumers in small quantities. Some of the processing companies also act as retailers.

4.3.5.2.8 Exporters

Exporters, including processing companies, procured chilli and chilli powder from traders and processors and exported to various countries.

4.3.5.3 Quantifying physical flows

In the chilli value chain, the commodity undergoes several stages of transfer of ownership as well as change in form by processing, before eventually reaching the consumers through different distribution channels. In this process, chilli physically flows down the value chain passing from one agent to the next. The Supply Utilization Account (SUA) published by the Food and Agriculture Organisation (FAO) was used to analyse the quantity flows along the value chain. In the SUA, the total quantity used corresponds to total quantity supplied as indicated in Table 4.26. In 2018-19, the production of chilli in India was 18,08,011 tonnes out of which, 12,52,823 tonnes were used for food consumption. The opening stock was 8,87,466 tonnes and the import and export quantities were 1,361 tonnes and 3,86,276 tonnes respectively. The closing stock in the country was 10,13,683 tonnes.

Table 4.26 Supply utilization account of chilli in India (2018-19)

Sl. No.	Supply items (tonnes)		Utilization items (tonnes)	
1	Production	18,08,011	Food consumption quantity	12,52,823
2	Import quantity	1,361	Export quantity	3,86,276
3	Opening stocks	8,87,466	Closing stocks	10,13,683
4			Loss	44,056
5	Total	26,96,838	Total	26,96,838

Source: Adopted from Supply Utilisation Account published by Food and Agriculture Organisation (FAO)

4.3.6. Economic analysis of the value chain

The purpose of the economic analysis of the chilli value chain is to appraise the costs, revenues and margins for each activity, agent and segment of the value chain as well as the whole value chain, on the basis of prices actually paid and received by the economic agents.

4.3.6.1 Socio-economic profile of the farmers

The socioeconomic profile of the sample chilli farmers from Andhra Pradesh and Telangana states are presented in Table 4.27 and 4.28. The age-wise classification of the sample farmers indicated that more than 50 per cent of the farmers were in the age group of 45-60 years, while about one third of the farmers belonged to the age group of 30-45 years.

The gender-wise classification of the sample respondents showed that majority of the farmers were males and only 10 per cent were female farmers. The details of the educational status of the sample respondents showed that more than 50 per cent of them had only primary level education and one-fourth of the respondents possessed SSLC level education.

The sample farmers were divided into three categories depending on their farming experience as less than ten years, ten to thirty years, and more than thirty years. From Table 4.28, it could be observed that about two-third of the respondents had 10-30 years of experience in farming, whereas the remaining one-third of the sample farmers were having more than 30 years of experience.

It was observed that majority of the sample farmers i.e., 37.5 per cent had land holdings with size ranging from one to two hectares and one-third occupied land holding sized 2-5 hectares. In the study area, majority of the farmers from Prakasam and Mahabubabad districts were found to be having land holdings of 1-2 hectares, while majority of the farmers in Guntur and Khammam districts were medium and large, with land holdings sized 2-5 hectares and more than 5 hectares. The comparatively larger size of holdings in Guntur and Khammam districts of Andhra Pradesh could be attributed to the availability of better irrigation facilities in these districts. Chilli is one of the major crops grown in Guntur district, which is known as the 'Chilli capital of the country' and the crop is also identified under the One-District-One-Focus-Product (ODOFP) for the district.

In terms of family size, it could be observed that more than half of the sample farmers had family sized 4-6 members, while 27.5 per cent had families with 1-3 members. The details of the occupational status of the farmers clearly depicted that for more than 80 per cent of the farmers, agriculture was the major occupation. Majority of the farmers (42.5 per cent) had an average annual income in the range of ₹1-2 lakh, while 26.66 per cent had annual income ranging from ₹2-5 lakhs.

Table 4.27 District-wise socio-economic profile of sample chilli farmers

Particulars	Guntur (44)	Prakasam (16)	Khammam (32)	Mahabubab (28)
	No. of respondents	No. of respondents	No. of respondents	No. of respondents
Age (years)				
Less than 30	0	0	0	1
30-45	15	9	7	9
45-60	26	6	21	13
Greater than 60	3	1	4	5
Gender				
Male	43	12	31	22
Female	1	4	1	6
Educational status				
Primary	23	9	15	16
Up to SSLC	11	4	10	6
Higher Secondary	8	2	4	4
Graduation	2	1	3	2
Experience in farming (years)				
Less than 10	0	1	0	1
10-30	29	8	23	20
More than 30	15	7	9	7
Area owned (ha)				
Less than 1	2	3	1	4
1-2	13	8	8	16
2-5	20	4	10	6
More than 5	9	1	13	2
Family size				
1-3	13	2	12	6
4-6	27	11	15	13
More than 6	4	3	5	9
Occupational status				
Agriculture	38	13	24	22
Public sector	0	1	0	1
Private sector	5	2	6	4
Self employed	1	0	2	1
Annual income (₹)				
Less than 1 lakh	4	5	2	6
1-2 lakh	13	7	14	17
2 -5 lakh	19	3	7	3
More than 5 lakhs	8	1	9	2

Table 4.28 State-wise socio-economic profile of sample farmers

Particulars	Andhra Pradesh (60)	Telangana (60)	Total (120)	
	No. of respondents	No. of respondents	No. of respondents	Per cent to total sample
Age (years)				
Less than 30	0	1	1	0.83
30-45	24	16	40	33.34
45-60	32	34	66	55.00
Greater than 60	4	9	13	10.83
Gender				
Male	55	53	108	90
Female	5	7	12	10
Educational status				
Primary	32	31	63	52.50
Up to SSLC	15	16	31	25.84
Pre-Degree/Higher	10	8	18	15.00
Graduation	3	5	8	6.66
Experience in farming (years)				
Less than 10	1	1	2	0.00
10-30	37	43	80	43.33
More than 30	22	16	38	56.67
Area owned (ha)				
Less than 1	5	5	10	8.34
1-2	21	24	45	37.50
2-5	24	16	40	33.33
More than 5	10	15	25	20.83
Family size				
1-3	15	18	33	27.50
4-6	38	28	66	55.00
More than 6	7	14	21	17.50
Occupational status				
Agriculture	51	46	97	80.85
Public sector	1	1	2	1.66
Private sector	7	10	17	14.16
Self employed	1	3	4	3.33
Annual income (₹)				
Less than 1 lakh	9	8	17	14.16
1-2 lakh	20	31	51	42.52
2 -5 lakh	22	10	32	26.66
More than 5 lakhs	9	11	20	16.66

4.3.6.1 Economics of cultivation of chilli

The cost of cultivation for chilli was worked out using ABC cost concepts proposed by the Commission for the Agricultural Costs and Prices (CACP) for Mahabubabad, Khammam, Guntur and Prakasam districts and the weighted average of the cost of cultivation was also worked out as presented in Table 4.29. The cost A includes the cost incurred for hired labour, land preparation, seeds and nursery management, inter cultivation, manures, fertilizer, plant protection, interest on working capital, land revenue and depreciation. The rental value of owned land and interest rate on working capital were added to cost A to obtain cost B. The cost incurred on family labour was added to cost B to compute cost C. The estimated cost A for chilli in Mahabubabad, Khammam, Guntur and Prakasam districts were ₹2,73,196, ₹3,50,679, ₹3,61,389 and ₹3,27,669 respectively and the weighted average of cost A for all the districts was computed as ₹3,33,459. Similarly, cost B for chilli in the above districts were estimated as ₹3,12,720, ₹4,28,946, ₹4,36,507 and ₹3,79,558 respectively. The cost C for chilli cultivation in Mahabubabad, Khammam, Guntur and Prakasam districts were estimated as ₹3,84,626, ₹4,96,004, ₹5,07,375, ₹4,46,693 respectively. The weighted average value of cost B and C for chilli cultivation in these districts were ₹3,98,014 and ₹4,67,610 respectively. The highest values for all the three costs were found in Guntur, whereas it was the least in Mahabubabad district.

4.3.6.2 Input-wise cost of cultivation of chilli

The input-wise cost of cultivation of chilli was worked out separately for each of the two districts in Andhra Pradesh and Telangana, and the weighted average input-wise cost was also estimated (Table 4.30). It could be observed from the table that the major share of input-wise cost incurred for chilli in all the districts under study was accounted by hired human labour and was followed by family labour. The cost incurred for hired human labour accounted for 27 per cent of the total weighted average input cost, whereas that spent on family labour accounted for 14.8 per cent. The costs incurred on human labour, family labour and plant protection chemicals together contributed 53.57 per cent of the total cost.

Table 4.29 Cost of cultivation of chilli in Andhra Pradesh and Telangana (₹/ha)

Sl. No.	Particulars	Mahabubabad	Khammam	Guntur	Prakasam	Weighted mean
1	Hired human labour					
	a) Male labour	38,301	61,231	63,258	52,459	55,454
	b) Female labour	68,200	74,483	69,979	69,163	70,656
2	Land preparation (Machinery)	13,591	13,296	14,208	14,364	13,842
3	a) Seed cost	16,852	15,884	17,692	17,178	16,945
	b) Nursery Management cost	6,202	8,130	18,335	18,597	12,817
4	Inter-cultivation (Bullock labour)	17,643	25,950	22,857	18,755	21,918
5	Manures	17,050	23,788	23,257	18,038	21,255
6	Fertilizers	18,458	21,653	22,014	20,262	20,855
7	Plant protection chemicals	41,313	58,706	60,774	54,258	54,813
8	Irrigation	8,031	11,762	12,896	11,967	11,335
9	Others	9,810	13,591	12,652	11,334	12,063
10	Total operational cost	2,55,450	3,28,473	3,37,922	3,06,377	3,11,952
11	Interest on working capital	15,328	19,709	20,275	18,382	18,717
12	Land revenue	1,013	949	1,544	1,446	1,248
13	Depreciation	1,406	1,549	1,648	1463	1,541
14	**Cost 'A'**	**2,73,196**	**3,50,679**	**3,61,389**	**3,27,669**	**3,33,459**
15	Rental value of owned land	35,007	71,481	67,854	46,208	5,8271
16	Interest on fixed capital	4,519	6,785	7,262	5,681	6,284
17	**Cost 'B'**	**3,12,720**	**4,28,946**	**4,36,507**	**3,79,558**	**3,98,014**
18	Family human labour					
19	a) Male labour	34,100	28,169	29,800	29,528	30,332
20	b) Female labour	37,806	38,889	41,068	37,606	39,264
21	**Cost 'C'**	**3,84,626**	**4,96,004**	**5,07,375**	**4,46,693**	**4,67,610**

Table 4.30 Input-wise cost of cultivation of chilli cultivation in Andhra Pradesh and Telangana (₹/ha)

Sl. No.	Particulars	Mahabubabad	Share in per cent	Khammam	Share in per cent	Guntur	Share in per cent	Prakasam	Share in per cent	Weighted mean	Share in per cent
1	Hired human labour	1,06,500	27.69	135715	27.36	133236	26.26	121623	27.23	126111	26.97
2	Family labour	71,906	18.70	67058	13.52	70869	13.97	67134	15.03	69597	14.88
3	Machinery cost	13,591	3.53	13296	2.68	14208	2.80	14363	3.22	13841	2.96
4	Seedling’s cost	23,054	5.99	24013	4.84	36027	7.10	35775	8.01	29763	6.36
5	Bullock labour	17,643	4.59	25950	5.23	22857	4.50	18755	4.20	21918	4.69
6	Manures	17,050	4.43	23789	4.80	23257	4.58	18038	4.04	21255	4.55
7	Fertilizers	18,458	4.80	21653	4.37	22014	4.34	20262	4.54	20854	4.46
8	Plant protection chemicals	41,313	10.74	58707	11.84	60774	11.98	54259	12.15	54813	11.72
9	Irrigation	8,031	2.09	11761	2.37	12897	2.54	11968	2.68	11335	2.42
10	Rental value of owned land	35,006	9.10	71481	14.41	67854	13.37	46208	10.34	58270	12.46
11	Others	32,073	8.34	42580	8.58	43381	8.55	38308	8.58	39853	8.52
12	Total cost of cultivation	3,84,626	100.00	496003	100.00	507375	100.00	446693	100.00	467610	100.00

4.3.6.3 Yield and returns from chilli cultivation

The gross returns and net returns from chilli cultivation were worked out separately for four districts (Table 4.31). The gross returns from chilli cultivation was found to be the highest in Guntur (₹9,61,509 per ha), followed by Khammam (₹8,35,184 per ha), Prakasam (₹7,07,286 per ha) and Mahabubabad (₹5,70,845 per ha). The net returns estimated at cost A, B and Cwere highest in Guntur and were ₹6,00,120 per ha, ₹5,25,002 per ha and ₹4,54,133 per harespectively. The net returns estimated at cost A, B and C were found to be the least in Mahabubabad and were ₹2,97,650 per ha, ₹2,58,126 per ha and ₹1,86,220 per ha respectively. The weighted average of net returns estimated at cost A, B and C were ₹4,69,312 per ha, ₹4,13,339 per ha and ₹3,44,097 per ha respectively.

Table 4.31 Yield and returns from chilli cultivation (₹/ha)

Sl. No	Particulars	Mahabubabad	Khammam	Guntur	Prakasam	Weighted mean
1	Total yield (Qtl/ha)	55.60	71.14	74.75	64.99	68.02
2	Price/Qtl	10,267	11,740	12,863	10,883	11,694
3	Gross returns (₹/ha)	5,70,845	8,35,184	9,61,509	7,07,286	8,02,771
4	Net returns at Cost 'A' (₹/ha)	2,97,650	4,84,505	6,00,120	3,79,617	4,69,312
5	Net returns at Cost 'B' (₹/ha)	2,58,126	4,06,239	5,25,002	3,27,727	4,13,339
6	Net returns at Cost 'C' (₹/ha)	1,86,220	3,39,181	4,54,133	2,60,593	3,44,097

4.3.6.4 Benefit-Cost Ratio (BCR) for chilli cultivation

The B-C ratio was worked out at cost A, B and C for chilli cultivated in four districts and the results are presented in Table 4.32. The B-C ratio at cost A varied between the highest value of 2.66 for Guntur and the lowest value of 2.09 for Mahabubabad. The B-C ratio at cost B was found to be highest (2.2) in Guntur, while it was lowest (1.83) in Mahabubabad. Similarly, B-C ratio at cost C varied between 1.90 in Guntur and 1.48 in Mahabubabad.

Table 4.32 Benefit-Cost Ratio for chilli cultivation

Sl. No	Costs	Benefit-Cost Ratio				
		Mahabubabad	Khammam	Guntur	Prakasam	Weighted mean
1	Cost 'A'	2.09	2.38	2.66	2.16	2.45
2	Cost 'B'	1.83	1.95	2.20	1.86	2.06
3	Cost 'C'	1.48	1.68	1.90	1.58	1.75

4.3.6.5 Economics of marketing of chilli

4.3.6.5.1 Marketing channels of chilli

The chilli is majorly marketed as dry chilli and chilli powder through the following marketing channels. The marketing channels followed for dry chilli in Andhra Pradesh and Telangana are as follows:

1. Farmers - Commission Agents - Wholesaler cum traders - Retailers - Consumers
2. Farmers - Commission Agents - Wholesalers cum traders - Exporter
3. Farmers- Commission Agents - Wholesalers cum traders - Processors- Retailers-Consumer
4. Farmers - Commission Agents -Wholesalers cum traders -Processors- Exporters
5. Farmers - Processors cum retailers-Consumers
6. Farmers - Processors cum retailers- Exporters

The Marketing channels identified for chilli powder are:

1. Farmers - Village traders - Processors - Retailers
2. Farmers - Commission Agents - Wholesaler cum trader - Retailers - Consumers
3. Farmers- Commission Agents -Wholesalers cum traders -Processors- Exporters
4. Farmers - Processors cum retailers-Consumers
5. Farmers - Processors cum retailers- Exporters

4.3.6.6 Analysis of value chain performance

4.3.6.6.1 Marketing costs

The costs incurred for marketing activities such as assembling, transporting, storing, grading, processing, wholesaling, and retailing are called as marketing costs. The item-wise marketing cost incurred per kg of dry chilli and chilli powder are presented in Table 4.33 and Table 4.34 respectively. It could be observed from the table that the costs incurred on transportation and processing were the major costs for marketing of dry as well as powdered chilli.

Table 4.33 Marketing costs in different marketing channels of dry chilli (₹/ kg)

Market intermediary	Marketing Functions	Channel I	Channel II	Channel III	Channel IV	Channel V	Channel VI
Farmer	Cost of gunny bags	0.75	0.75	0.75	0.75	0.75	0.75
	Weighing, loading and unloading	0.46	0.46	0.46	0.46	-	-
	Transportation	0.98	0.98	0.98	0.98	0.25	0.25
	Labour charges	0.26	0.26	0.26	0.26	-	-
	Commission for commission agents	2.30	2.30	2.30	2.30	-	-
	Miscellaneous charges	0.13	0.13	0.13	0.13	-	-
Wholesaler cum trader	Market fee	1.15	1.15	1.15	1.15	-	-
	Weighing, loading and unloading	1.00	1.00	1.00	1.00	-	-
	Transportation	0.60	0.60	0.60	0.60	-	-
	Storage cost	1.62	1.62	1.62	1.62	-	-
	Others (Rent, labour charges and packing materials etc.)	1.03	1.03	1.03	1.03	-	-
Processor	Loading and unloading	-	-	3.60	3.60	7.80	7.80
	Transportation	-	-	2.10	2.10	10.89	10.89
	Processing loss (20 per cent conversion loss due to processing)	-	-	25.73	28.39	24.28	26.94
	Processing costs	-	-	22.00	22.00	40.00	40.00
Retailer	Storage	2.10	-	3.10	-	-	-
	Transport	1.45	-	8.80	-	-	-
	Others include package materials	1.21	-	11.70	-	-	-
Exporter	Loading and unloading	-	4.25	-	6.10	-	-
	Transportation	-	26.21	-	28.70	-	-
	Taxes	-	1.39	-	1.80	-	-
	Others	-	0.76	-	2.90	-	-

Table 4.34 Marketing costs in different channels of chilli powder (₹/ kg)

Market intermediary	Marketing Functions	Channel I	Channel II	Channel III	Channel IV	Channel V
Farmer	Cost of gunny bags	-	0.75	0.75	0.75	0.75
	Weighing, loading and unloading	-	0.46	0.46	-	-
	Transportation	-	0.98	0.98	0.25	0.25
	Labour charges	-	0.26	0.26	-	-
	Commission to commission agent	-	2.30	2.30	-	-
	Miscellaneous charges	-	0.13	0.13	-	-
Village trader	Cost of gunny bags, labour and others	1.42	-	-	-	-
	Weighing, loading and unloading	0.92	-	-	-	-
	Transportation	2.78	-	-	-	-
Wholesaler cum trader	Market fee	-	1.15	1.15	-	-
	Weighing, loading and unloading	-	1.00	1.00	-	-
	Transportation	-	0.60	0.60	-	-
	Storage cost	-	1.62	1.62	-	-
	Others (Rent, labour charges and packing materials etc.)	-	1.03	1.03	-	-
Processor	Loading and unloading	7.80	3.60	3.60	7.80	7.80
	Transportation	10.89	2.10	2.10	10.89	10.89
	Processing loss (5 per cent conversion loss due to processing)	6.73	8.23	8.89	6.07	6.73
	Processing costs	30.00	12.00	12.00	30.00	30.00
Retailer	Storage	3.10	3.10	-	-	-
	Transport	8.80	8.80	-	-	-
	Others include package materials	13.90	13.90	-	-	-
Exporter	Loading and unloading	-	-	8.60	-	-
	Transport	-	-	29.20	-	-
	Taxes	-	-	1.80	-	-
	Others	-	-	3.00	-	-

4.3.6.6.2 Price spread analysis of chilli

The price spread is defined as the difference between the price paid by the final consumer and price received by producer for an equivalent quantity of a commodity.

Table 4.35 Marketing costs, marketing margins and price spreads in different channels of dry chilli (₹/ Kg)

Sl. No	Details of prices, marketing costs and margins	Channel I	Channel II	Channel III	Channel IV	Channel V	Channel VI
1	Farmer's selling price	115.21	128.52	115.21	128.52	121.44	134.69
	Marketing cost	4.88	4.88	4.88	4.88	1	1
	Net price received by farmer	110.33	123.64	110.33	123.64	120.44	133.69
3	Wholesaler's selling price	128.67	143.95	128.67	143.95	-	-
	Marketing cost	5.4	5.4	5.4	5.4	-	-
	Marketing margin	8.06	10.03	8.06	10.03	-	-
4	Processor's selling price	-	-	192.05	211.29	231.59	250.32
	Processing and marketing cost	-	-	53.43	56.09	82.97	85.63
	Marketing margin	-	-	9.95	11.25	27.18	30
5	Exporter's selling price	-	186.05	-	265.19	-	-
	Marketing cost	-	32.6	-	39.5	-	-
	Marketing margin	-	9.5	-	14.4	-	-
6	Retailer's selling price	142.5	-	234.55	-	-	-
	Marketing cost	4.76	-	23.6	-	-	-
	Marketing margin	9.06	-	18.9	-	-	-
7	**Consumer's purchase price**	**142.5**	**186.05**	**234.55**	**265.19**	**231.59**	**250.32**
8	**Total marketing cost**	**10.17**	**38**	**82.43**	**100.99**	**82.97**	**85.63**
9	**Total marketing margin**	**17.12**	**19.53**	**36.91**	**35.68**	**27.18**	**30**
10	**Price spread**	**27.29**	**57.53**	**119.34**	**136.67**	**110.15**	**115.63**
11	**Producer's share in consumer's rupee (in per cent)**	**80.85**	**69.08**	**49.12**	**48.46**	**52.44**	**53.81**
12	**Marketing efficiency**	**14.01**	**4.90**	**2.85**	**2.63**	**2.79**	**2.92**

Table 4.36 Marketing costs, marketing margins and price spreads in different channels of chilli powder (₹/ Kg)

Sl. No.	Details of prices, marketing costs and margins	Channel I	Channel II	Channel III	Channel IV	Channel V
1	Farmer's selling price	113.72	115.21	128.52	121.44	134.69
	Marketing cost	-	4.88	4.88	1	1
	Net price received by farmer	113.72	110.33	123.64	120.44	133.69
2	Village trader's selling price	128.66	-	-	-	-
	Marketing cost	5.12	-	-	-	-
	Marketing margin	9.82	-	-	-	-
3	Wholesaler's selling price	-	128.66	141.97	-	-
	Marketing cost	-	4.24	4.24	-	-
	Marketing margin	-	9.21	9.21	-	-
4	Processor's selling price	166.44	166.44	180.41	206.38	224.14
	Processing and marketing cost	25.93	25.93	26.59	54.76	55.42
	Marketing margin	11.85	11.85	11.85	30.18	34.03
5	Exporter's selling price	-	-	239.02	-	-
	Marketing cost	-	-	42.6	-	-
	Marketing margin	-	-	16.01	-	-
6	Retailer's selling price	209.03	209.03	-	-	-
	Marketing cost	25.8	25.8	-	-	-
	Marketing margin	16.79	16.79	-	-	-
7	**Consumer's purchase price**	**209.03**	**209.03**	**239.02**	**206.38**	**224.14**
8	**Total marketing cost**	**56.85**	**55.97**	**73.43**	**54.76**	**55.42**
9	**Total marketing margin**	**38.46**	**37.85**	**37.07**	**30.18**	**34.03**
10	**Price spread**	**95.31**	**93.82**	**110.5**	**84.94**	**89.45**
11	**Producer's share in consumer's rupee (in per cent)**	**54.40**	**55.12**	**53.77**	**58.84**	**60.09**
12	**Marketing efficiency**	**3.68**	**3.73**	**3.26**	**3.77**	**4.04**

From the results of the price spread analysis given in Table 4.35 and Table 4.36, it could be observed that the price spread was highest in channel IV for dry chilli, while in the case of chilli powder, channel III had the highest price spread. The producer's share in consumer's rupee was highest (80.89 per cent) and the price spread was found to be the least (₹27.29/kg) in channel II for dry chilli, while for chilli powder the producer's share in consumer's rupee was highest (60.89 per cent) and the price spread was found to be the least (₹89.45/kg) in channel V. The marketing efficiency for dry chilli was found to be highest in channel I due to low marketing cost, and it was highest for chilli powder in channel V as the price paid by the consumer in this channel was the highest.

4.3.7 Constraint analysis of value chain actors

The Garrett ranking technique was used to analyse the major constraints faced for the different actors involved in the chilli value chain.

4.3.7.1 Constraints faced by the chilli producers

The sample farmers faced many constraints in the production and marketing of chilli. The major constraints faced by sample farmers were listed and then prioritised based on the responses during the sample survey. The ranks were then converted into mean scores for better understanding of the constraints. The constraints in chilli production and marketing faced by farmers are presented in Table 4.37. The scarcity of labour, with a Garrett score of 75.9, was identified as the most important constraint in the production and marketing of chilli, which is a highly labour-intensive crop. Increased opportunities in the non-farm rural sector such as services and manufacturing, with higher earnings and consistent incomes have caused the labourers to shift from agriculture to non-farm sectors. As a result, there is scarcity of labourers and hence farmers are sourcing labourers from distant places. High labour charges were identified as the second major constraint. The labour charges have increased over time due to scarcity of labour in the agricultural sector. Price volatility was identified as the next important constraint in production and marketing of chilli. There is no Minimum Support Price (MSP) for chilli, and hence there is no guarantee that the governments will intervene if the prices fall due to market glut. The market price of chilli is highly dependent on the international market price, futures prices and extreme weather events. The other constraints identified were severe pest and disease attacks, high post-harvest losses, increased prices of inputs, changes in climate, lower yield, higher transportation costs, decreased demand, low value addition and unavailability of inputs.

Table 4.37 Constraints in production and marketing of chilli

Sl. No.	Problems	Garrett score	Rank
1	Scarcity of labour	75.9	1
2	High labour charges	72.6	2
3	Price volatility	68.5	3
4	Pest and disease attack	67.1	4
5	Post-harvest losses	58.9	5
6	Increasing price of inputs	55.3	6
7	Climate change	50.2	7
8	Low yield	45.3	8
9	High transportation cost	37.8	9
10	Decreasing demand	31.2	10
11	Low value addition	25.3	11
12	Unavailability of inputs	25.8	12

4.3.7.2 Constraints faced by intermediaries

The intermediaries in the chilli value chain were also surveyed to find out the important constraints and the results are depicted in Table 4.38. Lack of infrastructural facilities like storage and processing, with a Garrett score of 73.6, was identified as the most significant constraint faced by the intermediaries.

Table 4.38 Constraints faced by intermediaries

Sl. No.	Problems	Garrett score	Rank
1	Lack of infrastructural facilities	73.6	1
2	High handling cost	64.3	2
3	Non availability of quality material	53.1	3
4	High transportation cost	42.8	4
5	Price fluctuations	28.9	5

High handling cost was identified as the second major constraint and the other major constraints include non-availability of quality material, high transportation cost and price fluctuations.

4.3.7.3 Constraints faced by exporters

The major constraints faced by chilli exporters are presented in Table 4.39. Highly volatile international price was identified as the major constraint with a Garrett score of 65.6. The international markets reject chilli with excessive pesticide residues and contaminants. Lack of technical guidance on export was identified as the second major constraint. Supply issues, uncertainties, procedural difficulties, and institutional rigidities are due to the inadequacies in technical guidance. Other major constraints were the delay in payment by the buyers and high transportation costs.

Table 4.39 Constraints faced by exporters

Sl. No	Problems	Garrett score	Rank
1	Highly volatile international prices	65.6	1
2	Lack of technical guidance on export red chilli	68.5	2
3	Delay in payment by the buyers	51.9	3
4	High transportation costs	46.8	4

4.3.7.3 Constraints faced by processors

The constraints faced by processors in chilli value chain are presented in Table 4.40. The lack of infrastructure with a Garrett score of 60.1, was identified as the major constraint by the processors.

Table 4.40 Constraints faced by processors

Sl. No	Problems	Garrett score	Rank
1	Lack of infrastructure	60.1	1
2	Lack of effective technology	59.5	2
3	Insufficient capital	53.2	3
4	High labour charges	41.4	4
5	Market related problems	27.4	5

For value addition and processing in chilli, advanced processing technology and infrastructure like cold storages are required. In the study area, only basic infrastructure facilities were available with the processors and hence it was identified as the major constraint.

Lack of effective technology is the second major constraint. Chillies are processed into a variety of products, including chilli powder, sauce, dried/dehydrated chilli, oleoresin and oils. It is critical to use suitable techniques in the manufacture of the final product. Inadequate primary processing, storage, and distribution facilities were some of the problems identified in the study area. Other constraints for processors include insufficient capital, high labour charges and market related problems.

5. SUMMARY AND CONCLUSION

The present study entitled “Export performance and value chain analysis of chilli in India," analysed the performance of chilli exports from India; assessed the export competitiveness measures and factors affecting chilli exports from India and undertook the value chain analysis of chilli in Telangana and Andhra Pradesh.

The export performance of Indian chilli was examined for the period from 1960 to 2019. The rate of growth in chilli exports from India has increased in the post-2001 period as compared to the pre-2001 period, while the instability in chilli exports has decreased in the post-2001 period. Among all the decomposed components of the changes in the average export value, the contribution of the changes in the mean export unit value of chilli was found to be highest. The increase in the mean export value of chilli between all the sub-periods was mainly due to the change in the mean export unit value, which contributed almost 100 per cent of the growth in export value.

Chilli is internationally traded as *Capsicum* or *Pimenta*, neither crushed nor ground and crushed or ground capsicum. Under the category of exports of *Capsicum* or *Pimenta* crushed or ground, different products such as chilli powder, chilli flakes, and chilli seeds are categorised. Till 2001-02, majority of the chilli exported from India was dry chilli and chilli powder. *i.e.,* it accounted for nearly 100 per cent share in the total chilli exports from India. It had reduced to 70 per cent in 2013, meanwhile the share of other ground or crushed products of chilli in exports from India has increased over the years.

The commodity concentration of chilli exports from India was high in pre-2001 period and became more diversified in the post-2001 period. The average value of the commodity concentration for chilli measured using the Gini concentration index was 76.46 for the overall period from 1986-87 to 2019-20. During the period from 1990-91 to 1999-20, the average commodity concentration index for chilli was 80.18, which declined to 74.57 during the period from 2010-11 to 2019-20. The exports of chilli from India became increasingly diversified to different countries and the Hirschman concentration indices have decreased over the years. Before 2001, the Hirshman index was above 40 per cent, indicating higher level of concentration and uneven distribution of export markets. Later, India’s exports of chilli were dispersed across different destinations as the Hirshman index was below 40 after 2010, subsequently decreasing to 32.86 per cent during 2016-17 and then increasing to 39.16 in 2019-20.

The dynamics in the direction of chilli exports from India was analysed using Markov chain analysis. UAE was found to be the most stable market for exports of chilli from India as its probability of retaining the previous period market share was 99.2 per cent. The Markov chain analysis showed that in the post-WTO period, a greater number of stable markets for chilli exports from India were identified. China, Thailand, Malaysia, Vietnam, Pakistan, Brazil and Indonesia became major markets for Indian chilli exports in the post-WTO period. China was an unstable export market for Indian chilli in the pre-WTO period, but it became a stable market in the post-WTO period due to high demand for chilli in China.

The trade complementarity indices estimated for chilli showed that the export pattern of chilli from India strongly matched with the import patterns of chilli in the partner countries. In addition, the increasing trend of the trade complementarity indices of India with partner countries in the trade of chilli after 2001 confirmed that India and its partner countries are becoming more complementary, which implied that India's export pattern was matching with the import requirements of those countries.

The estimated elasticity coefficients of the log-log model for finding out the determinants of Indian chilli exports showed that 88 per cent of the variation in the chilli exports could be explained by the variables included in the model. The domestic production in India and the international price were statistically significant and having positive effects on export supply of Indian chilli. This means that India's chilli exports will increase with the increase in the domestic production and international price of chilli. On the other hand, an increase in the domestic prices and real exchange rate were found to result in a decrease in the export of chilli from India.

The trade competitiveness of Indian chilli was measured in terms of comparative and competitive advantages. The comparative advantage of chilli was estimated using Revealed Comparative Advantage (RCA) index, while the competitive advantage was measured using Policy Analysis Matrix (PAM). The RCA analysis was carried out for major chilli producing countries and the results showed that India and China were having high comparative advantage in the export of chilli. The RCA index for India has increased over time, increasing from 12.73 in 1990 to 22.17 in 2019. China's RCA index dropped from 6.66 in 1995 to 1.79 in 2019.

The Policy Analysis Matrix (PAM) analysis for chilli was carried out under the exportable hypotheses to understand the comparative advantage of Indian chilli in an export

scenario. The estimated Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), and Domestic Resource Cost Ratio (DRCR) values were found to be less than one. The NPC was estimated as 0.73, which means that the domestic price of chilli was 27% [(NPC-1)100] less than the international price of chilli under the exportable hypothesis. The results showed that the Indian chilli was unprotected and competitive and hence the export of chilli from India will be profitable. The EPC was also less than one and exceeded NPC, which means that the domestic processors were not being protected in tradable inputs through government policy as they were realizing lesser returns as compared to a free-trade situation. The NPC and EPC values suggested a lower chilli price in the domestic market compared to the foreign market, indicating the Indian chilli's efficiency as an export competitive crop. The DRCR value (0.78) of less than one means that the cost of domestic resources required to produce a unit quantity of chilli was less than the net foreign exchange earned from its export. The PAM analysis under exportable hypotheses suggested that Indian chilli was a moderately competitive crop as an export commodity. The findings revealed that chilli was an efficient exportable item, demonstrating Indian chilli's international competitiveness.

The value chain analysis of Indian chilli was carried out from the perspective of different domains. The analysis of the socio-economic context of the chilli value chain in India has shown that the share of chilli exports in total agricultural exports from India was 0.7 per cent in 1960-61 and it has increased to 2.4 per cent in 2019-20. The value of output of chilli in India has also increased from ₹15,61,812 lakhs in TE2014-15 to ₹20,42,133 lakhs in TE2018-19, at current prices. India is the world’s largest producer of chilli and it accounted for 54.5 per cent of global production during TE2019. Chilli is mainly cultivated in the states of Andhra Pradesh and Telangana and, these states produced 6,60,000 tonnes and 3,01,000 tonnes respectively during 2019-20, which together accounted for more than 50 per cent of Indian production.

The analysis of demand for chilli in the value chain showed that the countries with greatest potential for export of chilli from India are China, United states of America, Thailand and Sri Lanka. The markets with greatest untapped potential for India’s chilli exports are USA, China and Spain. USA showed the largest absolute difference between potential and actual exports in value terms, leaving room to realize additional exports worth 202.5 million US$, followed by China and Bangladesh with 167.3 and 102.5 US$ million respectively.

China, USA, Sri Lanka and Vietnam imposed the highest number on NTMs on chilli exported from India. Even though the import requirements for Indian chilli in the form of NTMs were highest in number for China, India exported the highest quantity of chilli to China in 2020, which showed that the Indian exports were able to meet the import requirements of that country. The exports to Vietnam were the least and this could be attributed to the higher number of NTMs imposed by Vietnam on imports from India. In the case of all the countries with the exception of China, majority of the NTMs on Indian chilli exports were the Sanitary and Phyto Sanitary (SPS) measures, while China was having the highest number of Technical Barriers to Trade (TBT) on Indian chilli.

The analysis of institutional set-up of chilli value chain has shown that the major institutions providing technical, extension and administrative supports in the chilli value chain are Spices Board, Directorate of Marketing and Inspection (DMI), National Horticulture Board (NHB), Agricultural and Processed Food Products Export Development Authority (APEDA), State Agricultural Marketing Board (SAMBs), Department of Agriculture, Agricultural Produce Market Committees (APMC), Regional Agricultural Research Stations (RARS), and Krishi Vigyan Kendras (KVK). The major input suppliers for chilli are fertilizer and pesticide shops owned by input dealers. Majority of the farmers were growing the chilli variety "Teja".

The analysis of input and output markets showed that farmers were given credit by commission agents, private money lenders and institutional agencies including commercial banks and cooperatives. The major input suppliers for chilli farmers were fertilizer and pesticide shops owned by input dealers. The exclusive regulated markets for chilli were the major institutional entities established under the state APMC Act, which facilitated efficient marketing by providing necessary market infrastructure and preventing malpractices during the marketing process. In the case of farmers practising contract farming, the contracting companies which are mostly processing companies were the sole buyers and hence a monopsony market structure was found to be prevalent in such cases.

The Supply Utilization Account (SUA) published by the Food and Agriculture Organisation (FAO) was used to analyse the quantity flows of chilli along the value chain in India. In 2018-19, the production of chilli in India was 18,08,011 tonnes out of which, 12,52,823 tonnes were used for consumption. The opening stock was 8,87,466 tonnes and the import and export quantities were 1,361 tonnes and 3,86,276 tonnes respectively. The closing stock in the country was 10,13,683 tonnes.

The socio-economic characteristics of respondents like age, gender, education, occupation, annual income, land holding pattern and family size were analysed using the primary data. The age-wise classification of the sample farmers indicated that more than 50 per cent of the farmers were in the age group of 45-60 years, while about one third of the farmers belonged to the age group of 30-45 years. The gender-wise classification of the sample respondents showed that majority of the farmers were males and only 10 per cent were female farmers. The details of the educational status of the sample respondents showed that more than 50 per cent of them had only primary level education and one-fourth of the respondents possessed SSLC level education. The sample farmers were divided into three categories depending on their farming experience as less than ten years, ten to thirty years, and more than thirty years. It could be observed from results that about two-third of the respondents had 10-30 years of experience in farming, whereas the remaining one-third of the sample farmers were having more than 30 years of experience. It was observed that majority of the sample farmers i.e., 37.5 per cent had land holding size in the range from one to two hectares and one- third occupied land holdings sized 2-5 hectares. In terms of family size, it could be observed that more than half of the sample farmers had family sized 4-6 members, while 27.5 per cent had families with 1-3 members. The details of the occupational status of the farmers clearly depicted that for more than 80 per cent of the farmers, agriculture was the major occupation. Majority of the farmers (42.5 per cent) had an annual income of Rs.1-2 lakh rupees, while 26.66 per cent had annual income of Rs.2-5 lakhs.

The cost of cultivation of chilli was worked out using ABC cost concept methodology proposed by the Commission for the Agricultural Costs and Prices (CACP). The estimated weighted average of cost A for cultivation of chilli in all the sample districts was computed as ₹3,33,459 per ha. The weighted average value of cost B and C for chilli cultivation in these districts were ₹3,98,014 per ha and ₹4,67,610 per ha respectively. The highest values for all the three costs were found in Guntur, whereas it was the least for Mahabubabad district. The major share of input-wise cost incurred for the cultivation of chilli in all the districts under study was accounted by hired human labour and was followed by family labour. The cost for hired human labour accounted for 27 per cent of the total weighted average input cost, whereas that incurred on family labour accounted for 14.8 per cent. The costs incurred on human labour, family labour and plant protection chemicals together contributed 53.57 per cent of the total cost cultivation.

The gross returns from chilli cultivation were found to be the highest in Guntur (₹9,61,509 per ha), followed by Khammam (₹8,35,184 per ha), Prakasam (₹7,07,286 per ha) and Mahabubabad (₹5,70,845 per ha). The net returns from cultivation of chilli, estimated at cost A, B and C were highest in Guntur and were ₹6,00,120 per ha, ₹5,25,002 per ha and ₹4,54,133 per ha respectively. The weighted average of net returns estimated at cost A, B and C were ₹4,69,312 per ha, ₹4,13,339 per ha and ₹3,44,097 per ha respectively. The B-C ratio at cost A varied between the highest value of 2.66 for Guntur and the lowest value of 2.09 for Mahabubabad. The B-C ratio for chilli cultivation estimated at cost B was found to be highest (2.2) in Guntur, while it was lowest (1.83) in Mahabubabad. Similarly, B-C ratio, estimated at cost C varied between 1.90 in Guntur and 1.48 in Mahabubabad.

The marketing process in chilli involves many intermediaries like village traders, commission agents, wholesalers cum traders, processors, exporters and retailers. The costs incurred on transportation and processing were the major costs for marketing of dry as well as powdered chilli. Six marketing channels were identified for dry chilli, while for chilli powder, five channels were identified. The marketing channels identified for dry chilli were, Channel I, Farmers - Commission Agents - Wholesaler cum traders - Retailers - Consumers; Channel II, Farmers - Commission Agents - Wholesalers cum traders - Exporters; Channel III, Farmers- Commission Agents - Wholesalers cum traders - Processors- Retailers-Consumers; Channel IV, Farmers - Commission Agents -Wholesalers cum traders -Processors- Exporters; Channel V, Farmers - Processors cum retailers-Consumers and, Channel VI, Farmers - Processors cum retailers- Exporters. The marketing channels identified for chilli powder were, Channel I, Farmers - Village traders - Processors - Retailers; Channel II, Farmers - Commission Agents - Wholesaler cum traders - Retailers - Consumers; Channel III, Farmers- Commission Agents - Wholesalers cum traders -Processors- Exporters; Channel IV, Farmers - Processors cum retailers-Consumers and, Channel V, Farmers - Processors cum retailers- Exporters.

The price spread was found to be highest in channel IV for dry chilli, while in the case of chilli powder, channel III had the highest price spread. The producer's share in consumer's rupee was highest (80.89 per cent) and the price spread was found to be the least (₹27.29/kg) in channel II for dry chilli, while for chilli powder the producer's share in consumer's rupee was highest (60.89 per cent) and the price spread was found to be the least (₹89.45/kg) in channel V. The marketing efficiency for dry chilli was found to be highest in channel I due to low marketing cost, and it was highest for chilli powder in channel V as the price paid by the consumer in this channel was the highest.

The constraints faced by producers, market intermediaries, exporters and processors of chilli were analysed using Garrett ranking technique. The scarcity of labour was identified as the most important constraint in the production and marketing of chilli, which is a highly labour-intensive crop. Increased opportunities in the non-farm rural sector such as services and manufacturing, with higher earnings and consistent incomes have caused the labourers to shift from agriculture to non-farm sectors. As a result, there is scarcity of labourers and hence farmers were hiring labourers from distant places. High labour charges was identified as the second major constraint. Price volatility was identified as the next important constraint in production and marketing of chilli.

Lack of infrastructural facilities like storage and processing were identified as the most significant constraint faced by the intermediaries. High handling cost was identified as the second major constraint and the other major constraints include non-availability of quality material, high transportation cost and price fluctuations. The major constraint faced by chilli exporters was highly volatile international price. Lack of technical guidance on export was identified as the second major constraint. In the case of constraints faced by processors in chilli value chain, the lack of infrastructure was identified as the major constraint by the processors. For value addition and processing in chilli, advanced processing technology and infrastructure like cold storages are required. In the study area, only basic infrastructure facilities were available with the processors and hence it was identified as the major constraint. Lack of effective technology was found to be the second major constraint for processors.

The following policy suggestions are proposed for resolving the existing constraints in exports of Indian chilli, and also for improving the production and marketing of chilli in India.

1. Since SPS measures were the major NTMs in international trade of chilli, the quality of Indian chilli should be ensured by encouraging the farmers to adopt Good Agricultural Practices (GAP), while the processors should be motivated to implement Good Manufacturing Practices (GMP).
2. The absence of storage facilities was a major constraint for chilli farmers and hence, warehousing facilities need to be developed for scientific storage of chilli.
3. The chilli prices were highly volatile and hence there is a need for recommendation of Minimum Support Price (MSP) in chilli. The possibility for making a price deficiency payment to the farmers based on a realistically estimated base price need to be explored.
4. Dissemination of timely marketing intelligence is necessary to help the farmers to decide on the time of harvest, period of storage and place of sales.

5. Indian chilli exports are concentrated on few products and the country needs to explore the possibilities for value addition and product diversification which will help the farmers to move up in the value chain.
6. India needs to develop policies to sustain as well as increase the share in stable export markets of chilli and must strive to enter non-traditional markets.

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Appendices

APPENDIX I

Kerala Agricultural University

Export performance and value chain analysis of chilli in India

Schedule for chilli Farmers

Block / Mandal: village: Date:

1. <u>Socio-economic details of the farmer:</u>

A. Name of the respondent:

B. Age:

C. Gender:

D. Address:

E. Contact number:

F. Educational qualification:

a) Below SSC ☐ b) SSC ☐ c) Plus Two ☐ d) Degree ☐

e) Post graduation ☐ f) Diploma ☐

Specify (If any other) ……

G. Experience in farming(years):

H. Number of members in a family:

2. <u>Income details:</u>

A. Annual income

<50,000	50000-1 lakh	1 lakh- 1.5 lakh	1.5 lakh- 2 lakh	>2 lakh
☐	☐	☐	☐	☐

B. Source of income:

a) Farming alone ☐ b) Farming+ Business ☐ c) Farming+ Government job ☐

d) Farming+ Self employed ☐

Specify, if any other: _____

3. **Land details:**

Ownership status	Irrigated	Rainfed	Total (Ha)
Own land			
Leased-in			
Leased out			

Rental value of own land (leased out):

Rental value of leased-in land :

4. **Crop details:**

S.No	Name of the Crops	Acres	Rain fed	Well Irrigation	Drip irrigation
1					
2					
3					
4					

Other crops:

Chilli as : a) Main crop ☐ b) Intercrop ☐

Other intercrop: if any, _____

5. **Method of chilli cultivation:**

a) Organic ☐ b) By using chemicals ☐ c) Organic + Chemical ☐

d) Others ☐

6. **Input requirement details:**

A. Quantity of seed required per acre:_____and its price:_____

B. Sources of procurement of seed: a) Own ☐ b) Fellow farmer ☐ c) Dealers ☐

d) Nursery ☐ d) KVK ☐ e) Research station ☐

C. Sources of irrigation:

I. Owned well ☐ b) Canal ☐ c) Rain water ☐ d) Bore well ☐

e) Others (specify) ☐

II. Availability of irrigation facility? a) Adequate ☐ b) Not adequate ☐

D. Other input required and its sources:

Sl. No.	Inputs/Operation	Quantity	Unit price (Rs.)	Labour hours		Cost of labour/ Day
				Manual	Machine	
1	Land preparation					
2	Seed					
3	Manures					
4	Fertilization					
5	Plant protection chemicals					
6.	Weedicides					
7	Hormones					
8	Irrigation					
9	Harvesting					
10	Others					

E. Whether you are getting any technical support? Yes ☐ / No ☐

If yes, details of support:

Sl.No.	**Name of the institution**	**Kind of support**
1	chilli farmers association	
2	KVK	
3	Spice board	
4	Government Institutions	
5	Farmer Producer Companies	
6	Others /private companies	

7. Production details:

Cultivation practice followed:

Sl No.	Stages of chilli cultivation	Name	Quantity	Price	Source	Constraints
1	Land preparation					
2	Planting	Seed				
3	Manuring	Compost/FYM Fertilizers				
4	Irrigation					
5	Flower induction					
6	Plant protection					
7	Labour charges					

8. Details of labour employed:

A. Number of man days:

Rate/ day: (un skilled): Rate/ day (skilled labour):

B. Availability of labour: a) More than adequate ☐ b) Adequate ☐ c) Less than adequate

C. Skilled labour problem: Yes ☐ No ☐

D. Did you experienced any kind of loss due to: a) Pest and diseases ☐ b) Climate ☐

c). Government policy on pricing ☐ d) Labour shortage ☐

E. In case of pest and disease, specify the kind and cause of attack:

---

9. Yield obtained per acre:

Sl. No.		Previous year		Current year	
		Quantity	Price/kg	Quantity	Price/kg
1	Dry chilli				

10. Post-harvest details:

A. Are you harvesting chilli : a) Green ☐ b) Ripen ☐ c) Dry ☐

B. Number of pickings during the chiili harvesting? _____

C. Do you practice any of the following drying methods:

a) drying under direct sunlight ☐ b) drying under shade ☐ c) solar drying ☐

D. After the harvest, do you attempt any value addition to the chilli?

a) Drying ☐ b) Cleaning ☐ b) Sorting ☐ c) Grading ☐

d) All of the above ☐ e) Other ☐

E. Is that beneficial? How? What is the difference in price?

F. Do you carry out the processing of chilli at your level? Yes ☐ No ☐

a. If yes, what are they? _____

Level of processing	Products processed	Cost per operation	Price per unit of value-added product

b. Channels adopted for the sale of value-added products

Crop variety	**Value added products**	**Quantity (Quintal)**	**Channel adopted**

c. If No, why? _____

Problems face by you during processing: a) Lack of infrastructure facility ☐

b) High cost of processing ☐ c) Lack of technical knowledge ☐ d) Others ☐

d. Are you applying any pretreatment (pre-harvest) to chilli ? Yes ☐ / No ☐

If yes, mention the chemical used for pretreatment: _____

Quantity:_____ Price: _____

e. Storing methods of the chilli : a) Keeping in the gunny bags ☐

Keeping in the cold storages ☐ c) Stacking ☐ d) other modes ☐

f. What are the difficulties encountered in growing and selling chillies?

_____

11. Credit details:

a. Did you avail any loan, to undertake production? Yes ☐ No ☐

If yes, source:

Sl. No	Particulars	Amount	Period	Interest rate (%)
1	Financial institutions (Banks)			
2	Cooperatives			
3	SHG			
4	Money lenders			
5	Friends and relatives			
6	Others			

b. Are you a loan defaulter? Yes ☐ No ☐

12. Details of marketing:

a. Who are the buyers of chilli?

Sl. No	Consumers	Quantity	Unit Price (in Rs.)
1	Household consumption		
2	Individual consumer		
3	APMC		
4	Traders		
5	Processors		
6	Government/ Corporations		
7	Exporters		

c. Type of the marketing channel adopted: _____

13. Price details:

A. How do you fix the price for the quality chilli you sell? a) Market price ☐

b) Supply ☐ c) Demand ☐ d) considering all ☐ e) Cost incurred ☐

B. Unit price of chilli (in Rs.):

C. Whether the payment is made on spot: Yes ☐ No ☐

14. Whether the entire chilli produced during the season is marketed? Yes ☐ No ☐

15. Whether you are getting the reasonable prices at all the levels? Yes ☐ / No ☐

16. Which are the exclusive institutional supports available in marketing of produce?

_____

17. Mode of transportation used for marketing the produce: _____

18. Who will meet the cost of transportation?

Met by	Producer	Trader	Processors	Others
Rs.				

19. Costs incurred by the producer

Loading and unloading charges	
Sampling, watching and Temporary storage etc.	
Losses Due to Storage, Transport	
Cost of packing (including gunny bags charge gunny bags cost per /Quintal)	
Total	

20. Are you satisfied while marketing the produce? Yes ☐ / No ☐

If no, why?

21. Are you a member of any association related to chilli cultivation and marketing

Yes ☐ / No ☐ If yes, specify the name(s)

22. What are the benefits you obtained being a member of such associations?

23. Do you undertake contractual agreement with any of the market intermediaries?

If yes, specify the type of contract _____

24. Suggestions to improve chilli productivity:

a) At your farm:

b) In your region:

25. Rank the constraints faced in chilli cultivation and marketing:

	Problems	**Ranks**
1	Low yield	
2	High labour charge	
3	Scarcity of labour	
4	Climate change	
5	Unavailability of inputs	
6	Increasing price of inputs	
7	Post and disease attack	
8	Decreasing demand	
9	High transportation cost	
10	Price fluctuations	
11	Low value addition	
12	Post-harvest losses	

APPENDIX II

Kerala Agricultural University

Export performance and value chain analysis of chilli in India

Schedule for intermediaries

(Village traders, Commission agents, Wholesalers and Retailers)

1. Name of the agent: Date:
2. Address and Ph. no.:
3. Nature of Business:

   a) Village trader ☐ b) Commission agent ☐

   c) Wholesalers cum trader ☐ d) Retailer ☐
4. Experience in trading:
5. Place of operation:
6. Are your single commodity trader: Yes ☐ No ☐

   If no, specify other commodities: _____
7. Quantity (volume) of transaction/year:
8. Frequency of purchase:
9. In which form, you are procuring chilli?

   a) Raw / Dry chilli ☐ b) Processed ☐
10. Chillies are collected from:

Sl. No.	Particulars	Quantity	Price paid (in Rs.)
1	Farmers		
2	Village traders		
3	Commission agents		
4	Wholesalers cum traders		

11. To whom, you sell the produce?

Sl. No	Particulars	Quantity	Price receive (in Rs)
1	Commission agents		
2	Traders		
2	Processor		
3	Exporters		
3	Others:		

12. Cost incurred by agents

Market fee	
Transportation charges	
Loading and unloading charges	
Processing charges if any	
Storage cost	
Packaging cost	
Average loss in handling	
Other costs	
Total costs	

12. Mode of cash transaction:

Within what time period amount is paid to the farmers/ Agent?

a) On spot ☐ b) One day ☐ c) Week ☐

13.Do you facilitate contract farming? Yes ☐ / No ☐

If yes: specify the type of agreement: _____

Sl. No.	Particulars	No. of farmers	Amount / farmers
1	Financial assistance		
2	Seed		
3	Fertilizer Pesticide		
4	Pesticides/ fungicides		
5	Growth hormones		
6	Transportation		
7	Other goodwill		

14. Do you undertake any value addition?

If yes, specify: _____

Details of value Addition

S.No	Name of the Produce	Name of the value added Product produced	Price / Unit	Details of process

15. Marketing channels adopted for the sale of the products

Particulars	**Product 1**	**Product 2**	**Product 3**
Name of the product / Produce			
Cost for procurement (Rs)			
Volume of product / produce (Quintal)			
Market channel adopted			
Marketing cost incurred (per Quintal)			
Selling price of products (Rs)			
Volume of product sold (Quintal))			
Margin (%)			

16. Commission percentage:

17. Profit margin:

18. Whether the supply of chilli is adequate to meet the demand in the market?

Yes ☐ / No ☐

If no, _____

19. From where did you get the market information?

_____

20. On what basis chilli price is fixed? _____

21. Rank important problems faced by you relate to procurement:

Sl. No.	Particulars	1	2	3	4	5
1	Lack of transportation facility					
2	High transportation cost					
3	Unavailability of labour					
4	High labour charges					
5	Non availability of quality material					
6	Others					

APPENDIX III

Kerala Agricultural University

Export performance and value chain analysis of chilli in India

Schedule for Chilli Processors

Date:

1. Name of the respondent / processing unit:
2. Full address and Ph. no. :
3. Location of the unit:
4. Legal status: a) Registered ☐ b) Non registered ☐
5. Size of the unit: a) Small ☐ b) Medium ☐ c) Large ☐
6. Type of unit: a) Govt. ☐ b) Private ☐ c) Cooperative ☐
7. What variety chilli does you process chilli? _____
8. What forms of chilli products do you process?

   a) _____

   b) _____

   c) _____

   d) _____

   e) _____

   f) _____

9. How long you have been engaged in chilli processing?_____years
10. What are the different levels of processing that you are engaged?

    a) Primary ☐ b) secondary ☐ c) tertiary ☐

    _____

11. From where do you procure chilli?

    a) Farmers ☐ b) Traders ☐ c) commission agents ☐ c) Others: ☐

    _____

12. . Do you facilitate contract farming? Yes ☐ / No ☐

If yes: specify the type of agreement: _____

Sl. No.	Particulars	No. of farmers	Amount / farmers
1	Financial assistance		
2	Seed		
3	Fertilizer Pesticide		
4	Pesticides/ fungicides		
5	Growth hormones		
6	Transportation		
7	Other goodwill		

13. What is the average quantity of chilli procured for this season :_____

14. What is the average price per quantity at the time of procurement :_____

15. Are you getting adequate quantity of chilli for processing? Yes: ☐ No: ☐

If yes, quantity:_____

If no, why and what is the

alternative?_____

What is the

shortage?_____

16. What are the prescribed specifications of chilli for processing?

_____

_____

17. How do you make payment for purchase?

a) Spot payment ☐ b) Credit ☐ c) Other (specify) ☐

18. Are you using any preservative? Yes ☐ No ☐

If yes, specifies the name, quantity and sources of supply:

_____

_____

19. **Costs, margins and Distribution channel for chilli products**:

Particulars	**Product 1 ( )**	**Product 2 ( )**	**Product 3 ( )**
Crop variety used			
Quantity of raw material used for processing			
Cost for raw material (Rs.)			
Cost for processing (Rupees per Quintal)			
Volume of processed products (Quintals)			
Market channel adopted			
Price per unit product (Rs.)			
Volume of processed products sold (Quintals)			
Margins (%)			

Distribution channel	**Quantity**	**Price (Rs.)**	**Mode of receipt**	**Form of products: processed / semi processed**	**Place of sale**
Distributers					
Wholesalers					
Retailers					
Consumers					

20. Is it profitable? Yes ☐ No ☐

21. Price gap between the raw chilli and processed chilli:

22. Problems faced by the processor
    Rank the problems (Rank1-highest to 6 lowest)

Problem	Rank
1. Non availability of raw material	
2. Lack of effective technology	
3. High cost of labour	
4. Transportation	
5. Marketing	
6. Lack of capital	

23. Suggestions, if any to improve the value chain of chilli:_____

APPENDIX IV

Kerala Agricultural University

Export performance and value chain analysis of chilli in India

Schedule for Chilli Exporters

Date:

1. Name of the Exporter/ Enterprise:
2. Address and Ph. no. :
3. Type of Exporting Unit
4. Nature of Exports
5. Years of experience in Export Business
6. Forms of Business

7. a) Name of the Product/products Exported

   b) Description of the Product including various Specification, Characteristics, forms and grades

   c) Details of the sales negotiation process

   d) Details of countries to which the products have been exported?

8. Details of Product Exported – Volume and Price of Exports
9. Chillies are collected from:

Sl. No.	Particulars	Quantity	Price (in Rs.)
1	Farmers		
2	Traders		
3	Processors		

10. Do you undertake any contractual agreement with farmers? if yes, specify the contract

    _____

11. Do you undertake any value addition?

    If yes, specify: _____

12. Exporting Channel:

13. Quantity / Volume of Exports of Various Products

Name of the Product	Year	Name of the Country	Volume of Exports	Unit Value	Value of Exports (RS)

14. Cost of Export :

    Specify costs for individual or specific functions or operations carried out

15. Margins of Export
16. Rank important problems faced by you relate to Export:

Sl. No.	Particulars	1	2	3	4	5
1						
2						
3						
4						
5						

EXPORT PERFORMANCE AND VALUE CHAIN ANALYSIS OF CHILLI IN INDIA

By

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(2019-11-044)

ABSTRACT OF THE THESIS

Submitted in partial fulfilment of the requirement for the degree of

Master of Science in Agriculture

(Agricultural Economics)

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2021

ABSTRACT

Chilli and chilli products are the most important spices exported from India. The country is world's leading producer of chilli as well as exporter, accounting for almost half of the global export volume of chilli. The present study entitled “Export performance and value chain analysis of chilli in India," analysed the performance of chilli exports from India; assessed the export competitiveness measures and factors affecting chilli exports from India and undertook the value chain analysis of chilli in Telangana and Andhra Pradesh.

The export performance of Indian chilli was examined for the period from 1960 to 2019. The rate of growth in chilli exports from India has increased in the post-2001 period as compared to the pre-2001 period, while the instability of chilli exports has decreased in the post-2001 period. Among all the decomposed components of the changes in the average export value, the contribution of the changes in the mean export unit value of chilli was found to be highest. The commodity concentration of chilli exports from India was high in pre-2001 period and the exports became more diversified in the post-2001 period. The average value of the commodity concentration index for chilli was 76.46 for the overall period from 1986-87 to 2019-20. The exports of chilli from India became increasingly diversified to different countries and hence the Gini concentration indices have decreased over the years. Before 2001, the geographic concentration estimated using the Hirshman index was above 40 per cent, denoting the higher level of concentration and uneven distribution of export markets. The Markov chain analysis showed that in the post-WTO period, a greater number of stable markets for chilli exports from India were identified. China, Thailand, Malaysia, Vietnam, Pakistan, Brazil and Indonesia became major markets for Indian chilli exports in the post-WTO period. China was an unstable export market for Indian chilli in the pre-WTO period, but it became a stable market in the post-WTO period due to high demand for chilli in China. The increasing trend in the trade complementarity indices of India with partner countries in the trade of chilli after 2001 confirmed that India and its partner countries are becoming more complementary, which implied that India’s export pattern was matching with the import requirements of those countries.

The estimated elasticity coefficients of the log-log model for finding out the determinants of Indian chilli exports showed that the production in India and the international price were statistically significant and having positive effects on export supply of Indian chilli, while an increase in the domestic prices and real exchange rate were found to result in a

decrease in the export of chilli from India. The Revealed Comparative Advantage (RCA) analysis showed that India and China were having high comparative advantage in the production and export of chilli. The estimated Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), and Domestic Resource Cost Ratio (DRCR) values were found to be less than one. The Policy analysis Matrix (PAM) analysis under exportable hypotheses suggested that Indian chilli was a moderately competitive crop as an export commodity. The findings revealed that chilli was an efficient exportable item, demonstrating Indian chilli's international competitiveness.

The analysis of demand for chilli in the value chain showed that the countries with greatest potential for export of chilli from India are China, United states of America, Thailand and Sri Lanka. The markets with greatest untapped potential for India's chilli exports are USA, China and Spain. The highest number of NTMs on chilli exported from India were imposed by China, USA, Sri Lanka and Vietnam. The analysis of institutional set-up of chilli value chain has shown that the major institutions providing technical, extension and administrative supports in the chilli value chain are Spices Board, Directorate of Marketing and Inspection (DMI), National Horticulture Board (NHB), Agricultural and Processed Food Products Export Development Authority (APEDA), State Agricultural Marketing Board (SAMBs), Department of Agriculture, Agricultural Produce Market Committees (APMC), Regional Agricultural Research Stations (RARS), and Krishi Vigyan Kendras (KVK). The major input suppliers for chilli are fertilizer and pesticide shops owned by input dealers and majority of the farmers were growing the chilli variety "Teja". The Supply Utilization Account (SUA) published by the Food and Agriculture Organisation (FAO) was used to analyse the quantity flows of chilli along the value chain in India. In 2018-19, the production of chilli in India was 18,08,011 tonnes, out of which, 12,52,823 tonnes were used for consumption. The opening stock was 8,87,466 tonnes and the import and export quantities were 1,361 tonnes and 3,86,276 tonnes respectively. The closing stock in the country was 10,13,683 tonnes.

The estimated weighted average of cost A incurred for chilli cultivation in the sample districts was computed as ₹3,33,459 per ha. The weighted average value of cost B and C for chilli cultivation in these districts were ₹3,98,014 per ha and ₹4,67,610 per ha respectively. The highest values for all the three costs were found in Guntur, whereas it was the least for Mahabubabad district. The major share of input-wise cost incurred for cultivation of chilli in all the districts under study was accounted by hired human labour and was followed by family labour. The weighted average of net returns estimated at cost A, B and C were ₹4,69,312 per

ha, ₹4,13,339 per ha and ₹3,44,097 per ha respectively. The B-C ratio for chilli cultivation at cost A varied between the highest value of 2.66 for Guntur and the lowest value of 2.09 for Mahabubabad. The B-C ratio for chilli cultivation at cost B was found to be highest (2.2) in Guntur, while it was lowest (1.83) in Mahabubabad. Similarly, B-C ratio at cost C varied between 1.90 in Guntur and 1.48 in Mahabubabad.

The price spread in marketing of chilli was found to be highest in channel IV for dry chilli, while in the case of chilli powder, channel III had the highest price spread. The producer's share in consumer's rupee was highest (80.89 per cent) and the price spread was found to be the least (₹27.29/kg) in channel II for dry chilli, while for chilli powder the producer's share in consumer's rupee was highest (60.89 per cent) and the price spread was found to be the least (₹89.45/kg) in channel V. The marketing efficiency for dry chilli was found to be highest in channel I due to low marketing cost, and it was highest for chilli powder in channel V as the price paid by the consumer in this channel was the highest. The scarcity of labour was identified as the most important constraint in the production and marketing of chilli and high labour charges as well as price volatility were identified as the other important constraints. Lack of infrastructural facilities like storage and processing were identified as the most significant constraint faced by the intermediaries. The major constraint faced by chilli exporters was highly volatile international price, and in the case of processors, the lack of infrastructure was identified as the major constraint.

As SPS measures were the major NTMs in International trade, the quality of Indian chilli should be ensured by encouraging the farmers to adopt Good Agricultural Practices (GAP), while the processors should be motivated to implement Good Manufacturing Practices (GMP). Development of proper warehousing facilities is essential for scientific storage of chilli as absence of proper storage facilities was reported as a major constraint. The chilli prices were highly volatile and hence the recommendation of Minimum Support Price (MSP) or possibility for making a price deficiency payment to the farmers based on a realistically estimated base price need to be explored. The dissemination of timely marketing intelligence is necessary to help the farmers to decide on the time of harvest, period of storage and place of sales. Indian chilli exports were found to be concentrated on few products and the country needs to explore the possibilities for value addition and product diversification which will help the farmers to move up in the value chain. India needs to develop trade policies to sustain as well as increase the share in stable export markets of chilli and must make efforts to enter non-traditional markets.