

# **Comparative Advantage of Fruit Exports in Sri Lanka**

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## FOREWORD

Calculations related to food security and sovereignty necessarily take into account matrices of availability and affordability. The more nuanced of analyses that draw from such data inevitably consider the vexed issue of entitlements, relevant mismatches and the political economy within which all these are framed.

While much has been written on post-harvest loss and food-waste, both which bear upon such issues, an area which seems to have been largely neglected is that of food sources that are not used or are under-utilised. There's much information on vegetables and fruit that make their way to outlets, especially supermarkets and fairs, but very little on the rich yield that is typical of a country like Sri Lanka — leafy greens, less-advertised vegetables, yams, medicinal plants and tropical fruit. Unexplored potential, therefore, is a vast subject.

Not all that is unexplored resides on the earth, below and above it, so to speak. This study delves into an important area with considerable and yet unfulfilled potential, the development of the fruit exporting industry. It is an important policy-related intervention by the Hector Kobbekaduwa Agrarian Research and Training Institute in the context of the institute's preferred focus on domestic processes related to production, processing and consumption. In other words it is an important departure which in the first instance recognises the realities of global processes and the necessity to address these when formulating agricultural policy.

The research team, in this study, has comprehensively assessed competitiveness of fruit exports using relevant comparative advantage indices, a necessary preliminary exercise to ensure that correct conclusions are drawn and are thereafter taken into account when designing policy.

Considering that fruit exports account for less than 0.3% of total exports, the potential for improvement is obvious. It is important also to orient exports towards the correct competencies in order to enhance competitiveness in the global markets.

The study covers important new ground in the literature and provides rich empirical information. Moreover, it provides a template which would be of much benefit to further exploration of the potential for fruit exports, especially those fruits that are yet to enter the export matrix, consequent of course to a comprehensive enumeration and mapping of the same.

**Dr. G.G. Bandula**  
**Director/CEO**

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**E.A.C. Priyankara**  
**N.P.G. Samantha**  
**Virajith Kuruppu**

## EXECUTIVE SUMMARY

Global competition for agricultural products in the future is on the rise, as evidenced by the number of global level trade pacts and agreements coming into force, with no exception for fruit exports, particularly from developing countries like Sri Lanka. Almost 90 per cent of the processed products are exported to the European market. United Arab Emirates, Saudi Arabia, Qatar, Maldives, India, and the U.K. Kuwait, Germany, and Pakistan are the top fruit and vegetable importing countries from Sri Lanka. Therefore, fruit exports should be oriented towards the right competencies for competing in the global trade arena.

In this context, the study is aimed at assessing Sri Lanka's international competitiveness in fruit exports (eight types) in the world market by comparing the results across countries, regions and time. This study accounts for the determinants of the comparative advantage of fruit exports by applying a range of revealed comparative advantage indices i.e., Balassa's Revealed Comparative Advantage Index (BRCA), Vollarth Revealed Comparative Advantage Index (VRCA), Revealed Systematic Comparative Advantage Index (RSCA), Normalized Revealed Comparative Advantage (NRCA), and Additive Revealed Comparative Advantage Index (AI).

The study found that 22 of 65 papaw exporting countries and 19 of 90 pineapple exporting countries gain the international competitiveness and Sri Lanka also has the comparative advantage of exporting only those crops. Sri Lanka does not have comparative advantage in exporting avocado, banana, cashew, lime and lemon, mango, and orange. Sri Lanka's position among its competitors in fruit export, is ninth in papaw and 12<sup>th</sup> in pineapple. A trend analysis reported that Sri Lanka has a significant upward trend of comparative advantage for papaya, but not for pineapple. It is also negative for exporting avocado, banana, and mango, a positive significant trend prevails for comparative advantage. In terms of product mapping, many countries in the group do not show international competitiveness and trade surplus, and most of these countries have not moved into any group during the studied four sub-periods. The results indicate that GDP per capita, capital-labour ratio, government expenditure, and foreign direct investment positively and significantly influence revealed comparative advantage.

**Keywords:** *Competitiveness, Fruit exports, Product Mapping, Revealed Comparative advantage, Specialization, Trade Balance*

# CONTENTS

	Page No
<b>FOREWORD</b> .....	<b>i</b>
<b>ACKNOWLEDGEMENTS</b> .....	<b>ii</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>iii</b>
<b>CONTENTS</b> .....	<b>iv</b>
<b>LIST OF TABLES</b> .....	<b>viii</b>
<b>LIST OF FIGURES</b> .....	<b>ix</b>
<b>Page No.</b> .....	<b>ix</b>
<b>LIST OF MAPS</b> .....	<b>xi</b>
<b>Page No.</b> .....	<b>xi</b>
<b>LIST OF ABBREVIATIONS</b> .....	<b>xiii</b>
<b>CHAPTER ONE</b> .....	<b>1</b>
<b>Introduction</b> .....	<b>1</b>
1.1 Background.....	1
1.2 Research Problem and Justification .....	3
1.3 Significance of the Study .....	3
1.4 Research Questions .....	4
1.5 Objectives .....	4
1.6 Contribution of the Study.....	4
1.7 Chapter Outline .....	4
<b>CHAPTER TWO</b> .....	<b>7</b>
<b>Literature Review</b> .....	<b>7</b>
2.1 Introduction.....	7
2.2 Theories .....	7
2.2.1 Classical Theory of International Trade.....	7
2.2.2 Neoclassical Trade Theory.....	11
2.2.3 Post- Heckscher-Ohlin Trade Theories .....	15
2.3 Measures of Comparative Advantage.....	20
2.4 Empirical Studies .....	20
2.4.1 Changing patterns of the comparative advantage across countries.....	21
2.4.2 Changing patterns of the comparative advantage over the period .....	21
2.4.3 Shift in comparative advantage between sectors and commodities.....	22
2.4.4 Determinants of Comparative Advantage .....	23
<b>CHAPTER THREE</b> .....	<b>27</b>
<b>Methodology</b> .....	<b>27</b>
3.1 Introduction.....	27
3.2 Data Collection .....	27

3.3	Comparative Advantage Indices.....	27
3.4	Data Analysis .....	31
3.4.1	State and Level of Comparative Advantage .....	31
3.4.2	Changes in Comparative Advantage over the Period .....	32
3.4.3	Comparative Advantage across the Countries.....	32
3.4.4	Product Mapping.....	32
3.4.5	Determinants of Comparative Advantage .....	33
<b>CHAPTER FOUR .....</b>		<b>35</b>
<b>Overview of Fruit Trade in the Asian Region .....</b>		<b>35</b>
4.1	Introduction.....	35
4.2	International Trade in Asia .....	35
4.2.1	Trade of Avocado .....	35
4.2.2	Trade of Banana .....	36
4.2.3	Trade of Cashew.....	38
4.2.4	Trade of Lime and Lemon.....	39
4.2.5	Trade of Mango .....	41
4.2.6	Trade of Orange.....	42
4.2.7	Trade of Papaya.....	44
4.2.8	Trade of Pineapple .....	45
4.3	International Trade of Fruits in Sri Lanka.....	47
4.4	Chapter Summary.....	51
<b>CHAPTER FIVE .....</b>		<b>53</b>
<b>State and the Level of Comparative Advantage.....</b>		<b>53</b>
5.1	Introduction.....	53
5.2	Comparative Advantage and Disadvantage Countries .....	53
5.2.1	Avocado.....	53
5.2.2	Banana.....	58
5.2.3	Cashew .....	63
5.2.4	Lime and Lemon .....	67
5.2.5	Mango.....	72
5.2.6	Orange .....	76
5.2.7	Papaw .....	81
5.2.8	Pineapple.....	86
5.3	Level of Comparative Advantage .....	91
5.3.1	Avocado .....	91
5.3.2	Banana .....	97
5.3.3	Cashew .....	102
5.3.4	Lime and Lemmon .....	107
5.3.5	Mango.....	112
5.3.6	Orange .....	117
5.3.7	Papaw .....	123
5.4	Ranking of Countries .....	135
5.4.1	Avocado.....	135
5.4.2	Banana.....	135

5.4.3	Cashew .....	135
5.4.4	Lime and Lemon .....	136
5.4.5	Mango.....	136
5.4.6	Orange .....	137
5.4.7	Papaw .....	137
5.4.8	Pineapple.....	137
<b>CHAPTER SIX .....</b>		<b>139</b>
<b>Patterns of Comparative Advantage .....</b>		<b>139</b>
6.1	Introduction.....	139
6.2	Trend Analysis .....	139
6.2.1	Avocado.....	139
6.2.2	Banana.....	140
6.2.3	Cashew .....	140
6.2.4	Lime and Lemon .....	141
6.2.5	Mango.....	142
6.2.6	Orange .....	143
6.2.7	Papaw .....	143
6.2.8	Pineapple.....	144
6.3	Product Mapping.....	150
6.3.1	Avocado.....	150
6.3.2	Banana.....	153
6.3.3	Cashew .....	157
6.3.4	Lime and Lemon .....	161
6.3.5	Mango.....	165
6.3.6	Orange .....	168
6.3.7	Papaw .....	172
6.3.8	Pineapple.....	177
<b>CHAPTER SEVEN .....</b>		<b>181</b>
<b>Determinants of Comparative Advantage .....</b>		<b>181</b>
7.1	Introduction.....	181
7.2	Papaw .....	181
7.3	Pineapple.....	182
<b>CHAPTER EIGHT.....</b>		<b>185</b>
<b>Conclusion and Policy Implications .....</b>		<b>185</b>
8.1	Conclusion .....	185
8.2	Main Findings .....	185
8.2.1	Avocado.....	185
8.2.2	Banana.....	186
8.2.3	Cashew .....	187
8.2.4	Lime and Lemon .....	187
8.2.5	Mango.....	188
8.2.6	Orange .....	188
8.2.7	Papaw .....	189

8.2.8 Pineapple.....	189
8.3 Policy Implications.....	190
Reference .....	192

## LIST OF TABLES

	Page No.
Table 4.1: Import, Exports, Trade Balance and Export Share of Avocado .....	36
Table 4.2: Import, Exports, Trade Balance and Export Share of Banana .....	37
Table 4.3: Import, Exports, Trade Balance and Export Share of Cashew .....	39
Table 4.4: Import, Exports, Trade Balance and Export Share of Lime and Lemon.....	40
Table 4.5: Import, Exports, Trade Balance and Export Share of Mango .....	42
Table 4.6: Import, Exports, Trade Balance and Export Share of Orange.....	43
Table 4.7: Import, Exports, Trade Balance and Export Share of Papaya .....	45
Table 4.8: Import, Exports, Trade Balance and Export Share of Pineapple .....	46
Table 5.1: Summary Table of Sri Lanka Comparative Advantage or Disadvantage on Selected Fruits.....	91
Table 5.2: Mean, Maximum and Minimum Comparative Advantage Scores of Avocado, 2000-2019 (NRCA values in $10^{-7}$ , AI values in $10^{-3}$ ) .....	94
Table 5.3 Mean, Maximum and Minimum Comparative Advantage Scores of Banana, 2000-2019 (NRCA values in $10^{-7}$ , AI values in $10^{-3}$ ) .....	99
Table 5.4: Mean, Maximum and Minimum Comparative Advantage Scores of Cashew, 2000-2019 (NRCA values in $10^{-7}$ , AI values in $10^{-3}$ ) .....	104
Table 5.5: Mean, Maximum and Minimum Comparative Advantage Scores of Lime and Lemon, 2000-2019 (NRCA values in $10^{-7}$ , AI values in $10^{-3}$ ).....	109
Table 5.6: Mean, Maximum and Minimum Comparative Advantage Scores of Mango, 2000-2019 (NRCA values in $10^{-7}$ , AI values in $10^{-3}$ ).....	114
Table 5.7: Mean, Maximum and Minimum Comparative Advantage Scores of Orange, 2000-2019 (NRCA values in $10^{-7}$ , AI values in $10^{-3}$ ) .....	120
Table 5.8: Mean, Maximum and Minimum Comparative Advantage Scores of Papaw, 2000-2019 (NRCA values in $10^{-7}$ , AI values in $10^{-3}$ ).....	126
Table 5.9: Mean, Maximum and Minimum Comparative Advantage Scores of Pineapple, 2000-2019 (NRCA values in $10^{-7}$ , AI values in $10^{-3}$ ).....	132
Table 6.1: Summary of Sri Lanka trend of the selected fruits .....	145
Table 6.2: Trend Analysis 2000-2019.....	146
Table 7.1: Statistics of variance inflation factor (VIF).....	181
Table 7.2: FGLS Results of Papaw .....	182
Table 7.3: Statistics of variance inflation factor (VIF).....	183
Table 7.4: FGLS Results of pineapple.....	183

## LIST OF FIGURES

	Page No.
Figure 2.1: Neoclassical Gains from Trade (Home Country) .....	11
Figure 2.2: Consumption Gain and Production Gain from Trade.....	13
Figure 3.1: Flying Gees Path .....	33
Figure 4.1: Top 10 Fruit Exporting Countries from Sri Lanka (2015 - 2018).....	47
Figure 4.2: Average Export Growth of Fruit and Vegetable Export Sector of Sri Lanka (2015 - 2018) .....	48
Figure 4.3: Export Values by Fruit Category (2000 - 2019) .....	49
Figure 4.4: Import Values by Fruit Category (2000 - 2019).....	50
Figure 4.5: Trade Balance by Fruit Category (2000 - 2019).....	50
Figure 4.6: Export Share by Fruit Category (2000 - 2019).....	51
Figure 6.1 : Product Mapping of Avocado 2000 – 2004.....	150
Figure 6.2: Product Mapping of Avocado 2005 – 2009.....	151
Figure 6.3: Product Mapping of Avocado 2010 – 2014.....	152
Figure 6.4: Product Mapping of Avocado 2015 – 2019.....	153
Figure 6.5: Product Mapping of Banana 2000-2004 .....	154
Figure 6.6: Product Mapping of Banana 2005-2009 .....	155
Figure 6.7: Product Mapping of Banana 2010-2014 .....	156
Figure 6.8: Product Mapping of Banana 2015-2019 .....	157
Figure 6.9: Product Mapping of Cashew 2000 – 2004 .....	158
Figure 6.10: Product Mapping of Cashew 2005– 2009 .....	159
Figure 6.11: Product Mapping of Cashew 2010– 2014 .....	160
Figure 6.12: Product Mapping of Cashew 2015– 2019 .....	161
Figure 6.13: Product Mapping of Lime and Lemon 2000– 2004.....	162
Figure 6.14: Product Mapping of Lime and Lemon 2005– 2009.....	162
Figure 6.15: Product Mapping of Lime and Lemon 2010– 2014.....	163
Figure 6.16: Product Mapping of Lime and Lemon 2015– 2019.....	164
Figure 6.17: Product Mapping of Mango 2000-2004.....	165
Figure 6.18: Product Mapping of Mango 2005-2009.....	166
Figure 6.19: Product Mapping of Mango 2010-2014.....	167

Figure 6.20: Product Mapping of Mango 2015-2019 .....	167
Figure 6.21: Product Mapping of Orange 2000– 2004.....	169
Figure 6-22: Product Mapping of Orange 2005– 2009.....	170
Figure 6.23: Product Mapping of Orange 2010– 2014.....	171
Figure 6-24: Product Mapping of Orange 2015– 2019.....	172
Figure 6-25: Product Mapping of Papaw 2000– 2004.....	173
Figure 6.26: Product Mapping of Papaw 2005– 2009.....	174
Figure 6.27: Product Mapping of Papaw 2010– 2014.....	175
Figure 6-28: Product Mapping of Papaw 2015– 2019.....	176
Figure 6.29: Product Mapping of Pineapple 2000-2004 .....	177
Figure 6.30: Product Mapping of Pineapple 2005-2009 .....	178
Figure 6.31: Product Mapping of Pineapple 2010-2014 .....	179
Figure 6.32: Product Mapping of Pineapple 2015-2019 .....	180

## LIST OF MAPS

	Page No.
Map 5 - 1: Avocado BRCA Index .....	54
Map 5 - 2 Avocado Vollrath RCA Index .....	55
Map 5 - 3 Avocado RSCA Index .....	55
Map 5 - 4 Avocado NRCA Index.....	56
Map 5 - 5: Avocado AI Index.....	57
Map 5 - 6: Avocado overall comparative advantage and disadvantage .....	57
Map 5 - 7: Banana BRCA Index .....	59
Map 5 - 8: Banana Vollrath RCA Index .....	60
Map 5 - 9: Banana-RSCA Index .....	60
Map 5 - 10: Banana-NRCA Index .....	61
Map 5 - 11: Banana-AI Index .....	62
Map 5 - 12: Banana-Overall Comparative Advantage and disadvantage .....	63
Map 5 - 13: Cashew BRCA Index.....	64
Map 5 - 14 : Cashew Vollrath RCA Index.....	64
Map 5 - 15 : Cashew RSCA Index .....	65
Map 5 - 16 : Cashew NRCA Index .....	66
Map 5 - 17: Cashew AI Index .....	66
Map 5 - 18 : Cashew- Overall Comparative Advantage and disadvantage .....	67
Map 5 - 19: Lime and Lemon BRCA Index .....	68
Map 5 - 20: Lime and Lemon Vollrath RCA Index.....	69
Map 5 - 21: Lime and Lemon RSCA Index.....	69
Map 5 - 22: Lime and Lemon NRCA Index .....	70
Map 5 - 23: Lime and Lemon AI Index.....	71
Map 5 – 24: Lime and Lemon- Overall comparative advantage and disadvantage.....	72
Map 5 - 25: Mango BRCA Index.....	73
Map 5 - 26: Mango Vollrath RCA Index .....	73
Map 5 - 27: Mango RSCA Index .....	74
Map 5 - 28 : Mango NRCA Index .....	75
Map 5 - 29: Mango AI Index .....	75
Map 5 - 30: Mango - Overall comparative advantage and disadvantage .....	76
Map 5 - 31: Orange BRCA Index .....	77
Map 5 - 32: Orange Vollrath RCA Index.....	78

Map 5 - 33: Orange RSCA Index.....	78
Map 5 - 34: Orange NRCA Index.....	79
Map 5 - 35: Orange AI Index.....	80
Map 5 - 36: Orange - Overall comparative advantage and disadvantage.....	81
Map 5 - 37: Papaw BRCA Index .....	81
Map 5 - 38: Papaw Vollrath RCA Index.....	82
Map 5 - 39: Papaw RSCA Index.....	83
Map 5 - 40: Papaw NRCA Index.....	83
Map 5 - 41: Papaw AI Index.....	84
Map 5 - 42: Papaw-Overall comparative advantage and disadvantage.....	85
Map 5 - 43: Pineapple BRCA Index .....	86
Map 5 - 44: Pineapple Vollrath RCA Index .....	87
Map 5 - 45: Pineapple RSCA Index .....	87
Map 5 - 46: Pineapple NRCA Index.....	88
Map 5 - 47: Pineapple AI Index.....	89
Map 5 - 48: Pineapple- Overall comparative advantage and disadvantage .....	90

## LIST OF ABBREVIATIONS

AI	-	Additive Index
ASEAN	-	Association of South East Asian Nation
BRCA	-	Balassa's Revealed Comparative Advantage
CA	-	Comparative Advantage
CMS	-	Constant Market Share
CPF	-	Consumption Possibility Frontier
DRC	-	Domestic Resource Cost
EU	-	European Union
F	-	Fruit
FAO	-	Food and Agriculture Organization
FDI	-	Foreign Direct Investment
FGLS	-	Feasible Generalized Least Squares
GDP	-	Gross Domestic Product
MARDI	-	Malaysian Agricultural Research and Development Institute
MRS	-	Marginal Rate of Substitution
MU	-	Marginal Utility
NPC	-	Nominal Protection Coefficient
NRCA	-	Normalized Revealed Comparative Advantage
OLS	-	Ordinary Least Square
PCT	-	Product Life Cycle Theory
PPF	-	Production Possibility Frontier
RCA	-	Revealed Comparative Advantage
RSCA	-	Revealed Symmetric Comparative Advantage
SA	-	South Africa
SUR	-	Seemingly Unrelated Regressions
TBI	-	Trade Balance Index
TEU	-	Twenty-Foot Equivalent Unit
TOT	-	Terms of Trade
UAE	-	United Arab of Emirates
UNCTAD	-	United Nations Conference on Trade and Development

USA	-	United States of America
V	-	Vegetable
VIF	-	variance inflation factor
VRCA	-	Vollrath's Revealed Comparative Advantage
WTO	-	World Trade Organization

# CHAPTER ONE

## Introduction

### 1.1 Background

Trade has rapidly evolved over the decades due to its dynamic nature and relative importance in the global economy. Many nations around the globe fully or partially opened up their borders for international trade to accelerate economic growth and cater to the needs of the population. This has been evident in many ways and is best exemplified in terms of importation and exportation between countries (Vixathep, 2008). With this, global competition for trade has been initiated. Therefore, nations exert efforts to build and maintain the right competencies. Various theories and measures have been developed with increased interest on trade between borders to ensure sustainability (Poth, 2014). One such theory is Comparative Advantage (CA) theory. It simply can be defined as the production of goods and services for a lower opportunity cost than the other. A nation could easily have a trade-off worth it with comparative advantage. Four broad reasons that mainly generate comparative advantage are technological superiority, resource endowments, demand patterns and commercial policies (Gupta, 2015). This enables countries to turn basic trade into a proper commercialized trade and trigger lagging economies through demand stimulus. Hence, CA crafts the path for higher economic potentials even in fully employed economies.

According to the World Shipping Council, Sri Lanka is identified as one of the active trading hubs in the Asian region. Colombo Port has been ranked within the top 50 container ports in the world with a total volume of 7.05 million TEU<sup>1</sup>. Throughout history, Sri Lanka played a pivotal role in the trading process, thus, attracting many foreign nations. As a result, the economy of the country gradually shifted from a self-sufficiency to export-import economy (Hettiarachchi, 2018). Three distinct policy changes were visible in Sri Lanka, two directing on liberalizing reforms and the other on protectionism. However, prior to these three policy reforms, Sri Lanka followed a state-led import substitution strategy which was more inward-oriented (Kaminski and Francis, 2013). Hence, Sri Lanka has experienced several types of trade policy regimes. With these reforms, notable structural changes have also taken place in the economy, and the best example is the drastic reduction of relative importance (from 30% in 1960 to less than 10% in 2015) in the contribution of the agriculture sector to the GDP (Athukorala et al., 2017). Currently, the total export earnings of the country are comprised of industrial exports (79%) and agricultural exports (21%). Total import expenditure is included intermediate goods (57%), investment goods (23%) and the rest from consumer goods (Central Bank of Sri Lanka, 2019).

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<sup>1</sup> TEU stands for Twenty-Foot Equivalent Unit which can be used to measure a ship's cargo carrying capacity. The dimensions of one TEU are equal to that of a standard 20' shipping container. 20 feet long, 8 feet tall.

Hence, agricultural exports represent a considerable portion of the total exports in Sri Lanka. Major agricultural exports comprise tea, rubber, coconut, spices, vegetables, fruits, seafood and other minor crops. In 2019, Sri Lanka earned a total of US \$ 2,462 million from agricultural exports. More than 50% of the total agricultural export value is generated from tea and it is also the second-largest contributor to the total export earnings of the country having a fair potential in exports (Central Bank of Sri Lanka, 2019).

Further, it is evident that contributions of major export crops to export earnings of Sri Lanka are slowly diminishing, while minor export crops are increasingly providing significant contributions to earnings. In view of the significant contributions made by minor export crops to the Sri Lankan economy, it is rather surprising that there has been no clear evidence in recent studies to identify the comparative competitive position of minor export crops in Sri Lanka (Sachitra and Chong, 2015). Moreover, processed food and beverages, spices and concentrates are among the six focus sectors for innovation and export diversification under the Export Development Board (EDB) export development vision of Sri Lanka: *An export hub driven by innovation and investment, selected under the national export strategy of Sri Lanka 2018-2022* (Sri Lanka Export Development Board, 2018).

Regarding food and beverages, it is one of the fastest growing local industries, with more than 110 manufacturing and marketing companies involved. The industry's export value was over \$250m in 2018, representing about 2.2% of total exports. It employs more than two million people and comprises approximately 40% of micro, small and medium-sized enterprises (Oxford Business Group, 2021). Further, Sri Lanka has a favourable demand in the international fresh fruit and vegetable (F and V) export market, and export earnings have increased over time. However, due to high concentrations of F and V export products and depending on a limited number of markets, export revenue is susceptible to fluctuation over the years. Sri Lanka's F and V exports are mainly limited to the top three to five products and around five to ten export destinations. Therefore, introducing new products and entry into new markets is vital for F and V export growth as Sri Lanka F and V sector growth has taken place with increasing real value of existing F and V products and markets and contribution of new products and new products and new markets is very less (Perera et al., 2015).

Fruits and vegetable exports account for about 0.3% per cent of the total exports of the country (Sri Lanka Export Development Board, 2019). Sri Lanka exported 38,896 metric tons of fresh fruit, worth US dollars 41.1 million during 2019 (Central Bank of Sri Lanka, 2019). Sri Lanka exports fresh and processed fruits and vegetables, and 65 per cent of the fresh products are targeted at the Middle East and the Maldivian markets. Almost 90 per cent of the processed products are exported to the European market. United Arab Emirates, Saudi Arabia, Qatar, Maldives, India, U.K. Kuwait, Germany, and Pakistan are the top fruit and vegetable importing countries of Sri Lanka (Sri Lanka Export Development Board, 2019).

Therefore, exports should be oriented towards the right competencies in order to compete in the global trade arena. Without identifying the comparative advantages of the export commodities, it is hard to set strategies for developing the export industry. In addition, long-term strategic goals like export diversification should be aligned accordingly. If not, the sustainability of the export industry might get affected by the dynamic nature of the sector. In light of this, conducting research work on exploring the CA and assessing the level of performance in the export of fruit commodities is of utmost importance and timely valuable as there is no clear empirical evidence in Sri Lanka regarding the sources of competitive advantage of agricultural crops which calls studies to bridge the gap (Sachitra and Chong, 2015).

## **1.2 Research Problem and Justification**

The export industry in Sri Lanka is encountering numerous issues due to a lack of focus and inherent weaknesses, resulting in continuous deterioration in international trade. Some major aspects of this issue are limited awareness of export category wise prioritization of the sectors which have a comparative advantage over others and also stagnation within the traditional rooted practices related to international trade (Sachithra et al., 2014). Thus, the country's export performance has been downgraded and has not been at a satisfactory level since 2000. Further, continuous trade deficits over the years illustrate a poor growth rate in the export sector (Velnampy and Achchuthan, 2013). It is also highlighted that the country's two leading exports are not even among the top ten product categories trade in the world. However, when considering the other Asian countries, their top exports are at least within the top five product categories traded in the world (Verité Research, 2017).

Since most of the agricultural exports in Sri Lanka are limited to primary commodities, vulnerability to sudden external shocks is frequent and severe. Therefore, exploring the level of CA is important to understand to make a sensible export strategy. Identifying the level of CA for commodities is pivotal since it directly impacts the decisions related to product specialization and building foreign trade relations. This also enhances the trade of tradable goods (Gallardo, 2005). On the other hand, it is identified that growth in export sector tremendously determines the growth in production and employment of the country.

## **1.3 Significance of the Study**

International competitiveness is one of the most important topics in the economic and management literature, and it has traditionally been at the core of the agenda of academics, policymakers and practitioners in general. This has also been highlighted in the national policy programmes and agendas. Hence, the export industry is considered as one of the key sectors for foreign gains. It is also reported Sri Lanka has lost traditional international markets for its agricultural products; hence, investigating the reasons for such changes is important to identify the underlying causes. In light of that, it is questionable how competitive Sri Lanka is in the world market and its rivalry in the international arena (Sri Lanka Council for Agricultural Research Policy, 2017).

Therefore, researching comparative advantage related to agricultural export is a key national need. The present government has developed an agricultural policy framework of “People-Centric Economy” with “Vistas of Prosperity and Splendor 2020” with a goal of modernizing Sri Lankan Agriculture. It also identifies the importance of revolutions in using lucrative income from export crops.

#### **1.4 Research Questions**

- i. What is the level of comparative advantage/disadvantage of fruit exports?
- ii. What is the trend of comparative advantage/disadvantage of fruit crops over the period?
- iii. Who are the major competitors of Sri Lankan fruit crops with higher comparative advantage in the world market?
- iv. What are the contributing factors behind the comparative advantage/disadvantage of fruit exports?

#### **1.5 Objectives**

##### ***Overall Objective***

To assess the comparative advantage of export of fruit in Sri Lanka, to measure the level of comparative advantage, identify major competitors of Sri Lanka in the international fruit trade and explore possible potentials.

##### ***Specific Objectives***

- i. To calculate and determine the level of comparative advantage of fruit crops.
- ii. To investigate the trends and patterns of comparative advantage of fruit crops.
- iii. To determine the major competitors for Sri Lanka’s fruit crops.
- iv. To identify the contributing factors behind comparative advantage/disadvantage of fruit crops.

#### **1.6 Contribution of the Study**

The extensive empirical literature review offers evidence that debate on comparative advantage, its patterns and trends, and determinants in the case of agricultural commodities still going on, and researchers could not come to a common agreement on the matters. At the same time, available empirical studies have rarely considered the Sri Lankan context. Therefore, the current study aims at bridging the gap and makes a comprehensive study.

#### **1.7 Chapter Outline**

This study flows through eight chapters. Following the introduction, second and third chapters are devoted to the literature review and research methodology, respectively.

The fourth chapter is dedicated to a brief discussion about the fruits export economy of the Asian region as well as of Sri Lanka. Chapters 5, 6 and 7 are allocated for the data analysis section of this research. Accordingly, chapter 5 is for the state and the level of comparative advantage in all eight fruits crops. It investigates the countries having comparative advantage/disadvantage, the level of comparative advantage and the countries' position in the world market. Chapter 6 is for changes in comparative advantage over time and across the countries and the patterns of comparative advantage. Chapter 7 is devoted to the investigation of the determinants of revealed comparative advantage. Conclusions, main findings and policy implications have been outlined in chapter 8.



## CHAPTER TWO

### Literature Review

#### 2.1 Introduction

This section reviews theories of international trade in the literature, measures of comparative advantage, and empirical studies. Literature review reveals that various theories have been introduced to explain international trade. *'The Theory of Absolute Advantage'* is the first theory in international trade coined by Adam Smith in 1776, the father of modern economics (Bozduman and Erkan, 2018; Verter, 2015). Since Adam Smith, many developments to the international trade theory have been made. Various such theories are Comparative Advantage Theory, The Heckscher – Ohlin Theorem (H-O model), Country Similarity Theory, International Product Life Cycle Theory, Intra-Industry Trade, the New Trade Theory (NTT), the Gravity Model of Trade, and New 'New Trade' Theory. The introduction of international trade theories has a long history, and as of today, there are rich theories that explain trade between countries. However, empirical testing of international trade theories was an important question among economists. Answering the question, about half a century ago, a seminal paper by an eminent scholar, Balassa (1965), proposed the first use of 'Revealed Comparative Advantage' (RCA). Since then, many developments to Balassa's model have been introduced while many new measures of international trade were also developed. A rich empirical literature also has been built through the application of those measures.

#### 2.2 Theories

##### 2.2.1 Classical Theory of International Trade

###### 1. Absolute Advantage Theory

Adam Smith in 1776 introduced the theory of absolute advantage, which is a process in which an individual or country can produce a specific product at a lower cost than another country. This is the first attempt to explain why countries engage freely in international trade (Krugman and Obstfeld, 2003; Smit, 2010). This theory explains that a country can enhance its prosperity if it specializes in producing goods and services with an absolute cost advantage over other countries and imports those with an absolute cost disadvantage (Smit, 2010). This theory explains why countries, through imports, can increase their welfare by simultaneously selling goods and services in international markets (Smit, 2010). Adam Smith thus viewed trade as a positive-sum game, and it was in direct contrast to the viewpoint of the mercantilists of the 16th century that trade is a zero-sum game (Smit, 2010). If a country involves international trade, it must be specialized in producing goods, which has an absolute advantage over another (Verter, 2015). The *Absolute Advantage Theory* explains how international trade can take place assuming that a labour theory of value is employed, which means that goods exchange for each other at home in proportion to the relative

labour time embodied in them. Thus, the exchange ratios reflect the relative quantities of labour required to produce the goods in the countries. That is viewed as opportunity costs which are commonly identified as the price ratios in autarky. Hence, the country having less labour time earns the absolute advantage in producing the respective good (Appleyard & Field, 2014).

Absolute advantage theory defines the gains from trade. According to Smith's explanation, specialization in production of goods and services will lead to increased output (Verter, 2015). Thus, when the countries specialize and increase total output in their goods, international trade will benefit trading partners rather than producing each good domestically (Appleyard & Field, 2014). Further, he stated that 'Global Efficiency' in terms of utilization of available resources will increase because of the specialization. The home country can produce and export cheaper products than the other country and import other products produced by other countries at a lower cost (Verter, 2015). Thus, all countries participating in the international trade benefitted and added specialization for the products they produce at a cheaper cost. When theory introduced, it was initially very significant as Smith stated that trade is a positive-sum game and not a zero-sum game as argued by mercantilists (Appleyard & Field, 2014). In addition, Adam Smith stated that the sources of absolute advantage area unique set of natural resources (including climate) and capabilities that categorize a particular nation, transfer, accumulation, and adaptation of skills and technology game (Appleyard & Field, 2014).

## **2. Comparative Advantage Theory**

The economists admit that the international trade theory makes a significant contribution using the absolute advantage theory. However, economists claim that Adam Smith's absolute advantage theory becomes a paradox when one country has the absolute advantage for all goods and services over another country. If one country gained the absolute advantage for all products, it would not import because it could already produce more efficiently than other countries. Therefore, according to the absolutes advantage theory, some countries may exclude from the trade, hence gains from the trade. This paradox, i.e., absolute advantage leads to specialization. Still, such specialization not necessarily leads to gains from trade, which was answered by David Ricardo in 1817, who introduced Comparative Advantage Theory over absolute advantage theory (Smit, 2010).

In the Ricardian Model, the term "Comparative" is stated as relative, not certainly absolute (Widodo, 2009). Thus, Ricardo argues that countries must specialize in a product that has the highest output and lowest opportunity cost relatively compared with the trading partner. Thus, each country can gain a comparative advantage for the product with the highest production efficiency as long as there is a difference in cost of production among trading countries (Verter, 2015). Thus, the theory highlights that a nation can still export the goods or services with the highest comparative advantage and import goods and services with the least comparative advantage (Appleyard & Field, 2014; Widodo, 2009).

This implies that despite absolute cost disadvantages in producing goods and services, a country can still export those goods and services in which its absolute disadvantages are the smallest and import products with the largest absolute disadvantage. It also implies that a country with absolute cost advantages in all its products will specialize and export those products where the absolute advantage is the largest and will import products with the smallest absolute advantages.

However, the common question that arises concerning Ricardo's comparative advantage theory is, how it is possible for a country to be less efficient in the production of all products to export any of these products to another country that is more efficient in the production of all these products. The answer lies in the self-equilibrating nature of the trade balance between countries (Krugman, 1993). If the input cost is sufficiently lower in one country than in another, the price of the product will be lower in the low input cost country, even if that country is less efficient in the production of the product (Salvatore, 2002). Any deviations from equilibrium will automatically realign the exchange rate between the two countries to ensure a new trade equilibrium.

Ricardo's theory of comparative advantage is based on the labour theory of value (Salvatore, 2002). This implies that labour is the only production factor and that it is used in fixed proportions in the production of all products. The theory also assumes that labour is homogeneous (Salvatore, 2002). These unrealistic assumptions led to the incorporation of opportunity cost into explaining the theory of comparative advantage. Suppose the Ricardian theory of comparative advantage is redefined in terms of opportunity cost. In that case, a country will have a comparative advantage in producing goods and services if such goods and services can be produced at a lower opportunity cost. This implies that a country will have a comparative cost advantage in producing goods and services that can be produced at a lower opportunity cost than in other countries (Salvatore, 2002).

The Ricardian model can be represented in the Production Possibility Frontier (PPF) concept. According to the classical model in autarky, participating countries are producing and consuming on their production-possibility frontiers. Further, the constant-cost assumption denotes that the opportunity cost of production remains the same at various levels of production. The slope of PPF represents the opportunity cost of the economy-wide output, and the shift represents a graphical picture of the Ricardian model and escaping from the labour theory of value retaining the comparative advantage conclusions about the basis for trade. Whereas the slope of the PPF specifies the amount of production of one commodity must give up obtaining one additional unit of the other commodity. The calculations reflect the cost of all inputs that go into the production of the commodities (Appleyard & Field, 2014).

Ricardian model stressed that the gains from trade occur even if the country's production of goods is absolutely more or less efficient than the other countries. The relative prices with trade differ from relative prices in autarky, where the source of gains lies. But classical theory does not provide a satisfactory explanation for why the

production conditions differ between countries. Thus, the underlying cost differences can be identified that determine outside of the production system and the natural endowments of a country's resources. Moving further, Smith and his successors stated that the endowments influence things like entrepreneurship, labour skills and organizational capacity, which causes the production conditions across the countries (Appleyard & Field, 2014).

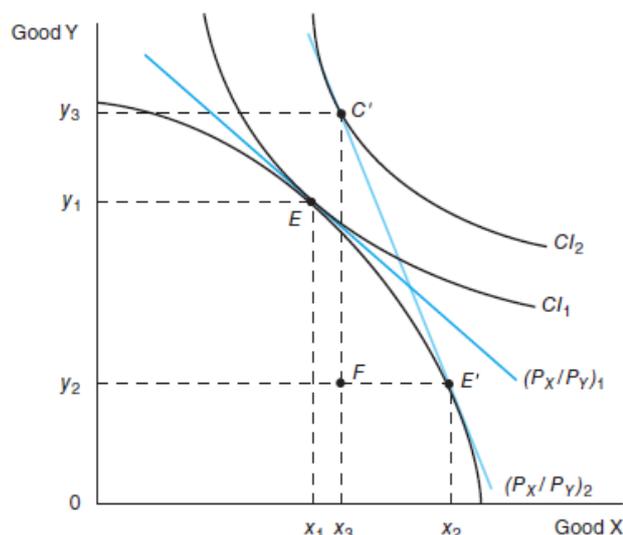
Although the theory of comparative cost advantage is based on a set of strict assumptions, this does not invalidate the general acceptance of the theory in explaining gains from trade (Krugman, 1990; Culbertson, 1986; Keasing, 1966; Vernon, 1979). This is furthermore underscored by the fact that most of the principles of the World Trade Organization (WTO) are based on the belief in the validity of the law of comparative advantage (Root, 2001). Even the relaxation of most of the assumptions does not affect the general validity of the theory in any significant way (Harkness 1983; Balassa, 1965), and enough empirical evidence exists to support the theory of comparative advantage (Bernhofen and Brown, 2004; Schott, 2004; Uchida and Cook, 2005; Krugman and Obstfeld, 2003). The superiority of the theory of comparative advantage lies in the remarkable amount of useful information that it summarizes clearly and concisely. According to Salvatore (2002: 91): "It shows the conditions of production, the autarky point of production and consumption, the equilibrium relative commodity prices in the absence of trade, the comparative advantage of each nation ... it also shows the degree of specialization in production with trade, the volume of trade, the terms of trade, the gains from trade, and the share of these gains to each of the trading nations." This power of the theory provides a convincing explanation for why trade is a positive sum game (Krugman, 1993a, 1993b, 1994a, 1994b, 1995, 1998).

Classical economists believe that it is a strong positive force derives to the development by foreign trade. Moreover, Adam Smith argued that export markets enable a country to use resource and otherwise would remain idle. The result of the full employment of a country will increase the level of economic activity and allow acquiring foreign goods to improve consumption and/or investment and growth. Ricardo and the subsequent classical economists argued that the benefits from trade gain not only from the employment of underused resources but also from the efficient use of domestic resources that specialized in production, according to the comparative advantage. Further, John Stuart Mill, an economist, pointed out that dynamic effects of trade were of critical importance for the economic development of a country besides the static gains from the reallocation of resources. Moreover, this included the ability to gain foreign capital and technology and the influence of trade and resource allocation for the accumulation of savings. On the other hand, more benefits that can be identified are countries that can contact other countries and cultures that may help break the blinding traditions and stimulate entrepreneurship, innovations, and inventions (Appleyard & Field, 2014).

Several common extensions for the Classical Ricardian model of trade have been developed by economist with time. Thus, relaxing the restrictive assumptions for the

full understanding of the forces impact world trade patterns. The basic Ricardian model was made more realistic by combining wage and exchange rates, analyzing trade in terms of money and prices. Moreover, for a thorough examination of the role of wages, productivity, and exchange rate influencing trade patterns and including a larger number of commodities, transportation costs, and more than two countries, the model has been further extended (Appleyard & Field, 2014).

### 2.1.2 Neoclassical Trade Theory



Source: Appleyard and Alfred J. Field, 2014

**Figure 2.1: Neoclassical Gains from Trade (Home Country)**

The neoclassical argument of gains from trade can be illustrated using the Figure 2-1. The point “E” in Figure 2.1 is the equilibrium of the country at autarky. Taking account of both supply and demand at point “E”, the country produces the quantity OY1 from the Goods Y and the quantity of OX1 from the Goods X. At the point “E”, the country reaches the highest possible community indifference curve (CI1). At point “E”, the slope of PPF represents the Marginal Rate of Transfer (MRT),  $(P_X/P_Y)_1$  represents the price at autarky, which is the relative price ratio, the slope of community indifference curve represents the marginal rate of substitution (MRS) which is the ratio of marginal utilities ( $M_{UX}/M_{UY}$ ). Therefore, at point “E” of PPF, the price line, and community indifference curve are tangent, and both producers and consumers are at equilibrium, fulfilling the following condition.

$$\mathbf{MRT=MCX/MCY=(PX/PY)_1=MUX/MUY=MRS}$$

Therefore, at the point “E”, neither producer nor consumer improves their welfare. It should be noted that without trade, the country’s consumption possibilities were confirmed by the PPF, and the PPF was also the Consumption Possibility Frontier (CPF). At the point “E”, the country is unable to attain a higher consumption possibility

represented by a higher indifference curve as in CI2 due to the given production constraint.

When the country faces international prices of  $(P_X/P_Y)_2$ , its slope is steeper than the  $(P_X/P_Y)_1$  at autarky. The new set of steeper price lines reflects that the relative prices at the home market are lower for Goods X and higher for Goods Y, which implies that the home country has the *comparative advantage in producing the Goods X and a comparative disadvantage in producing the Goods Y*. The differences in relative prices in the home country and set of international prices indicate that the home country in Figure 2-1 is relatively more efficient in producing X and relatively less efficient in producing Y. At this point, the producers face a higher relative price for X than it in autarky; therefore, they need to shift the production more towards the X and away from Y as they want to maximize the profit moving from point “E” to point “E1” in Figure 2-1. There is a motivation for producers to move from point “E” to “E1” because  $(P_X/P_Y)_2$  is higher than  $MC_X/MC_Y$  at point “E”. Therefore, new production is set as OY2 and OX2 (Appleyard and Alfred J. Field, 2014).

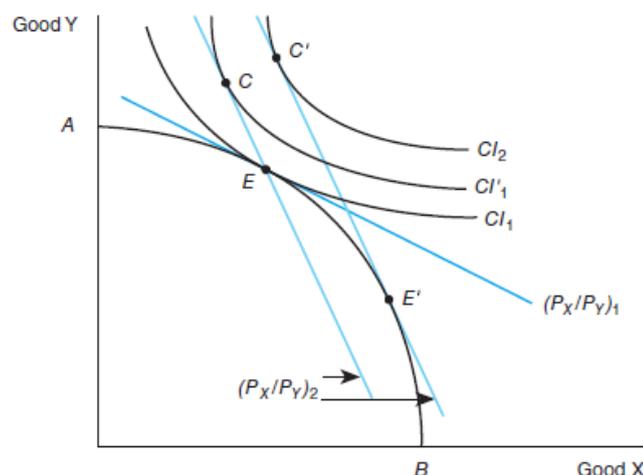
With regard to the consumption, since now the country is producing more quantities of X, the country can exchange units of X for units of Y in the world market at the new prevailing prices of  $(P_X/P_Y)_2$  and settle anywhere of the price line. Since the consumer chooses a consumption where indifference curve tangent with relative price line, according to the consumer behaviours theory, with trade, consumers can choose point C’ in figure 2-1. Therefore, at point C’ the consumers' well-being is maximized. At the point “E1”, the production of X is OX2, of which consumption is OX3 and export is X3X2. Similarly, the production of Y is equal to OY2, and consumption is OY3. The difference (Y2Y3) is imported. The country can settle anywhere on the price line by exchanging its X for Y in the world market. Hence, with trade and new relative prices, the production and consumption will adjust until,

$$\mathbf{MRT=MC_X/MC_Y=(P_X/P_Y)_2=MUX/MUY=MRS.}$$

According to Figure 2-1, the CPF represents the international price line different and above the PPF. This means that the trade permits a higher consumption combination that cannot be simply achieved by domestic production alone. Access to CPF benefits the country because consumption possibilities can be attained, which was not previously possible. Therefore, the new CPF allow the country to reach a higher community indifference curve, CI2.

Neoclassical economists summarize the trade pattern into a trade triangle, as shown in Figure 2-1, which is FC’E’. FE’ represent to the exports of the country. FC’ represents the imports of the country. C’E’ represent the trading line. Economists divide the gains from trade into two parts conceptually, namely (1) consumption gain or gain from exchange and (2) production gain or gain from specialization. In Figure 2-2, moving from point E to point C is due to consumption gain (or gain from the exchange), and

moving from point C to C' is due to production gain (or gain from specialization) (Appleyard and Alfred J. Field, 2014).



Source: Appleyard and Alfred J. Field, 2014

**Figure 2.2: Consumption Gain and Production Gain from Trade**

Neoclassical economists show two principal sources of relative price variation between two countries. (1) differences in supply conditions. (2) differences in demand conditions. They establish minimum conditions for trade, generating relative price differences in autarky. They first consider the role of demand, assuming identical production conditions, and second, the role of supply under identical demand conditions. Doing so, they show that trade between identical economies with different demand/supply patterns can be a source of gain and can be interpreted easily by neoclassical trade theory. At the same time, the classical model cannot explain why trade would take place because, with identical constant-opportunity cost PPFs, relative prices in the two countries would not differ (Appleyard and Alfred J. Field, 2014).

### Heckscher- Ohlin Theory

Up to this point, the international trade theorists prove that a country can gain from trade at any time if the terms of trade differ from its relative prices in autarky. And further, they demonstrated the basis for relative price differences leading to international trade that can be traced to differences in supply and/or demand conditions in two countries. The respective production possibilities frontiers and community indifference curves representing the source of differences in pre-trade price ratios among countries lie in the interaction of aggregate supply and demand. Hence, there is a basis for a trade whenever supply conditions or demand conditions vary between countries (Appleyard & Field, 2014).

The H-O model was developed by Eli Heckscher and Bertil Ohlin based on the Ricardian Model (Appleyard & Field, 2014). That is examining how different relative quantities of the trade of production can influence product price and produce a basis for trade,

and how the resulting trade will, in turn, affect factor prices and income distribution within the trading countries. The H-O theory provides a deeper understanding of the critical factors underlying relative cost differences and therefore, comparative advantage (Appleyard & Field, 2014). The assumptions made by Hechster and Ohlin are common to previous models. But two critical assumptions can be identified in explaining the emergence and structure of the trade. (1) factor endowments are different in each country, and (2) commodities are always an incentive in a factor irrespective of factor prices (Appleyard & Field, 2014).

As stated in H-O theory, different factor endowments refer to different relative factor endowments, but not different factor amounts, implying that factor proportions are different between countries. The theory specifies two-factor abundances as 'physical definition' and 'price definition'. The physical definition stands for the factor abundance in terms of physical units of two factors (the supply). Assuming two countries A, and B, whereas the ratio of capital to the labour of country -A goes over the ratio of capital to labour in the country- B, country-A recognised as a capital-abundant country, and country B recognized as a labour-abundant country  $[(K/L)_A > (K/L)_B]$ . The price definition indicates the relative prices of capital and labour to discover the type of factor abundance characterizing two countries. Therefore the country will be a capital-abundant country if  $(r/w)_A < (r/w)_B$  (Appleyard & Field, 2014).

In addition, the connection between the above definitions is greater the relative abundance of a factor is, the lower its relative price. However, the problem between these definitions is that the price of factors also reflects the structure of final demand and production technology employed without limiting the supply of a factor. Further, the H-O theory assumes taste, production technology, and preference are similar. The connection between the definitions is definite unless demand or technology differ between two countries (Appleyard & Field, 2014).

Commodity factor intensity is the second critical and strong assumption of the H-O theory, which implies at the movement not only that the two commodities have different factor intensities at common factor prices as well the difference takes for all possible factor price ratios in both countries, which indicates that at all possible factor prices, the capital/labour ratio is higher for the commodity that used more technology than for the other commodity. However, this will not exclude substituting capital for labour whenever the relative price of labour rises. Thus, that will change the labour/capital ratio in both commodities, and it will not cause the second commodity to use more capital relative to labour compared with the first commodity (Appleyard & Field, 2014).

In addition to the above critical assumptions, the H-O theory determines that a capital-abundant country exports capital-intensive goods and imports labour-intensive goods. And the opposite for labour-abundant countries. Thus, the H-O theory explains that differences in relative endowments are sufficient to generate the basis of trade, even though there are no differences in demand or labour conditions based on country (Appleyard & Field, 2014). Further, the H-O theory predicts that because relative

prices in autarky are different between two countries, a clear basis of trade results from the different factor endowments (Appleyard & Field, 2014).

According to the trade implications represented in H-O theory, it visualizes that when two countries open for trade, the international Terms of Trade (TOT) line that necessarily lies between the two internal price ratios as being flatter than the autarky price line of one country and steeper than the autarky price line of the another country which will lead to attaining higher indifference curve (Appleyard & Field, 2014). Moreover, the common equilibrium, TOT, will be determined between the autarky prices of both countries that in a higher indifference curve. When equilibrium occurs, other countries gain mutual gain from trade (Appleyard & Field, 2014).

Factor Price Equalization Theorem is also presented by the H-O theory while explaining the basis of trade. The theory explains that trade will expand until both countries experience the same relative factor prices. Demonstrating that trade would lead to an equalization of factor prices between trading partners, which is not limiting the pattern of trade based on initial endowments. Stolper and Samuelson (2014) introduced the Stolper-Samuelson Theorem to justify the income effect of tariffs, specifying that the H-O theory will lead to improvement of the income of abundant factor owners while the declining income of scarce factor owners. Hence, abundant resource factor owners will be 'free traders' while scarce factor owners are experiencing 'trade restrictions'.

### **2.2.3 Post- Heckscher-Ohlin Trade Theories**

#### **1. The Imitation Lag Hypotheses**

Relaxing the same technology assumptions in the H-O theory, Posner (1961) introduced Imitation Lag Hypothesis for international trade. Imitation lag and demand lag is a matters for the transfer of technology and know-how of the products from exporting countries to importing countries. Hence, to produce imported products at home, the importing country may acquire the technology and know-how of the imported products within some time (Appleyard & Field, 2014).

#### **2. The Product Cycle Theory**

Raymond Vernon (1966) developed the Product Life Cycle Theory (PCT) by relaxing several assumptions in traditional trade theories. It is based on limitation lag theory and its treatment of the role of time in the diffusion of technology. The life cycle of the product is divided by Vernon into main three stages as 1. New product stage 2. Maturing-product stage, and 3. Standardize-product stage. In the first phase, he states that developed countries invent new products and consume them only by developing countries. Further, firms close the markets to detect consumers' responses to products. Thus, there is no trade at this stage (Appleyard & Field, 2014).

In the second phase of the product life cycle, the general standards and characteristics begin to emerge, large-scale production technologies are adopted, and economies of

scale are realized. Since the Ricardian and H-O theories assumes constant returns of scale, they should be distinguished in PCT. Moving further, in the second stage, foreign demand for the product grows up where developed countries export its product to the developing countries. Thus, it can be identified trade patterns between high-income countries. Further, if the cost is in favour, an exporting country may be encouraged to invest in producing the exporting goods in developed countries.

In the third phase of the PCT, the product is familiar to consumers and the production process is well known by the producer. At this point, new products are invented by developed countries. As argued by Vernon, in this stage, production is shifted to the developing countries while labour cost plays an important role in the process. Hence, finally, developed countries may import from developing countries. Concluding the PCT, first, a country should domestically produce and consume before moving to other countries, and in the long-run, production and sales may be shifted to other countries. Hence, the theory suggests a dynamic comparative advantage as the country comparative advantage shifted through the life cycle (one country to another) (Appleyard & Field, 2014).

### **3. Vertical Specialization-Based Trade**

In different countries, any product, different production stages that can take place is the major idea stated by Vertical Specialization-based trade theory (Appleyard & Field, 2014; Hummels, Rapoport, & Yi, 1998). Further, this approach acknowledges that the comparative advantage may pertain to a part of the production process of a product rather than to the entire product. Thus, the theory describes a new aspect of internationalization that is discussed under global value chain management. The international movement of production and consumption of an entire product is examined by Vernon's PCT theory, whereas the Vertical Specialization-based Theory focuses on splitting the production process into several stages. Moreover, the production process is distributed in different developed and developing countries because the terms of capital and labour intensity may vary in various types of production stages. Thus, the key point is that countries acquire a comparative advantage in different stages of production and efficient coordination of the global supply chain system (Appleyard & Field, 2014).

### **4. Firm-Focused Theories**

The theories discussed so far are based on the characteristics of countries. However, certain theories are focused on firm-specific characteristics, such as Stage Theory by Johanson and Vahlne (1977), Resource Exchange Theory by Zacharakis (1997) and Network theory by Barbara et al. (2008).

The stage theory by Johanson and Vahlne (1977) states that internationalization is a gradual procedure of a firm that requires acquisition, integration, and knowledge about the foreign markets. Accumulating resources, earning excess capacities and accumulating resources can be identified when firms grow over time, directing the management for more efforts to exports. 'Entrepreneurial Learning' is highlighted by

stage theory that owners and managers develop intellectual capital used to develop resource allocation and internationalization strategies over time. In addition to that, exporting firms are larger, founded, and managed by old, more experienced managers (Appleyard & Field, 2014).

The resource-exchange theory by Zacharakis (1997) stated that since organizations could not generate all the required resources internally, they entered into the international relationship caused to exporting. According to the theory, it explained that firms must gather firm-level tangible and financial assets and intellectual resources that include individual characteristics such as growth orientation, management experience, knowledge, network, and command of foreign languages (Barbara, et al., 2008; Dhanaraj & Beamish, 2003). Further, the theory demonstrates the differences in export propensity relate to owners, managerial or entrepreneurial skills (Dhanaraj & Beamish, 2003). The resource-exchange theory does not believe that the acquisition of organizational resources proceeds linearly, which is a major deviation compared to the stage theory.

International new ventures are explained in the network theory (Barbara et al., 2008). The network theory claims that firms access strategic resources externally via interdependencies among network players. Thus, the theory aims at the cooperative relationship between partners at various stages in the supply chain in order with the ability of collaborations to speed the internationalization of firms (Jones, 1999; Barbara et al., 2008). Thus, the network theory is different from the above-mentioned firm-focused theories. Hence, the network theory challenges the argument that firms to participate in international trade should be large and well established with experienced management. In conclusion, the network theory argues that by finding experience and international expertise through networking, new firms will also be able to enter international trade (Appleyard & Field, 2014).

## **5. The Linder Theory**

Linder (1966) proposed the theory mentioning main two aspects. First, consumers are strongly conditioned concerning their income levels and secondly focus on manufacturing goods. Thus, the theory makes two departures from the H-O theory as, (1) exclusively demand-oriented, but H-O theory focuses on factor endowments, and factor intensities as it is supply oriented (2) considers only manufactured goods, where H-O theory is fully capable of explaining the international trade of primary goods (Appleyard & Field, 2014). The Linder theory explains that the international trade in manufactured goods will be more concentrated between countries having similar per capita income rather than countries with different per capita income levels. The theory has an important effect on international trade by identifying the base of trade. However, the theory does not identify the direction of trade, which cannot be recognized as an error, as the theory explains that trade might be for both sides. Or in other words, it explains that the same country is done both export and import. In contrast, such trade flow is not possible in the previous approaches as a country

experiencing comparative advantage and disadvantage over the same good. But this will be possible practically due to product differentiation (Appleyard & Field, 2014).

### **The New Trade Theory**

A new family of trade models indicating new trade theories in literature developed by Krugman (1979), Helpman and Krugman (1985) and Verter (2015). Krugman's model is considered the pioneered model in this section. According to Krugman, factor endowment or comparative advantage is essential. But theories don't effectively explain the pattern of trade. The main features that Krugman's model differentiates from other international trade models are *monopolistic competition* and *economies of scale*. In addition, Krugman believes that labour is the only factor in production. The economies of scale determine the amount of labour required to produce at a given output level. As economies of scale are to be doubled, the output requires an amount less than doubling the input (Appleyard & Field, 2014). Moving further, a monopolistic competition is a distinct feature in Krugman's model, whereas the trade models discussed up to now on perfect competition. Hence, zero profit for the firm, in the long run, differentiated products where advertising and sales strategies are used, easy entry and exit for firms to the industry, and products that are not homogeneous are some features that can be identified (Appleyard & Field, 2014).

Identical taste, characteristics of factors, and technology are the main features that assumed by Krugman in his model. According to the traditional trade theories, there is no incentive for trade for two countries with same general supply and demand conditions. However, Krugman argues that there is also an incentive for trade in these conditions. When two countries open up for trade, there are new potential buyers for any good; thus, the market size is enlarged for each firm in each country. In addition, production cost could be reduced, economies of scale will be there, and the consumers of both countries will be able to consume goods of both countries because of trade.

An increase in total consumption is a distinct feature explained in Krugman's model. As the total consumption increased, the firm's output increased. Thus, the unit cost gets reduced, and economies of scale will be there. An increase in product variety and consumer choice is also explained by Krugman, whereas there is similar trade between the countries, but products are differentiated. The model predicts an increase in real income; thus, increasing the well-being of all consumers is achievable in this model, which is impossible in H-O theory. Where H-O theory explains that a loss from trade will cause as the scarce factor of production. However, the Krugman model explains that a person will be able to gain higher real wage because of economies of scale and a high variety of goods because of product differentiation, which offset the loss as being a scarce factor.

### **The Reciprocal Dumping Model**

The Reciprocal Dumping Model is developed by James Brander (1981) and further extended by Brander and Paul Krugman (1983) (Appleyard & Field, 2014). This model

refers to price discrimination in the international market context as dumping. When the demand is more elastic in the international market than in the domestic market, price discrimination can be aroused. The model assumes that two countries as the home country and the foreign country, and the foreign firm is in the home country and the homogeneous goods. Hence, the barrier to trade and keeping the two markets separately is the transportation cost, an important feature identified by the Brander-Krugman model. Thus, when the transportation cost is too high to move the goods there is no motivation for trade, where all firms will produce for their home market and gain the benefits of monopoly. On the other hand, when the transportation cost between two countries not much high and the price in the foreign market exceeds the marginal cost of a unit of product in the home country and the transportation cost between the two countries, the home country will be able to sell in the foreign market. Similarly, if the opposite happens, a foreign country will be able to sell in the home market. Thus, a *duopoly market structure* emerges as two sellers are in the market. Hence, the price and the output level of other firms is considered by each firm when deciding price and the output level, which is the same as explained in the game theory. As concluded in the reciprocal dumping model, international trade for a homogeneous product must be exported and imported. These results occur as a result of an imperfectly competitive market, which never could happen in a perfect competitive market.

Moving further, with positive and negative welfare implications, the positive welfare implications that can identify is that in each country and world, welfare be likely to increase, which is not previously in a monopolistic market, but after the trade, after the rival and the competitiveness effect will reduce the prices. The negative implication is that the waste is an identical product between the two countries.

### **The Gravity Model**

Since focusing on the volume of trade other than the composition of that trade, the gravity model is much different from other trade theories, including traditional theories. The model has a long history, and researchers have been paying attention since the 1960s. Based on a bilateral basis, the volume of trade between any two countries predicts by the gravity model equation, which is developed and used by the law of gravity in physics. Furthermore, in selecting economic variables, it has to be well concerned that produce a 'good fit' and explains a substantial portion of the trade volume, at least in a statistical sense. The variables used in the equation mainly include the flow of exports from one country to another. National income as a variable for one country, where measure of distance between the two countries (as a proxy for transportation cost) and sometimes other variables like population size of the two countries or a variable to reflect an economic integration (such as free-trade area) among the two countries are employed (Appleyard & Field, 2014).

The gravity equation is better for similar countries with significant intra-trade with each other than the two countries with different factor endowments and majority with traditional trade and not having intra-industry trade. This proves that

differentiating in products is indeed considered in factor endowments. However, the gravity model is theoretically debated, and empirically it has proved the influence on the trade volume. The econometric analysis proved the importance of the volume as an important variable. Although many theories do not consider the volume of trade, it is important to understand the world economy (Appleyard & Field, 2014).

### **2.3 Measures of Comparative Advantage**

The introduction of the concept of comparative advantage and related theories has a history of over 200 years. Although a number of theories have been developed, economists faced the problem of measuring comparative advantage. Economists faced measuring H-O theory as the relative prices in autarky are not observable. Therefore, more practical measures of comparative advantage were introduced in the 1960s. Cai, Leung and Hishamunda (2009) and Yercan and Isikli (2007) points out that there are two complementary approaches to assessing comparative advantage. The first one is the Ricardian Approach (classical), and the second is the Revealed Comparative Advantage (RCA) Approach proposed by Balassa.

The Ricardian approach is based on profitability, specialization, factor endowment and technology. The Ricardian approach type analysis mainly uses variables, such as domestic and foreign prices of output, unit costs of factors of production and indicators for the level of technology employed. For the Ricardian approach, the Domestic Resource Cost (DRC) is widely used in the empirical literature. The DRC compares the social opportunity cost of domestic production to the value-added it generates in international prices. DRCs are interpreted as an indicator of the efficiency of the domestic output or international competitiveness (Yercan and Isikli, 2007; Zawalińska, 2004).

The RCA approach proposed by Balassa (1965) is based on the assumption that the trade pattern reflects relative costs and differences in non-price factors. This approach is based on trade shares and their changes over time, and it indicates that the comparative advantage is revealed in the export performance of the country. Therefore, analysis of the RCA approach is important for making policy suggestions to develop export potentials in goods it already has specialization.

A Series of measures have been introduced to calculate the RCA. It started with Balassa (1965) Revealed Comparative Advantage (RCA). Since then, various measures have been introduced to measure the comparative advantage, namely Revealed Symmetric Comparative Advantage (RSCA), Normalized Revealed Comparative Advantage (NRCA), Relative Import Advantage Index (RMA), Lafay Index (LFI), Trade Balance Index (TBI), and so forth.

### **2.4 Empirical Studies**

The previous empirical studies on comparative advantage can be categorized into four major branches based on the arguments that have been made. They are (1) changing

patterns of the comparative advantage across countries, (2) changing patterns of the comparative advantage over the period, (3) shift in comparative advantage between sectors and commodities, and (4). The determinants of comparative advantage. Some studies have considered at least one of these arguments, while some have incorporated more than one argument.

#### **2.4.1 Changing Patterns of the Comparative Advantage across Countries**

Rifin (2013) examines the competitiveness of cocoa beans in Indonesia in the world market and compared the results of Indonesia with Ivory Coast, Ghana, and Nigeria. The study finds Indonesia has a comparative advantage in producing cocoa beans. However, inter-country comparison shows that comparative advantage is higher for Ivory Coast, Ghana, and Nigeria than Indonesia. Further, cocoa beans in Indonesia and Ghana are complementary, and an increase in cocoa beans demand in the world will benefit Indonesia the most. Shohibul (2013) finds that China has a more established pattern of trade for primary products and manufacturing products, while it was dynamic in the case of Asian countries (Indonesia, Malaysia, Singapore, Philippines, and Taiwan). India enjoys a comparative advantage in exporting onion and peas compared to other vegetables.

The study by Carraresi and Banterle (2015) focuses on the competitive performance in the intra-EU market. It assesses the effect of the expansion of the EU and economic crisis on competitiveness. They find divergent trends in the competitiveness of the food industry and agriculture. Germany and Netherland are the mostly profited countries through the opportunities created by the EU enlargement, while France has lost it. Rizwanulhassan and Shafiqurrehman (2015) find that comparative advantage in mango exporting in the world market for Pakistan, India, and Brazil was losing during the study period while Mexico, Peru, Thailand and the Philippines were gaining from comparative advantage. The study by Ceylan (2019) finds that Hungary has a higher degree of specialization in wheat exports than Turkey. Ferto and Hubbard (2002) find that despite significant changes, the pattern of RCA is remained stable in Hungarian agriculture, RCA indices, provide a useful guide to insight the competitiveness of Hungarian agri-food sector revealing 22 products that gain comparative advantage. Kuldilok et al. (2013) found that Thailand has competitive advantage in major markets and stable in the Middle East, USA, Japan, and Canada while substantially fallen in Australia.

#### **2.4.2 Changing Patterns of the Comparative Advantage over the Period**

Seleka and Kebakile (2016) examine the export competitiveness of the beef industry in Botswana for the period 1961-2011. The study finds that Botswana enjoyed the comparative advantage during the study period, however, weakened after 1975 due to increased domestic demand while stagnating domestic supply. The study suggests removing the state-trader monopoly and allowing the private sector entry into the beef exporting sector. Ratna Sari and Tety (2017) find that Indonesian coffee has experienced a better position yearly as the RCA values are positive for the study

period. At the same time, the increased export share of Indonesia, measured by the CMS, is influenced by the increased world demand. Balogh and Jámber (2017) finds that only seven countries out of the 16 wine exporters from the European Union have a comparative advantage in wine exporting to the world market, however, comparative advantage had been weakened for the majority of countries over the period.

Seleka and Dlamini (2020) also find that African, Caribbean, and Pacific countries have a comparative advantage in sugar exports, however, it has been declined over the period. Similarly, Gupta and Kumar (2017) find that the comparative advantage of primary products in Rwanda has been declining due to the increased supply side from other competitive countries. Hatirli et al. (2004) also find that fruit exports (hazelnut, raisins, dried apricots, and figs) from Turkey have the highest competitive advantage over its main competitors, however, there was a declining trend of competitive advantage for Turkey. Benesova et al (2017) conclude that the Russian trade structure is continuously changing and evolving with economic transformation and trade liberalization. Thus, according to the analysis comparing the Russian status with that in African, Asian, and CIS countries, Russian exports were mostly strengthening. Assessing the Albanian olive oil production, Kapaj et al. (2010) found that the Albanian olive does not have a comparative advantage for the given condition of prices, production and technology. However, the production of olive oil is profitable for farmers and not for a country under given local and international prices.

### **2.4.3 Shift in Comparative Advantage between Sectors and Commodities**

Phuong Le (2010) examines the comparative advantage in Vietnam and its changes since the reforms began in 1986. The study finds rapid shift in comparative advantage structure from primary products towards labour-intensive manufacturing during 1991-96, and a further slow shift towards technology-intensive manufacturing since then, Vietnam's comparative advantage is still largely based on the country's endowments of labour and natural resource. By comparing the findings of Vietnam with the Philippines and Malaysia, the study shows that comparative advantage patterns of the Philippines have shifted from being based on a combination of various primary sections and labour-intensive sections in 1991 to being based on a combination of a primary section and a capital-intensive section in 2005. Similarly, the Malaysian comparative advantage structure has shifted from mainly primary sections to the capital-intensive manufacturing section.

Ishchukova and Smutka (2013) examine the specialization and comparative advantage in the Russian agricultural sector. The study also tries to capture the changes in patterns of comparative advantage over the period 1998-2000. Three different measures, namely Balassa RCA index, Vollrath index, and Lafay index, are used in the analysis. The results from the Balassa RCA index revealed that Russia has a stable comparative advantage for cereals (wheat, barley), by-products of cereals (bran of wheat), and products of cereal processing (cereal preparation), oilseeds, vegetable oil and chocolate. According to Vollrath's index, the number of products that had revealed

comparative advantages steadily grew over the period. The analysis of the Lafay index shows that different products have a comparative advantage in different regions. For example, “Primary products have the comparative advantage in relation to EU and Asian countries. In relation to the Commonwealth of Independent States and Americas, the processed products have comparative advantage, while most primary products have a comparative disadvantage. In relation to the whole world, analysis has also revealed a shift of comparative advantage from byproducts (e.g. bran of wheat, sunflower cake etc.) in 1998–2001 to primary products in 2002–2010”. However, Allo et al. (2017) finds that there are dynamic changes in agricultural products in Indonesia. The study categorizes the specialised and de-specialised commodities in the export market.

Bojnec and Ferto (2015) examine the competitiveness of the agri-food exports of the European Union (EU-27). The results from the RCA indices show that most of the agri-food products from the EU countries have a comparative disadvantage. According to the panel unit root test, the calculated RCA indices tend to be converged. Markov transition probability matrices shows that the “presence of very low probability (below 10 per cent) that agri-food products with a revealed comparative disadvantage ( $B < 1$ ) might shift to a revealed comparative advantage ( $B > 1$ ). Similarly, there were low the chances that those products with a  $B > 1$  may move backward by a switch to a  $B < 1$ .” Further, Kaplan-Meier survival rates shows that “most of the old EU-15-member states experience a greater number of agri-food products having a longer duration of revealed comparative advantages than have most of the new EU-12 member states”.

#### **2.4.4 Determinants of Comparative Advantage**

Another branch of studies has explored not only the comparative advantage but also the determinants of it. Ndubuto (2010) investigated the competitiveness export performance and determinants of cocoa export from Nigeria. The results indicate that Nigeria has a comparative advantage in the exportation of cocoa. World export volume, exchange rate and Nigerian cocoa output were identified as the major determinants of cocoa export from Nigeria. In a similar vein, Sawyer (2017) examine China's regional and sectoral patterns and determinants of comparative advantage. Capital-labour ratio, inputs, human capital, innovation, government policy and financial factors regressed as the determinants. The study finds that West and Central China have a comparative advantage in agriculture/mining, coastal provinces in manufacturing, and metropolitan provinces in services. This branch of studies is further supported by Torok and Jambor (2016) for European Ham Trade and Balogh and Jámbor (2017) for the cheese trade in the European Union.

Sarker and Ratnasena (2014) measure the international competitiveness of the wheat, pork and beef sectors in Canada. The study finds that Canada has international competitiveness in the wheat sector but not in the beef and pork sectors. The study also examines the determinants of such international competitiveness. The result indicates that seed cost is the main driver of the competitiveness of the wheat sector,

while it is the processing cost for the pork and beef sectors. The study further reveals that the exchange rate is the driver of the pork and beef sectors. The study further incorporating the Canadian farm policy, finds that such policies have not significantly impacted the international competitiveness of the wheat and pork sectors. Naseer et al. (2019) examine the competitiveness of the mandarin industry for the world's 15 leading mandarin exporters. They also explore the effect of productivity growth and real effective exchange rate on the competitiveness of the mandarin industry through panel regression analysis. The study finds varying RSCA patterns between the selected countries.

Balogh and Jambor (2017) examine the determinants of RCA in the cheese trade in the European Union. The study identifies that factor endowment, EU membership and a geographical indication as positive and significant determinants of revealed comparative advantage, while FDI affected the competitive position in the European cheese market negatively. Torok and Jambor (2016) investigate the determinants of the RCA in the ham trade. The study finds that the four-member states of the EU are competitive in the ham market while some countries had to work to gain a comparative advantage. Further, the study suggests that the competitiveness has worsened in most cases between 1999 and 2013.

Sawyer et al. (2017) examine the regional and sectoral patterns and determinants of comparative advantage in China. The results implied that for agriculture/mining in West and Central China, manufacturing coastal provinces, and for services, metropolitan provinces have a comparative advantage. Further, the regression analysis indicates that labour endowments are the key determinant for comparative advantage in total trade and physical capital as the driving force of domestic trade. Government spending and human capital positively impact on comparative advantage while provincial trade barriers, industrial loans and taxes. Minh et al. (2016) evaluate the competitive advantage in "DAK LAK Coffee" exporting. The study found that the competitiveness (DRC) is very sensitive to the changes in export prices.

Amarender Reddy and Bantilan (2012) investigate the international competitiveness of groundnut kernel, oil, and cake for different periods, namely pre-TMO (Technology Mission on Oilseeds), to enhance the productivity of edible oils), TMO, and post-WTO periods. The study finds India's competitiveness for ground nut cake and kernels, but not for ground nut oil. The study further reveals that India almost reached the self-sufficiency level in edible oil during the TMO period, at the cost of 71% higher domestic prices than the world market prices. However, opening the sector through reducing the tariffs to almost zero level for successive years leads to reducing the Nominal Protection Coefficient of output (NPC) and increasing imports. Although higher protection during the TMO period leads to higher productivity growth, it is shaded during post-WTO.

De Pablo Valenciano et al. (2017) test the impact of the global and financial crisis on the pears trade of South Africa (SA). The results show that, before the global economic and financial crisis, the structural effect of the SA exports contributed most to the sales

growth of pears to the EU, and a general competitiveness effect contributed to a lesser extent. After the crisis, exports continued to grow but at a slower rate, and the composition of the contribution to the sales growth to the EU changed completely. From 2007 onwards, specified competitiveness is the main contributor to the export growth of SA pears, even counteracting the negative, post-crisis impact suffered by the exports' structural effect". Chawarika et al. (2017) find that Zimbabwe's wheat production is not competitive under the current policy framework. Zimbabwe wheat farmers incurred a high cost of production (DRC = -0.6), while NPC of output (1.036) was not adequate to meet the high cost of production.

In summary, previous empirical studies have focused on agricultural export competitiveness in a single country or some selected group of countries, mostly skewed towards developed countries. Regarding the commodities examined, a few studies considered fruit exports. Thus far, no study examined the comparative advantage of fruit exports from Sri Lanka to the world, and compared the competitiveness with its competitors. In the absence of empirical analysis on the comparative advantage of Sri Lanka's fruits exports in the global market, the challenging issues are determining in-depth empirical facts to measure the outcomes of the changing global competitive trade on the comparative advantage of fruits export. Presently, Sri Lanka urgently needs foreign currency as its two major foreign exchange earning i.e., tourism and remittances, have undergone a huge negative shock due to the COVID-19 pandemic. Therefore, this research rectifies the missing empirical research in the empirical literature in the case of the comparative advantage of fruit exports in the global market.



## CHAPTER THREE

### Methodology

#### 3.1 Introduction

This chapter reviews the methodology that is followed in the present analysis. The data collection method used in the study is elaborated along with the comparative advantage indices which are used to measure the level of comparative advantage of the respective countries. Further, the chapter describes the methods that are used to analyze the data focusing on the state and level of comparative advantage, changes of the comparative advantage over time and across the countries. Moreover, a product mapping is used in the present study, and an analysis to identify the determinants of the comparative advantage. Thus, the chapter delivers the methodology that was followed.

#### 3.2 Data Collection

This study employs data from the World Food and Agriculture Organization (FAO). The FAO database includes crop-wise and destination-wise exports and imports data in terms of quantity and volume. The commodity list investigated in the current research is major fruits, avocado, banana, mango, orange, papaw, pineapple, lime and lemon, and cashew. Many scholars have used exports and imports data from the FAO database to examine the comparative advantage. For example, but not limited to, Irshad et al. (2018), Rizwanulhassan and Shafiqurrehman (2015), Seleka and Dlamini (2020), Seleka and Kebakile (2016), and Abdullah et al. (2015) have used data from FAO database.

#### 3.3 Comparative Advantage Indices

An extensive review of empirical work shows that almost all studies have been employed more than one measure to assess the comparative advantage/disadvantage due to inherent merits and demerits in the available measures. Some studies have employs measures related to the RCA approach, while others consider the measures in the classical (Ricardian) approach. Some studies employed measures in both RCA and classical approaches. Therefore, the current study also employs measures of RCA, namely Balassa's Revealed Comparative Advantage Index (RCA), Vollrath's Revealed Comparative Advantage Index (VRCA), Revealed Symmetric Comparative Advantage Index (RSCA), Normalized Revealed Comparative Advantage (NRCA), Additive Revealed Comparative Advantage Index (AI), and Trade Balance Index (TBI) as given below.

##### (i). Balassa's Revealed Comparative Advantage Index (BRCA)

Answering the problem of accounting for all factors considered in comparative advantage theories while measuring the comparative advantage, Balassa (1965)



time, industries and countries (Richardson and Zhang, 1999; Supongpan Kuldilok et al., 2013). Fertő and Hubbard (2002) note that BRCA measures are useful to highlight specialization patterns (Supongpan Kuldilok et al., 2013).

As Sanidas and Shin (2015) point out, the BRCA index can be used in the econometric analysis to examine the structural changes in trade performances by applying Galtonian regression which was initially introduced by Cantwell (1989). The Galtonian regression measure technological comparative advantage. Since its introduction, numerous other scholars have applied the Galtonian regression to measure comparative trade advantage. This simple OLS method helps to compare two cross-sections at two different points of time and examines the change in the structure of trade specialization in a given country in a period of interest (Sanidas and Shin, 2015).

However, previous studies show some limitations in the BRCA index. (1). Since the BRCA is calculated based on post-trade data, it may not capture the true comparative advantage due to market distortions (Fertő and Hubbard, 2002; Supongpan Kuldilok et al., 2013). (2). BRCA may not capture the future comparative advantage because it uses post-trade data. (3). BRCA may become irrelevant in a situation where intra-industry trade appears. BRCA can be calculated only at one time period; therefore, it is neither a cardinal nor ordinal measure (Hillman, 1980; Supongpan Kuldilok et al., 2013; Yeats, 1985). (5). De Benedictis and Tamberi (2004) pointed out that BRCA indices are asymmetric, implying that when  $BRCA > 1$ , the country has a comparative advantage but no upper bound. However, despite some limitations, BRCA has been widely used in empirical analysis. For example but not limited, (Chawarika et al., 2017; De Pablo Valenciano et al., 2017; Rifin, 2013; Sarker and Ratnasena, 2014).

## (ii). Additive Revealed Comparative Advantage Index (ARCA)

Hoehn and Oosterhaven (2006) point out that the multiplicative BRCA index has problematic properties as the index values range from 0 to  $\infty$ . It has a moving mean larger than its expected value of 1, while its distribution strongly depends on the number of countries and industries. These properties make its outcomes incomparable across time and place, and its economic interpretation problematic (Hoehn and Oosterhaven, 2006). In order to solve these shortcomings of the BRCA index, Hoehn and Oosterhaven (2006) propose an alternative index, called as Additive Revealed Comparative Advantage Index (ARCA) of country  $A$  in sector  $j$  is defined in the following formula (2).

$$ARCA_j^A = \frac{X_j^A}{X^A} - \frac{X_j^{REF}}{X^{REF}} \dots \dots \dots (2)$$

Although BRCA defines the RCA as a ratio between the share of an industry within a country and that of the world, ARCA defines it as the difference between them. The value of the ARCA index falls between -1 and +1. Three different outcomes are produced from ARCA index values. (1), if  $ARCA = 0$ , the export share of sector  $j$  in country  $A$  is equal to that of referenced countries. (2), if  $ARCA > 0$ , country  $A$  has

revealed a comparative advantage. (3). if  $ARCA < 0$ , country A has revealed a comparative disadvantage (Hoen and Oosterhaven, 2006).

**(iii). Revealed Symmetric Comparative Advantage Index (RSCA)**

One of the shortcomings of the BRCA index is the calculated index values are asymmetric and therefore face a problem of econometric analysis application (Laursen, 2015). Answering the problem, Vollrath (1991) suggests taking a log transformation of the Balassa index as a solution to the asymmetry problem, however, it also added another problem in that the Balassa index could not be defined in the case of zero export. In order to answer the problem of asymmetry of the BRCA index, **without the zero export issue**, Dalum et al. (1998) and Laursen (2015) modify the BRCA index as in the Equation (3).

$$RSCA_{ij} = \frac{RCA_{ij} - 1}{RCA_{ij} + 1} \dots \dots \dots (3)$$

With the modification, the RSCA values lie between -1 and +1 ( $-1 \leq RSCA \leq 1$ ). The decision criterion is that if RSCA is greater than 0, there is a comparative advantage, and if RSCA is less than 0, there is a comparative disadvantage (Naseer et al., 2019; Shohibul, 2013).

**(iv) Vollrath Revealed Comparative Advantage Index (VRCA)**

Another limitation of the BRCA index is that it is based on only exports. Vollrath RCA index accounts not only for the volume of exports but also the volume of imports. Unlike the BRCA index, the Vollrath index is symmetric. The positive values of the index indicate the comparative advantage, while the negative values indicate the comparative disadvantage (Vollrath, 1991). In order to derive the Vollrath RCA index, he calculated two sub-indexes. (1) Relative Export Advantage (RXA), similar to the BRCA. (2) Relative Import Advantage (RMA). The Vollrath RCA index is derived from the difference between RXA and RMA (Equation 4-6).

$$RXA = \frac{X_{ij}/X_{it}}{X_{nj}/X_{nt}} \dots \dots \dots (4)$$

$$RMA = \frac{M_{ij}/M_{it}}{M_{nj}/M_{nt}} \dots \dots \dots (5)$$

$$Vollrath\ RCA = \ln RXA - \ln RMA \dots \dots \dots (6)$$

**(v) Normalized Revealed Comparative Advantage (NRCA)**

Yu et al., (2009) introduce another form of RCA, which is called Normalized Revealed Comparative Advantage (NRCA), as shown in the formula (7). The NRCA index calculates the degree of deviation of a country’s actual exports from its comparative-advantage-neutral level in terms of its relative scale with respect to the world exports market. It thus provides a proper indication of the underlying comparative advantage. The salient features of the NRCA index include its symmetrical distribution and

independence from the number of countries and sectors. Therefore, the present study has applied the NRCA index to examine the comparative advantage of fruit exports (Hassan and Ahmad, 2018). The index value of NRCA lies between -0.25 and +0.25, and the index value takes zero when the actual export is equal to the expected export. A higher value of NRCA value indicates a stronger comparative advantage while a lower NRCA value indicates comparative disadvantage.

$$NRCA_{ij} = \frac{\Delta X_{ij}}{X_w} = \frac{X_{ij}}{X_w} - \frac{X_{wi}X_i}{X_wX_w} \dots \dots \dots (7)$$

Where,

$$\Delta X_{ij} = X_{ij} - \widehat{X}_{ij} = X_{ij} - \frac{X_iX_wj}{X_w} \dots \dots \dots (8)$$

#### (vi). Trade Balance Index (TBI)

The Trade Balance index is introduced by Lafay (1992), which indicates whether the country holds the net exporter or net importer position in a given particular product group. The TBI of a country “i” for a product “j” is given below as in the equation (9).

$$TBI_{ij} = \frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}} \dots \dots \dots (9)$$

Country is referred to as a “net-importer” in a specific group of a product if the value of the TBI is negative and as a “net-exporter” if the TBI reaches positive values (Benesova et al., 2017; Widodo, 2009). The values of TBI range from -1 to +1. In one extreme case, when the TBI equals -1, the country only imports, while the TBI equals +1, the country only exports. A country is referred to as a “net-importer” in a specific group of products where the value of TBI is negative and as a “net-exporter” where TBI is positive. The TBI is not defined when a country neither exports nor imports. Any value between -1 and +1 implies that the country exports and imports a commodity simultaneously (Widodo, 2009).

### 3.4 Data Analysis

#### 3.4.1 State and Level of Comparative Advantage

All five comparative advantage indices are calculated for all the selected fruit exports in this study. Once comparative advantage indices are calculated, it is required to conclude whether individual countries have the comparative advantage for the selected fruits crop for the analysis time period. This conclusion is made by setting a criterion. Suppose a respective country had a comparative advantage for at least three indices out of five. In that case, that particular country has the “comparative advantage” of that specific fruit, and the rest have a “comparative disadvantage” of that fruit. As such, all the countries that export a particular fruit are divided into the “comparative advantage - Yes” group and “Comparative advantage - No” group to

identify Sri Lanka's state and the level of comparative advantage for the selected eight fruits crops.

### 3.4.2 Changes in Comparative Advantage over the Period

One of the objectives of this study is to assess the changes in the patterns of comparative advantage over the period. This study uses the Ordinary Least Squares (OLS) method to estimate two-period piecewise linear regression for each country to examine whether the comparative advantage of individual countries has increased or decreased over the period, thereby comprehensively examining the trend of comparative advantage of fruits exports from Sri Lanka. The linear regression equation is given in equation (10).

$$RCA_j^i = \alpha_i + \beta_i Y_t + \varepsilon_{it} \dots \dots \dots (10)$$

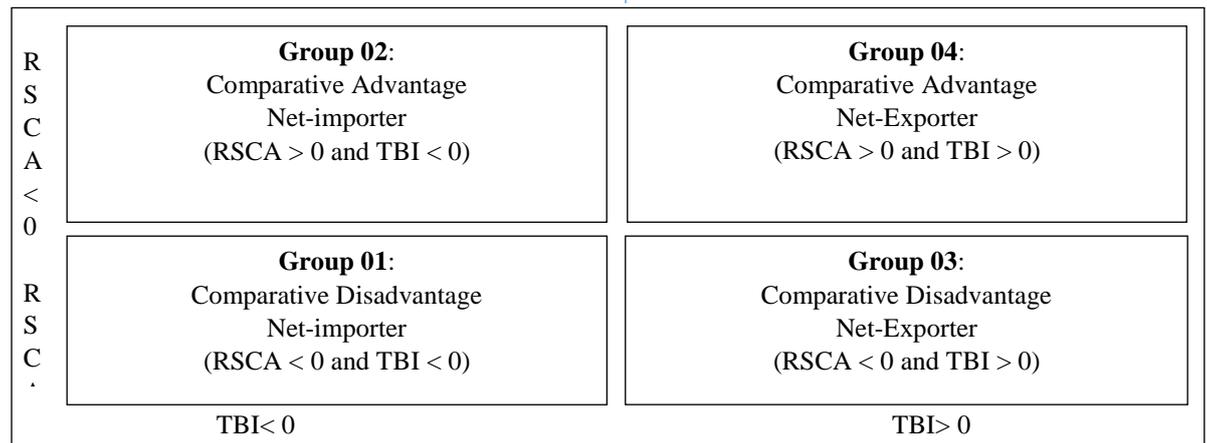
Where  $Y$  is the year (2000, 2001,.....2019),  $i$  denotes the country  $j$  represents the commodity,  $t$  represents the year,  $\varepsilon_{it}$  is the error term, and  $\alpha$  and  $\beta$  parameters are estimated. Therefore,  $\beta$  is the annual change in the comparative advantage scores for 2000-2019. The positive and significant coefficient of  $\beta$  indicates a positive trend in comparative advantage, and the negative and significant coefficient of  $\beta$  implies a negative trend in comparative advantage. An insignificant coefficient value of  $\beta$  (positive/negative) implies there is no significant comparative advantage trend either.

### 3.4.3 Comparative Advantage across the Countries

Comparing comparative advantage among countries gives important information for assessing comparative advantage changes, which helps identify countries that gained or lost their position in the world market over time. Therefore, this study compares comparative advantage among different countries by ranking the countries based on the strength of their scores of comparative advantages. The countries are ranked for all five comparative advantage indices: BRCA, RSCA, Vollrath's RCA, NRCA, and AI. The ranking also spread among different time periods dividing the full study period into four sub-periods of 5 years.

### 3.4.4 Product Mapping

Widodo (2008) establishes 'products mapping' as an analytical tool to determine the dynamic changes in comparative advantage. The tool facilitates to evaluation in two dimensions, the trade balance of the country and the comparative advantage for that country, as the classification reveals the country's position in gaining comparative advantage and the domestic trade balance. Thus, the analysis categorizes the countries as the strength of the comparative advantage according to the RSCA index and the TBI index, denoting that the country is a net importer or net exporter. The model proceeds with the countries, a combination of RSCA and TBI, perspective of flying gees patterns, and analyses the structural changes of the positions over the period.



Source: Widodo, 2008

**Figure 3.1: Flying Gees Path**

According to Figure 3-1, group one represents the countries with both no comparative advantage and no export specialization over the respective commodity. In other words, a net importer with no gains. Moving into group two, the countries classified as net importers have a comparative advantage. Thus, the country gains over the products but does not specialize in the export market. Countries without comparative advantage, however, being net exporters, and having export specialization, are categorized into group three. According to the flying gees model, the identical position, group four stands for the countries that are net exporters benefiting from comparative advantage over the respective commodity. As the category represents RSCA and TBI indexes are greater than zero.

In the present study, the five-year averages are calculated to identify the path that the countries move over the respective commodity, dividing 20 years into four categories. Hence, it elaborates the countries' path over the four periods, implying the comparative advantage, comparative disadvantage and a net exporter, net importer of the commodity.

### 3.4.5 Determinants of Comparative Advantage

This study aims to determine the determinants of comparative advantage, and the following econometric model was estimated.

$$RCA_{it} = \alpha + \beta_1 KL_{it} + \beta_2 PCGDP_{it} + \beta_3 FDI_{it} + \beta_4 TOT_{it} + \beta_5 G_{it} + \varepsilon_{it} \dots \dots \dots (11)$$

RCA=Revealed Comparative Advantage, KL= capital/labour ratio, PCGDP=per capita GDP of the exporting country, FDI=foreign direct investment, TOT=terms of trade, G=government expenditure, and  $\varepsilon_{it}$  =error term. The selection of independent variables is based on the work by Sawyer et al., (2017) (KL), Balogh and Jám bor, (2017) (PCGDP, FDI), and Hassan and Ahmad (2018) (FDI, TOT).

The equation (11) is estimated using panel data analysis techniques using Eviews-10 software. There are many panel data techniques which include pooled OLS, the fixed effects (FE) and the random effects (RE), the feasible generalized least squares (FGLS) and the generalized method of movement (GMM). Meanwhile, Torok and Jambor (2016) apply the panel-corrected standard errors (PCSE) panel estimation technique to investigate the determinants of revealed comparative advantage in the European Ham trade. Sawyer (2017) argued that since the RSCA index is limited to values between  $-1$  and  $1$ , estimation via OLS would result in inconsistent estimates. Therefore, they employ Tobit specification for panel data, which captures the lower and upper censoring of the dependent variable and produces consistent maximum likelihood estimates. Ferto and Jambor (2015) show that the FGLS method provides the best results among others. Balogh and Jám bor (2017) and Ferto and Jambor (2015) apply the FGLS model in their analysis. Therefore, the current study applies the FGLS to identify the determinants of comparative advantage.

## CHAPTER FOUR

### Overview of Fruit Trade in the Asian Region

#### 4.1 Introduction

This chapter describes the international trade patterns of selected fruit crops (avocado, banana, cashew, lime and lemon, mango, orange, papaya and pineapple) in Asia. It compares imports, exports, trade balances and export shares of each fruit crop in terms of value from 2010 to 2019. The chapter also sheds light on major producers, exporters and imports of each fruit crop and their trading nature. Next, the chapter critically analyses the international trade of selected fruit crops in Sri Lanka compared with the Asian context. It includes major countries which import fruits from Sri Lanka in terms of value, average export growth of the fruit and vegetable sector by countries, export values, import values, trade balance and export share of each fruit crop. Chapter concludes by summarizing overall insights on the international trade of selected fruit crops in Asia and emphasizing Sri Lanka.

#### 4.2 International Trade in Asia

During the recent decades, international agricultural trade has been viewed as a strategic tool in the development process with the increasing demand for food around the globe. Many nations have been vastly benefitting through the international agricultural trade by opening up their economies to absorb novelty in the trading process. Similarly, agricultural trade is expanding in all regions due to population growth, changing food habits and growing demand for processed foods. Interestingly, Asia is a region which illustrates rapid transformation over the years. Besides being the fastest-growing region of the world for several decades, the Asian region comprises more than 60% of the global population. It accounts for almost a quarter of global output (22%) (International Trade Centre, 2021). Asia has a diverse setup in terms of human development, population, size, political systems, culture, religion, and ecology and hence, facing diverse challenges in trade. In general, compared to 2000, agro-exports grew more than two and half times in 2008 in Asia. In 2009, the top 10 countries shared 87% of total Asia-Pacific exports, with China topping the list (Food & Agriculture Organization of the United Nations , 2012). However, the Asian region has risen significantly as an agricultural producer region with limited, proportionate reflection on its exports. It is also revealed that the export basket is dominated only by a hand full of countries in the region. Therefore, it is vital to understand and explore the nature of international agricultural trade during the last couple of decades to set priorities.

##### 4.2.1 Trade of Avocado

Mexico is the world-leading producer and exporter of avocado, with nearly 964,000 MT valued at over USD 2.4 billion in 2019/20 (United States Department of Agriculture ,

2020). Regarding the Asian context, according to Table 4.1, Hong Kong has the highest average monetary terms for exports (USD 25 million) and imports (USD 43 million) of avocado from 2015 to 2019. Export values of avocado in Hong Kong are six times greater than the second player in the region, UAE. A significant increment in export values during the period from 2015 to 2019 was also traced compared to the period from 2010 to 2014 in Hong Kong.

**Table 4.1: Import, Exports, Trade Balance and Export Share of Avocado**

	Exports (000' USD)		Imports (000' USD)		Trade Balance (000' USD)		Export Share	
	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019
Hong Kong	1,125	25,491	6,374	43,588	(5,249)	(18,096)	2.34E-06	4.76E-05
UAE	160	3,811	8,450	37,277	(8,290)	(33,466)	5.02E-07	1.13E-05
Singapore	298	1,173	6,809	16,516	(6,510)	(15,343)	7.48E-07	3.15E-06
Lebanon	444	944	115	548	329	396	8.53E-05	2.29E-04
Syrian Arab Rep.	30	691	-	1	30	689	4.5E-06	3.17E-04
Philippine	29	538	1	40	28	499	5.43E-07	8.28E-06
Turkey	17	414	245	992	(228)	(578)	1.17E-07	2.52E-06
Sri Lanka	14	143	-	-	14	143	1.43E-06	1.27E-05
Indonesia	107	83	20	327	87	(244)	5.88E-07	5.11E-07
Saudi Arabia	-	65	8,231	26,270	(8,231)	(26,205)	-	2.79E-07
Malaysia	15	59	720	8,505	(705)	(8,446)	6.72E-08	2.71E-07
Bahrain	-	39	16,976	4,560	(16,976)	(4,521)	-	2.4E-06
Brunei	-	23	16,377	818	(16,377)	(795)	1.78E-08	3.75E-06
Thailand	2	8	2,618	4,279	(2,616)	(4,271)	9.08E-09	3.43E-08
Korea	-	3	2,739	25,650	(2,739)	(25,647)	7.4E-10	6.2E-09

*Note: Parentheses represent negative values. The export share is calculated by dividing exports from merchandise exports of a particular country.*

Source: Authors' calculation based on the Data from FAO, 2021

Third, fourth, and fifth export values were reported for Singapore, Lebanon and Syrian Arab, respectively, during the period from 2015 to 2019 out of the 15 countries which exported avocado. However, the third, fourth and fifth import values were reported for Saudi Arabia, Korea and Singapore during the period from 2015 to 2019. Interestingly, a continuous positive trade balance was maintained by UAE, the Philippines, Sri Lanka and Singapore from 2010 to 2019 for avocado. In addition, the highest trade share was demonstrated by Syrian Arabs during the period from 2015 to 2019.

#### 4.2.2 Trade of Banana

Bananas are among the most traded fruits in the world. The global exports of bananas, excluding plantain, reached a record high of 22.2 million MT in 2020, a growth of 1.7%

compared to 2019. Asia is the largest banana-producing region, Latin America and the Caribbean are the largest exporting regions, responsible for approximately 80% of global exports (Food & Agriculture Organization of the United Nations , 2021). The highest average monetary terms (USD 1.112 billion) for banana export were shown by the Philippines from 2015 to 2019 out of 20 countries. This is 19 times greater than the second player in the region, India. Third, fourth and fifth average export monetary terms were represented by Turkey, Pakistan and Thailand.

**Table 4.2: Import, Exports, Trade Balance and Export Share of Banana**

	Exports (000' USD)		Imports (000' USD)		Trade Balance (000' USD)		Export Share	
	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019
Philippines	707,738	1,112,750	8	56	707,731	1,112,694	1.31E-02	1.71E-02
India	25,427	58,315	1	0	25,427	58,315	8.69E-05	1.97E-04
Turkey	15	27,986	106,806	112,370	(106,791)	(84,384)	1.00E-07	1.70E-04
Pakistan	21,865	22,911	621	9	21,244	22,902	9.02E-04	1.03E-03
Thailand	18,406	20,617	2,695	2,721	15,711	17,896	8.36E-05	8.84E-05
China	6,277	14,628	474,098	839,981	(467,821)	(825,353)	3.11E-06	6.29E-06
Cambodia	0	14,323	1	6	(1)	14,317	-	1.25E-03
Kuwait	5,543	12,991	45,356	76,790	(39,812)	(63,800)	5.45E-05	2.23E-04
Lebanon	12,606	11,690	129	866	12,477	10,825	2.42E-03	2.84E-03
Malaysia	7,355	8,231	4,080	10,106	3,275	(1,874)	3.29E-05	3.76E-05
Indonesia	283	4,862	758	7	(474)	4,855	1.56E-06	3.00E-05
Saudi Arabia	4,133	3,914	156,995	133,050	(152,862)	(129,136)	1.20E-05	1.68E-05
United Arab Emirates	454	3,824	63,676	128,274	(63,222)	(124,450)	1.42E-06	1.13E-05
Sri Lanka	63	2,374	-	-	63	2,374	6.38E-06	2.12E-04
Hong Kong SAR, China	5,790	2,324	736	630	5,054	1,693	1.20E-05	4.33E-06
Jordan	219	164	17,917	13,015	(17,698)	(12,851)	2.79E-05	2.11E-05
Cyprus	19	136	5,546	4,971	(5,527)	(4,835)	9.47E-06	3.76E-05
Singapore	157	105	23,891	32,985	(23,734)	(32,880)	3.94E-07	2.82E-07
Korea	177	75	251,094	334,450	(250,917)	(334,375)	3.28E-07	1.36E-07
Kazakhstan	35	60	24,762	23,569	(24,727)	(23,509)	4.41E-07	1.20E-06

Note: Parentheses represent negative values. The export share is calculated by dividing exports from merchandise exports of a particular country.

Source: Authors' calculation based on the Data from FAO, 2021

The highest average monetary value for imports was reported for China (USD 839 million), followed by Korea (USD 334 million) during the period from 2015 to 2019. The top five countries that imported bananas from 2015 to 2019 spent more than an average of USD 100 million in terms of value. In addition, nine countries out of 20 were able to maintain a positive trade balance for banana trade and the highest (USD 1 billion) was shown by the Philippines from 2015 to 2019. China showed the lowest (USD -825 million) trade balance. In the case of export share, the Philippines had the highest export share in the region during the period from 2015 to 2019. Second, third,

fourth and fifth export shares were demonstrated by Lebanon, Cambodia, Pakistan and Kuwait during the period from 2015 to 2019. The least export share was reported for Korea in the same period. Banana export from Sri Lanka has increased from 63 million USD from 2010-2014 to 2374 million USD from 2015-2019.

#### **4.2.3 Trade of Cashew**

Cashew is produced in 46 countries across Africa, Asia, Latin America and Caribbean islands. Africa is the leading cashew producer, accounting for more than 50% of the total production from 2014 to 2018. Similarly, West African countries are the leading exporters (77%) of raw cashew nuts during the period from 2014 to 2018. Interestingly, India and Vietnam are, by a wide margin, the largest importers of raw cashew nuts. Together, they accounted for an average share of 98% of global raw cashew nuts imports by volume from 2014 to 2018. From 2010 to 2019, cashew imports by Sri Lanka increased while exports decreased, thereby retaining a net importer (United Nations Conference on Trade and Development , 2021).

The leading (USD 758 million) cashew nut exports by value in Asia was reported for India during the period from 2015 to 2019 out of 24 exporters in the region. However, India is a net importer as the imports are higher than exports. United Arab Emirates possessed the second-highest (USD 112 million) export values, followed by Indonesia (USD 107 million) and Cambodia (USD 87 million). Second, third, fourth and fifth import values for cashew were reported for United Arab Emirates, China, Thailand and Saudi Arabia, respectively, during the period from 2015 to 2019. Only two countries, Indonesia and Cambodia, maintained a positive trade balance for cashew from 2015 to 2019. Even though India is the leading exporter in the region, India had the least trade balance for cashew compared to other cashew exporting and importing countries in the region. Cambodia, India and Syrian Arab were the first, second and third respectively in terms of export share in the region during the period from 2015 to 2019.

**Table 4.3: Import, Exports, Trade Balance and Export Share of Cashew**

	Exports (000' USD)		Imports (000' USD)		Trade Balance (000' USD)		Export Share	
	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019
India	807,802	758,050	882,045	1,383,543	(74,243)	625,493	2.76E-03	2.56E-03
United Arab Emirates	18,148	112,753	137,194	163,213	(119,045)	(50,460)	5.70E-05	3.34E-04
Indonesia	60,412	107,298	7,215	9,596	53,198	97,701	3.32E-04	6.61E-04
Cambodia	400	87,651	109	257	292	87,394	6.03E-05	7.63E-03
Thailand	70	2,716	43,441	75,321	43,371	(72,605)	3.19E-07	1.17E-05
Hong Kong SAR, China	1,388	1,670	10,706	13,924	(9,318)	12,254	2.88E-06	3.11E-06
Turkey	143	1,507	8,660	22,682	(8,517)	(21,174)	9.82E-07	9.16E-06
Syrian Arab Republic	-	1,451	5,068	3,278	(5,068)	(1,827)	0.00E+00	6.66E-04
Sri Lanka	1,636	1,039	1,913	4,138	(277)	(3,099)	1.64E-04	9.27E-05
Kuwait	477	878	12,353	20,825	(11,876)	(19,947)	4.69E-06	1.50E-05
Jordan	326	855	2,143	19,013	(1,818)	(18,158)	4.15E-05	1.10E-04
Latvia	773	783	1,859	2,298	(1,086)	(1,514)	5.86E-05	5.55E-05
Iran, Islamic Rep.	39	675	4,775	44,145	(4,736)	(43,470)	3.70E-07	8.34E-06
Singapore	529	597	18,892	19,584	(18,363)	(18,987)	1.33E-06	1.60E-06
Saudi Arabia	161	390	30,371	62,828	(30,210)	(62,438)	4.66E-07	1.68E-06
Philippines	218	350	4,005	8,060	(3,786)	(7,710)	4.03E-06	5.38E-06
Bangladesh	32	345	143	3,348	(111)	(3,003)	1.25E-06	9.48E-06
Oman	1	260	1,266	6,497	(1,265)	(6,237)	1.65E-08	7.43E-06
Lebanon	226	224	24,703	28,596	(24,477)	(28,373)	4.34E-05	5.43E-05
China	581	223	67,285	116,346	(66,704)	(116,123)	2.89E-07	9.58E-08
Korea, Dem. People's Rep.	24	205	16,283	30,110	(16,258)	(29,905)	4.51E-08	3.74E-07
Kazakhstan	1	79	5,300	3,961	(5,299)	(3,882)	7.60E-09	1.58E-06
Bahrain	7	37	4,097	8,019	(4,091)	(7,982)	3.42E-07	2.29E-06
Malaysia	13	21	10,880	22,658	(10,867)	(22,637)	5.73E-08	9.42E-08

Note: Parentheses represent negative values. The export share is calculated by dividing exports from merchandise exports of a particular country.

Source: Authors' calculation based on the Data from FAO, 2021

#### 4.2.4 Trade of Lime and Lemon

Exports of lime and lemon are led by Spain, Mexico, Netherlands, South Africa, and Turkey. The European market has one of the greatest demands for lemons in terms of consumption and the processing industry, for which Spain and Italy dominate.

However, the leading producer of lemons and limes is India, followed by Mexico, China, Argentina, and Brazil, while the importers are the US, Germany, Netherlands, France, and Russia. The world export value steadily increased between 2015 and 2019 but dipped slightly from 2018 to 2019 (Market Intelligence Team, 2021). Regarding the Asian trade, the leading average export value (USD 488 million) for lime and lemon was shown by the Maldives from 2015 to 2019. It is nearly twice than that of the second-best exporter in the region, Turkey. The third and fourth players were China and the United Arab Emirates, which showed comparatively lesser export values than the best two players in the region.

**Table 4.4: Import, Exports, Trade Balance and Export Share of Lime and Lemon**

	Exports (000' USD)		Imports (000' USD)		Trade Balance (000' USD)		Export Share	
	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019
Maldives	281,146	488,618	1,401	3,087	279,745	485,531	7.83E-04	1.18E-03
Turkey	303,240	292,310	1,731	2,120	301,509	290,190	2.08E-03	1.78E-03
China	15,823	88,392	68,268	86,496	(52,446)	1,896	7.85E-06	3.80E-05
United Arab Emirates	1,839	34,572	53,161	100,320	(51,322)	(65,748)	5.77E-06	1.03E-04
Hong Kong SAR, China	14,563	19,040	45,271	57,269	(30,708)	(38,229)	3.02E-05	3.55E-05
India	8,610	8,272	9	41	8,600	8,231	2.94E-05	2.79E-05
Singapore	3,189	4,958	11,957	19,306	(8,768)	(14,348)	7.99E-06	1.33E-05
Saudi Arabia	1,525	3,887	49,764	78,721	(48,238)	(74,834)	4.43E-06	1.67E-05
Israel	1,627	2,073	52	38	1,574	2,035	2.51E-05	3.38E-05
Jordan	3,980	1,610	9,127	15,825	(5,146)	(14,215)	5.07E-04	2.07E-04
Malaysia	2,130	1,577	6,606	23,518	(4,476)	(21,941)	9.54E-06	7.21E-06
Lebanon	5,071	1,000	833	199	4,238	801	9.75E-04	2.43E-04
Oman	547	956	3,995	7,874	(3,449)	(6,918)	1.13E-05	2.73E-05
Cyprus	2,127	888	1,752	1,990	375	(1,102)	1.05E-03	2.46E-04
Indonesia	246	653	5,067	26,677	(4,821)	(26,025)	1.35E-06	4.02E-06
Kuwait	308	528	12,561	22,098	(12,252)	(21,571)	3.03E-06	9.04E-06
Sri Lanka	725	510	5	2	720	508	7.29E-05	4.55E-05
Thailand	213	431	617	1,890	(404)	(1,460)	9.66E-07	1.85E-06
Bahrain	201	359	5,314	8,232	(5,113)	(7,873)	1.04E-05	2.22E-05
Bangladesh	37	249	61	62	(24)	187	1.43E-06	6.86E-06
Pakistan	72	137	5	10	68	128	2.99E-06	6.20E-06
Kazakhstan	2	81	3,841	6,060	(3,839)	(5,979)	2.79E-08	1.63E-06
Afghanistan	2	2	111	547	(109)	(545)	3.51E-06	2.76E-06

Note: Parentheses represent negative values. The export share is calculated by dividing exports from merchandise exports of a particular country.

Source: Authors' calculation based on the Data from FAO, 2021

The highest average import value (USD 100 million) was reported for the United Arab Emirates, followed by China (USD 86 million) and Saudi Arabia (USD 78 million) during the period from 2015 to 2019. The least average import value (USD 2,000) was reported for Sri Lanka during the period from 2015 to 2019. A continuous positive

trade balance for lime and lemon (from 2010 to 2019) was maintained by seven countries (Maldives, Turkey, India, Israel, Lebanon, Sri Lanka and Pakistan) out of 23. In addition, the highest export share was demonstrated by Turkey, followed by the Maldives during the period from 2015 to 2019.

#### **4.2.5 Trade of Mango**

Mango production is carried out in more than 100 countries around the globe, mainly in tropical and warmer subtropical climates. India is the largest producer of mangoes, accounting for almost 40% of production, followed by China, Thailand, Mexico, Indonesia, Pakistan, Brazil, Bangladesh and Egypt. In 2017, global mango production exceeded 50 million MT, doubling since 2001. Asia accounts for more than 70% of the world's mango production. Over the last five years, the global mango trade has grown by around 2.4% per annum, with approximately 1.5 million MT of mangoes traded globally in 2017 valued at USD 2.2 billion (Australian Centre for International Agricultural Research , 2019). The leading mango exporters are Mexico and Brazil, followed by Peru and Ecuador, while the US is the leading mango importer.

**Table 4.5: Import, Exports, Trade Balance and Export Share of Mango**

	Exports (000' USD)		Imports (000' USD)		Trade Balance (000' USD)		Export Share	
	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019
Thailand	136,991	311,012	525	11,755	136,467	299,257	6.22E-04	1.33E-03
India	199,465	175,856	639	1,122	198,826	174,734	6.81E-04	5.94E-04
Philippines	79,578	71,862	130	46	79,447	71,816	1.47E-03	1.10E-03
Pakistan	43,689	65,562	5	14	43,684	65,548	1.80E-03	2.96E-03
Israel	24,835	32,833	58	839	24,777	31,994	3.83E-04	5.36E-04
United Arab Emirates	1,615	9,977	58,273	-	(56,658)	(84,724)	5.07E-06	2.96E-05
Malaysia	5,837	6,676	15,407	19,420	(9,570)	(12,744)	2.61E-05	3.05E-05
Cambodia	3	6,053	1,206	622	(1,203)	5,431	4.52E-07	5.27E-04
Hong Kong SAR, China	2,630	5,612	33,519	38,052	(30,889)	(32,440)	5.46E-06	1.05E-05
Sri Lanka	332	1,640	1	269	331	1,371	3.34E-05	1.46E-04
Singapore	416	1,302	26,858	31,795	(26,442)	(30,492)	1.04E-06	3.50E-06
Indonesia	1,698	1,260	699	1	999	1,258	9.33E-06	7.76E-06
Oman	241	928	8,679	19,286	(8,438)	(18,357)	4.98E-06	2.65E-05
Saudi Arabia	1,074	907	51,486	51,460	(50,412)	(50,552)	3.12E-06	3.89E-06
Bahrain	33	136	7,931	11,747	(7,898)	(11,612)	1.73E-06	8.38E-06
Jordan	48	74	2,905	3,037	(2,857)	(2,963)	6.14E-06	9.50E-06
Turkey	79	73	262	602	(183)	(529)	5.40E-07	4.44E-07
Lebanon	23	44	1,228	7,589	(1,206)	(7,544)	4.34E-06	1.08E-05
Kuwait	5	30	15,891	22,239	(15,886)	(22,209)	4.92E-08	5.14E-07
Iran, Islamic Rep.	3	8	5,392	13,109	(5,388)	(13,101)	3.22E-08	1.04E-07
Cyprus	2	4	559	1,079	(557)	(1,074)	9.86E-07	1.16E-06
Korea	1	4	20,296	59,780	(20,296)	(59,776)	1.11E-09	7.66E-09

Note: Parentheses represent negative values. The export share is calculated by dividing exports from merchandise exports of a particular country.

Source: Authors' calculation based on the Data from FAO, 2021

The highest average export value (USD 311 million) for mango was reported for Thailand, followed by India during the period from 2015 to 2019. However, India had the highest average export value for mango from 2010 to 2014. Philippines, Pakistan and Israel are the next three countries on the list from 2015 to 2019. Regarding mango imports, the three highest average import values were reported from Korea, Saudi Arabia and Hong Kong from 2015 to 2019. A continuous trade balance for mango was maintained by only seven countries (Thailand, India, Philippines, Pakistan, Israel, Sri Lanka and Indonesia) in the region out of 22 countries during the period of 2015 to 2019. In addition, the highest export share was shown by Pakistan, followed by Thailand during the period 2015 to 2019.

#### 4.2.6 Trade of Orange

Global exports are estimated at 11 million MT, with oranges representing over 40% and tangerines/mandarins nearly 30%. Global orange production for 2020/21 is

estimated to be up 2.5 million tons from the previous year to 48.6 million. Egypt is the world's largest orange exporter in terms of volume. In the past two years, exports have grown by 30%, and Egypt has managed to overtake its biggest competitors, Spain and South Africa (Market Intelligence Team, 2021). Turkey (USD 151 million), Hong Kong (USD 125 million), and China (USD 100 million) are the three leading exporters in Asia for orange in terms of average value during the period from 2015 to 2019. Apart from that, the rest of the countries do not significantly contribute to exports.

**Table 4.6: Import, Exports, Trade Balance and Export Share of Orange**

	Exports (000' USD)		Imports (000' USD)		Trade Balance (000' USD)		Export Share	
	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019
Turkey	204,799	151,365	10,253	10,093	194,545	141,272	1.40E-03	9.20E-04
Hong Kong SAR, China	54,268	125,837	193,657	310,639	(139,389)	(184,802)	1.13E-04	2.35E-04
China	89,374	100,490	102,370	325,191	(12,997)	(224,701)	4.43E-05	4.32E-05
United Arab Emirates	3,073	28,002	107,672	125,531	(104,599)	(97,529)	9.65E-06	8.30E-05
Israel	47,636	12,180	1	4	47,635	12,176	7.34E-04	1.99E-04
India	8,423	10,207	18,831	35,836	(10,407)	(25,629)	2.88E-05	3.45E-05
Singapore	7,236	6,636	43,574	41,874	(36,338)	(35,238)	1.81E-05	1.78E-05
Lebanon	10,421	6,209	498	104	9,923	6,105	2.00E-03	1.51E-03
Saudi Arabia	4,663	5,438	192,323	199,412	(187,660)	(193,974)	1.35E-05	2.33E-05
Kuwait	2,334	5,320	39,572	43,146	(37,238)	(37,826)	2.30E-05	9.11E-05
Iran, Islamic Rep.	807	5,266	51,410	15,276	(50,603)	(10,010)	7.65E-06	6.50E-05
Malaysia	1,250	2,187	60,348	77,974	(59,098)	(75,787)	5.60E-06	1.00E-05
Cyprus	3,800	2,092	453	312	3,347	1,780	1.87E-03	5.79E-04
Pakistan	1,489	1,815	147	139	1,342	1,676	6.14E-05	8.19E-05
Thailand	2,546	1,524	6,952	6,758	(4,406)	(5,233)	1.16E-05	6.54E-06
Jordan	5,239	1,299	20,485	19,428	(15,245)	(18,129)	6.68E-04	1.67E-04
Oman	1,079	1,045	26,305	26,214	(25,226)	(25,169)	2.23E-05	2.98E-05
Bahrain	642	544	10,947	12,184	(10,305)	(11,640)	3.33E-05	3.37E-05
Bangladesh	-	181	40,800	69,572	(40,800)	(69,392)	0.00E+00	4.97E-06
Japan	110	77	131,727	120,099	(131,616)	(120,021)	1.45E-07	1.13E-07
Kazakhstan	26	41	8,953	3,627	(8,927)	(3,585)	3.27E-07	8.27E-07
Sri Lanka	111	38	3,979	5,461	(3,868)	(5,424)	1.12E-05	3.35E-06
Afghanistan	-	22	245	3,070	(245)	(3,048)	4.39E-07	2.98E-05
Korea	26	16	172,726	214,312	(172,700)	(214,296)	4.81E-08	2.95E-08
Indonesia	5	9	22,823	19,267	(22,818)	(19,258)	2.86E-08	5.54E-08

Note: Parentheses represent negative values. The export share is calculated by dividing exports from merchandise exports of a particular country.

Source: Authors' calculation based on the Data from FAO, 2021

China showed the highest average import value (USD 325 million) for oranges, followed by Hong Kong and Korea from 2015 to 2019. Orange is a much prominent agricultural import in most of the Asian countries both in terms of quantity and value. The top six countries that imported orange in Asia spent more than an average of USD 100 million from 2015 to 2019. In addition, five countries were able to maintain a positive trade balance for oranges during the period from 2010 to 2019. However, a significant reduction in the trade balance was noted during the periods. The highest export share was demonstrated by Lebanon followed by Turkey.

#### **4.2.7 Trade of Papaya**

Global papaya exports increased by 2.4% in 2020, to approximately 350,000 MT. The largest exporter of papaya is Mexico, and the leading importer is the US. The second and third leading suppliers of papaya to world markets continued to be Guatemala and Brazil, which exported some 55,000 MT and 43,000 MT in 2020, respectively (Food and Agriculture Organization of the United Nations, 2021). The majority export volumes of papaya in Mexico and Guatemala are destined for the US, while Brazil for the European Union. Apart from the US, two other importers are Netherland and Germany.

In Asia, the largest export value (USD 15 million) for papaya was shown in China during the period from 2010 to 2019. Interestingly, Sri Lanka is among the region's top five export earners. However, overall as a region, Asian contribution towards papaya export is trivial. On the other hand, United Arab Emirates had the highest average import value for papaya, followed by Singapore and China. Nine countries out of 15 were able to maintain a positive trade balance for papaya during the period from 2010 to 2019. Sri Lanka is also on the same list, which maintained a positive trade balance for papaya over the recent years. Interestingly, out of 15 countries, the highest export share for papaya was shown in Sri Lanka, followed by the Philippines.

**Table 4.7: Import, Exports, Trade Balance and Export Share of Papaya**

	Exports (000' USD)		Imports (000' USD)		Trade Balance (000' USD)		Export Share	
	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019
China	2,231	15,675	6,198	6,771	(3,966)	8,904	1.11E-06	6.74E-06
Malaysia	9,158	8,683	15	57	9,143	8,626	4.10E-05	3.97E-05
India	5,421	6,505	-	-	5,421	6,505	1.85E-05	2.20E-05
Sri Lanka	1,049	4,161	2	5	1,047	4,155	1.05E-04	3.71E-04
Philippines	3,986	2,946	-	-	3,986	2,946	7.36E-05	4.53E-05
Thailand	1,034	1,983	15	18	1,020	1,965	4.70E-06	8.51E-06
Bangladesh	41	268	7	10	35	258	1.61E-06	7.37E-06
United Arab Emirates	64	212	4,914	11,640	(4,851)	(11,428)	2.00E-07	6.28E-07
Cambodia	16	107	6	-	11	107	2.44E-06	9.28E-06
Israel	32	83	-	-	32	83	4.99E-07	1.36E-06
Bahrain	-	48	1,081	1,880	(1,080)	(1,832)	1.04E-08	2.97E-06
Indonesia	143	36	120	-	22	36	7.83E-07	2.23E-07
Hong Kong SAR, China	59	26	5,090	5,150	(5,031)	(5,124)	1.22E-07	4.85E-08
Oman	155	15	101	612	54	(596)	3.21E-06	4.39E-07
Singapore	2	3	7,639	9,106	(7,638)	(9,102)	4.51E-09	9.14E-09

Note: Parentheses represent negative values. The export share is calculated by dividing exports from merchandise exports of a particular country.

Source: Authors' calculation based on the Data from FAO, 2021

#### 4.2.8 Trade of Pineapple

The total export quantity of pineapple is 2.9 million MT in 2020; the leading exporters are Costa Rica and the Philippines. Pineapple exports from Costa Rica are almost exclusively destined to the US and the European Union, with 51% of shipments sent to the US in 2020 and approximately 37% to the European Union (Food and Agriculture Organization of the United Nations, 2021). Meanwhile, the Philippines exports mainly to China and Korea. Apart from that, the leading African pineapple supplier is Costa d'Ivoire, followed by Ghana. In addition, Kenya is identified as a fast-growing exporter in the African region for pineapple.

**Table 4.8: Import, Exports, Trade Balance and Export Share of Pineapple**

	Exports (000' USD)		Imports (000' USD)		Trade Balance (000' USD)		Export Share	
	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019	2010- 2014	2015- 2019
Philippines	102,435	210,870	-	26	102,435	210,844	1.89E-03	3.24E-03
United Arab Emirates	1,935	9,914	13,314	36,083	(11,380)	(26,170)	6.07E-06	2.94E-05
Malaysia	6,186	7,160	856	1,045	5,330	6,115	2.77E-05	3.27E-05
Thailand	2,515	5,900	56	20	2,459	5,881	1.14E-05	2.53E-05
Indonesia	67	5,828	24	-	42	5,828	3.67E-07	3.59E-05
China	2,029	5,498	45,096	168,018	(43,067)	(162,520)	1.01E-06	2.37E-06
Sri Lanka	2,613	4,107	18	6	2,595	4,101	2.63E-04	3.66E-04
India	1,695	3,613	12	2	1,683	3,612	5.79E-06	1.22E-05
Hong Kong SAR, China	3,696	1,410	10,958	11,630	(7,262)	(10,221)	7.67E-06	2.63E-06
Saudi Arabia	501	1,336	12,933	18,571	(12,432)	(17,235)	1.45E-06	5.73E-06
Turkey	32	259	5,800	6,945	(5,769)	(6,687)	2.17E-07	1.57E-06
Kuwait	106	141	1,884	4,721	(1,777)	(4,580)	1.05E-06	2.42E-06
Bahrain	45	122	1,761	2,497	(1,715)	(2,375)	2.34E-06	7.53E-06
Oman	54	98	2,261	2,744	(2,207)	(2,646)	1.11E-06	2.78E-06
Kazakhstan	5	48	2,412	2,885	(2,407)	(2,837)	5.82E-08	9.63E-07
Singapore	21	46	6,396	8,116	(6,375)	(8,069)	5.31E-08	1.25E-07
Japan	18	44	120,264	123,611	(120,246)	(123,567)	2.40E-08	6.51E-08
Korea	5	8	54,323	63,096	(54,318)	(63,087)	9.99E-09	1.53E-08

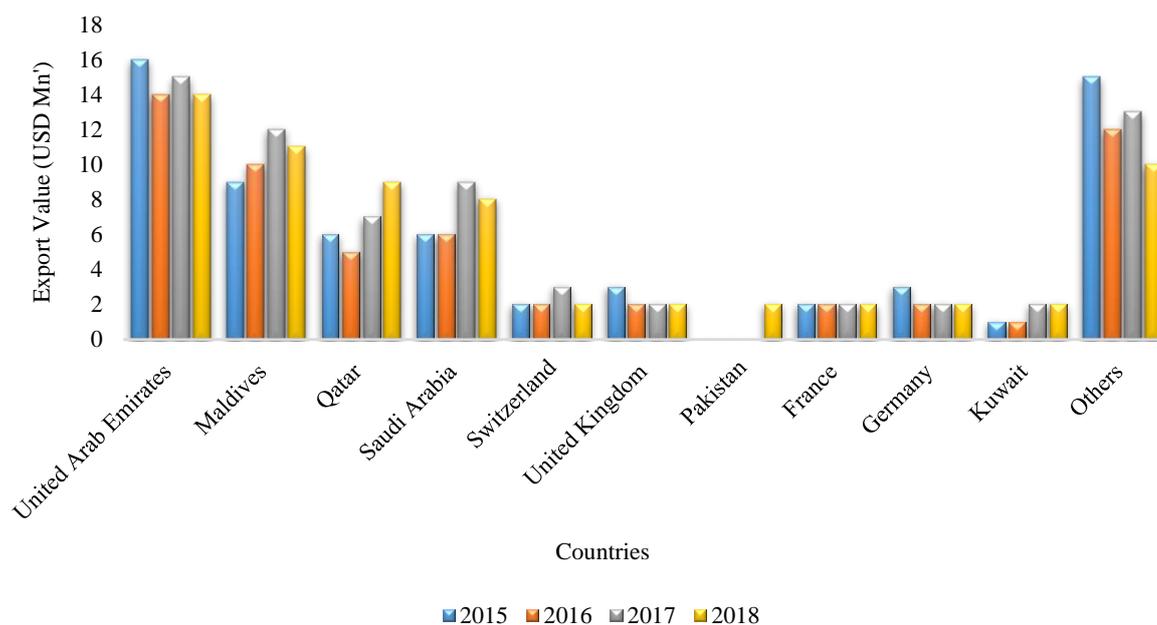
Note: Parentheses represent negative values. The export share is calculated by dividing exports from merchandise exports of a particular country.

Source: Authors' calculation based on the Data from FAO, 2021

Philippines is the largest pineapple exporter in Asia and recorded an average export value of USD 210 million from 2015 to 2019. This value is 20 times greater than the average export value of the second-best player in the region, the United Arab Emirates. The third, fourth and fifth players are Malaysia, Indonesia and China during the period from 2015 to 2019. Regarding the imports, China (USD 168 million) and Japan (USD 123 million) are the leading importers of pineapple from 2015 to 2019. Six countries out of 18 were able to maintain a positive trade balance for pineapple, including Sri Lanka. The highest export share of pineapple was reported for the Philippines followed by Sri Lanka from 2015 to 2019.

### 4.3 International Trade of Fruits in Sri Lanka

Sri Lanka has a diversified agricultural system due to its natural and man-made facilities: naturally rich soil, a wide range of agro-climatic zones, a well-distributed rainfall pattern, and a strong network of irrigation facilities. Hence, Sri Lanka is one of the ideal countries for agriculture and agro-based industries in the Asian region. Around 80 varieties of fruit and vegetables are grown in Sri Lanka's varied agro-climatic areas. They collectively produce more than 900,000 MT of fruit and vegetable annually and export fresh and processed varieties to many destinations worldwide. The manufacturing and exporting of more than 9000 MT of produce annually solidifies Sri Lanka as a major export of fruits, nuts, and vegetables (Sri Lanka Export Development Board, 2021). Sri Lanka also produces succulent tropical fruit such as pineapple, mangosteen, ripe jack, avocado, rambutan, star fruit, passion fruit, anoda, etc., which are known far and wide for their rich, unique flavours, aromas with bright, appetizing colours markets. Also, they're known to contain plenty of nutrients and entail significant health benefits. With an increasingly health-conscious consumer base, the global demand for Sri Lankan fruit is clearly on the rise. Around 65% of the fresh products are targeted for the Middle East and the Maldives Islands, and about 98% of the processed products for the European market. United Arab Emirates, Saudi Arabia, Maldives, India, UK, Kuwait, India, Germany, Qatar, and Pakistan have been enlisted as the major fruits, nut and vegetable importing countries from Sri Lanka.

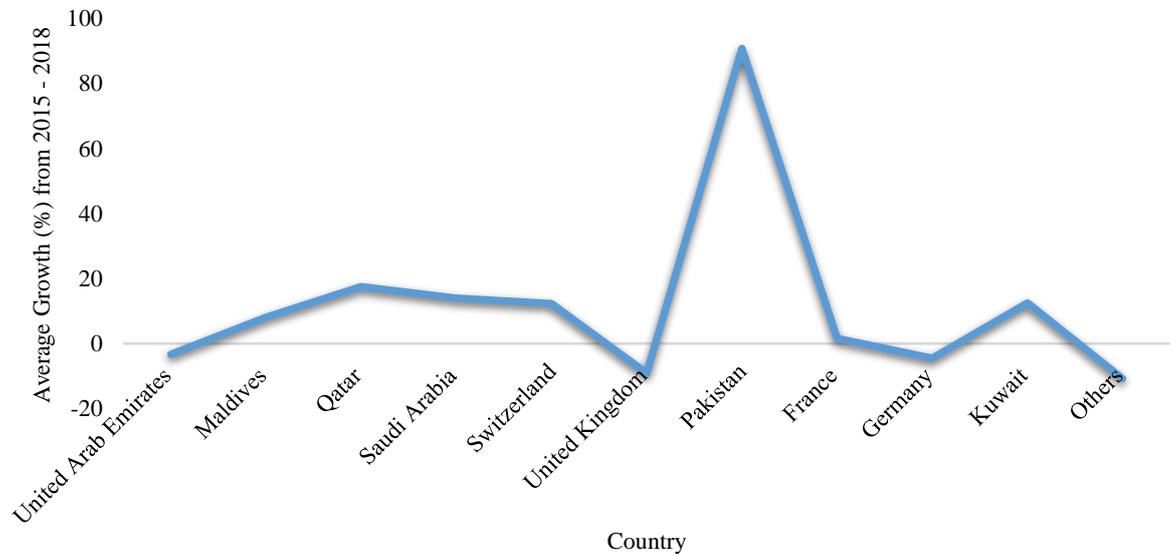


Source: Sri Lanka Export Development Board, 2021

**Figure 4.1: Top Ten Fruit Exporting Countries from Sri Lanka (2015 - 2018)**

In general, the major import client for fruits and vegetables in Sri Lanka was the United Arab Emirates during the period of 2015 to 2018 (Figure 4.1). The second-best contributor is Maldives, followed by Qatar and Saudi Arabia. However, over the years, a slightly decreasing trend in export values has been noted for the first two players

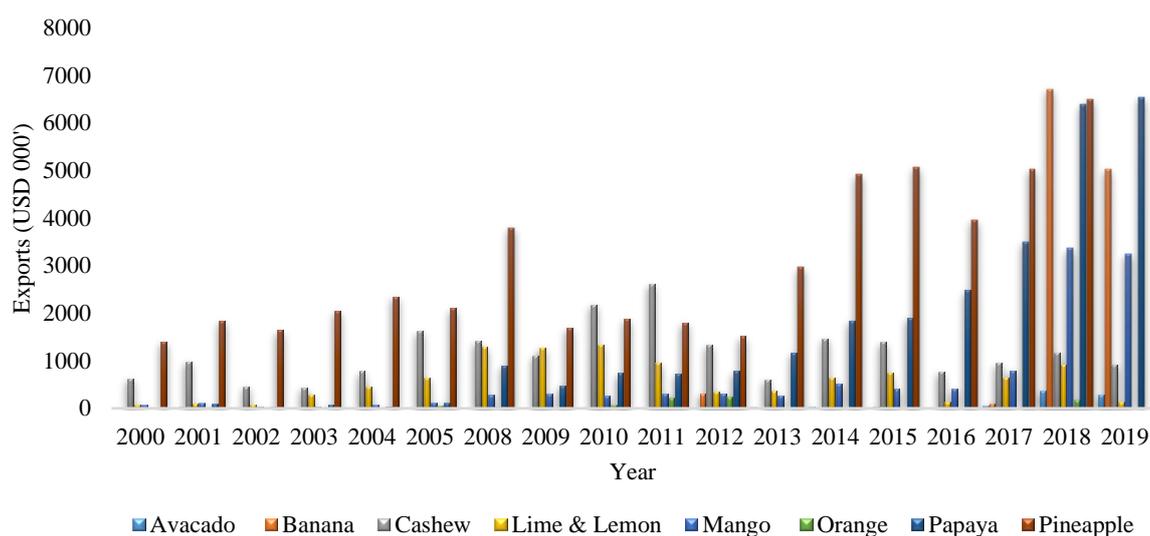
except for Qatar. Apart from the Asian and Middle East countries, Western countries such as Switzerland, the United Kingdom, France, and Germany are also importing fruits and vegetables from Sri Lanka. The leading importer is Switzerland followed by the United Kingdom.



Source: Authors' construction based on the Data from Sri Lanka Export Development Board, 2021

**Figure 4.2: Average Export Growth of Fruit and Vegetable Export Sector of Sri Lanka (2015 - 2018)**

Interestingly, the average growth of the leading importer (United Arab Emirates) of fruits and vegetables from Sri Lanka has decreased by 3% (Figure 4.2). However, the average growth of the rest of the four players (Maldives, Qatar, Saudi Arabia and Switzerland) has significantly increased. Apart from that, the average growth of the other players has also decreased by more than 10%.

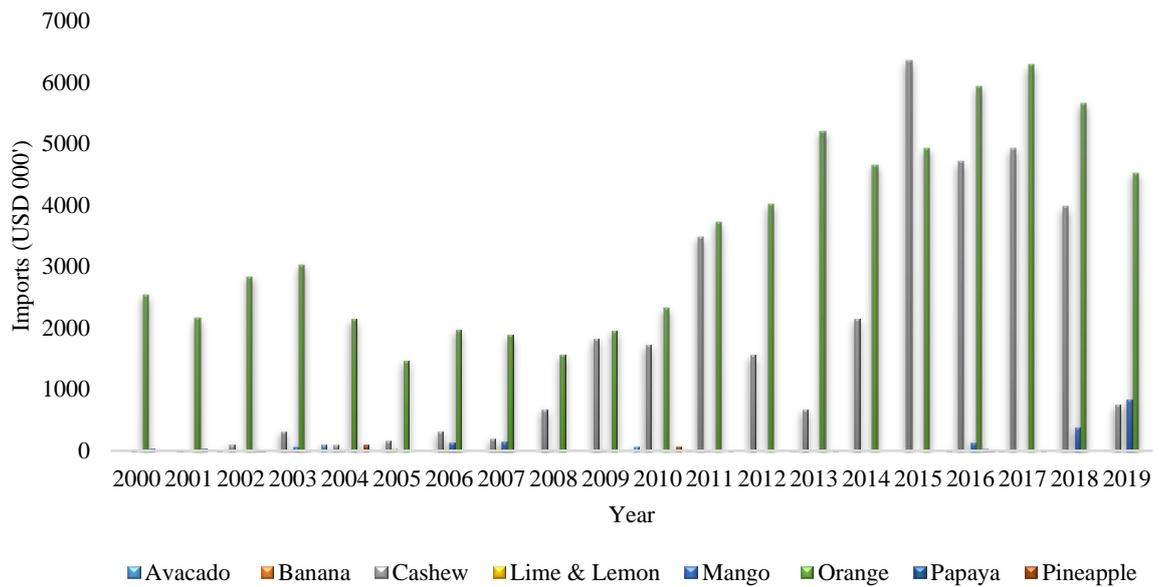


Source: Authors' constructed based on the Data from FAO, 2021

**Figure 4.3: Export Values by Fruit Category (2000 - 2019)**

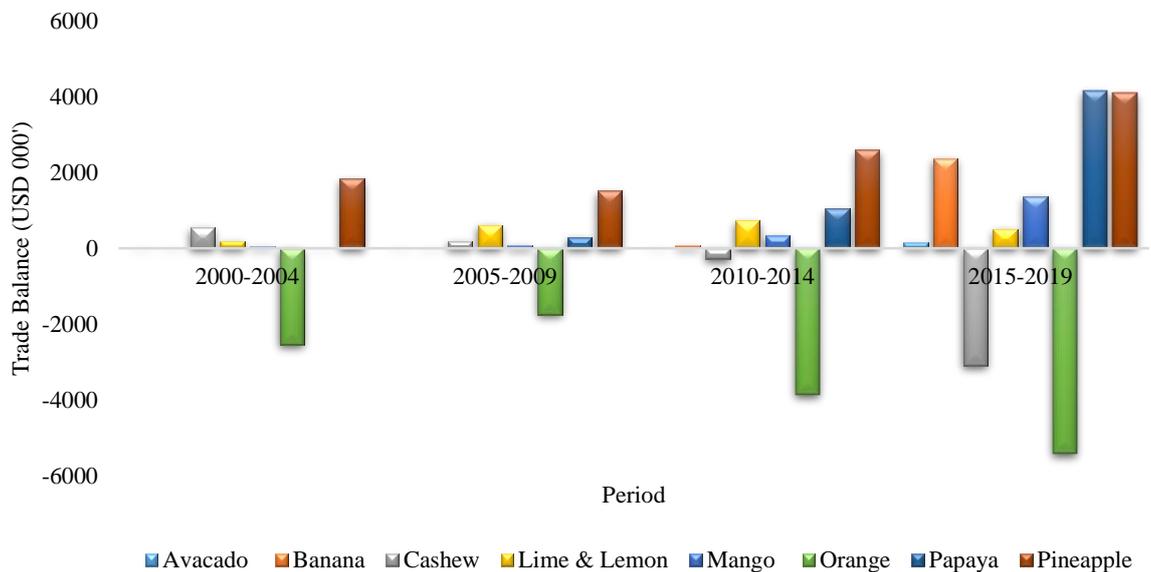
Pineapple is the commodity which had the highest average exports in terms of value over the period from 2010 to 2015 (Figure 4.3). After 2015, there was a steady increment in pineapple exports in terms of value. The second-highest average export value was recorded for papaya, followed by Cashew from 2010 to 2015. All three fruit (pineapple, papaya and cashew) commodities had an average value of over USD 1,000 million. Sri Lanka is the seventh out of 18, four out of 15 and nine out of 24 countries that exported pineapple, papaya and cashew, respectively, in terms of value during the period from 2015 to 2019. Banana, mango and, lime and lemon export values were placed as fourth, fifth and sixth fruit commodities, respectively.

Regarding imports, the highest average imports were recorded for orange in terms of value from 2000 to 2019 (Figure 4.4). This has gradually increased over the years as well. The second-highest average import value was derived for cashew, followed by mango. Import values of the rest of the fruit commodities were not much significant during the period from 2000 to 2019. The least average import value was recorded for bananas.



Source: Authors' constructed based on the Data from FAO, 2021

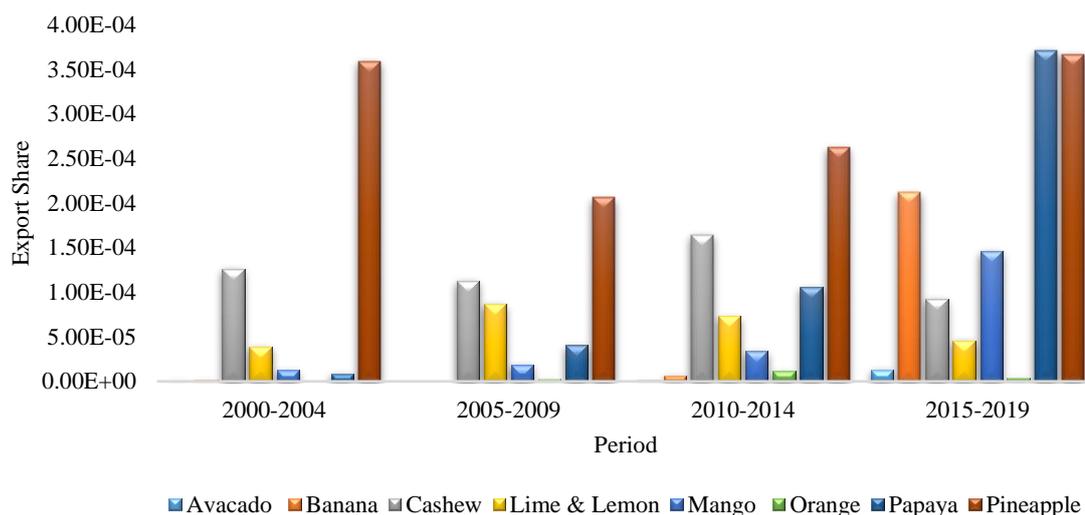
**Figure 4.4: Import Values by Fruit Category (2000 - 2019)**



Source: Authors' constructed based on the Data from FAO, 2021

**Figure 4.5: Trade Balance by Fruit Category (2000 - 2019)**

Sri Lanka maintained positive trade balances for papaya, pineapple, banana, mango, lime and lemon and avocado from 2010 to 2019 (Figure 4.5). The highest trade balance was recorded for papaya followed by pineapple. A negative trade balance was observed for both cashew and orange. The lowest trade balance was recorded for orange over the periods.



Source: Authors' constructed based on the Data from FAO, 2021

**Figure 4.6: Export Share by Fruit Category (2000 - 2019)**

The highest average export share was recorded for papaya, followed by pineapple during the period from 2015 to 2019. However, before 2015, the highest average export share was recorded for pineapple. Interestingly, Sri Lanka had the highest average export share for papaya out of 15 exporters in Asia and the second-highest average export share for pineapple out of 18 countries during the period from 2015 to 2019. Third, fourth and fifth average export shares were recorded for banana, mango and cashew, respectively (Figure 4-6).

#### 4.4 Chapter Summary

It is evident that the export performance related to fruit crops of the Asian region has gradually increased over the recent decades, and Asia has managed to make space as a significant player in the international trade. Dominant export players of avocado, banana, cashew, lime and lemon, mango, orange, papaya and pineapple are Hong Kong, the Philippines, India, Maldives, Thailand, Turkey, China, respectively. In addition, leading importers of avocado, banana, cashew, lime and lemon, mango, orange, papaya and pineapple are Hong Kong, China, India and United Arab Emirates respectively. Around 65% of the fresh products are targeted for the Middle East and the Maldives Islands, and about 98% of the processed products for the European market. The United Arab Emirates is the leading importer of fruits and vegetables from Sri Lanka over the years. Sri Lanka has the highest average export share for papaya, followed by pineapple.



## CHAPTER FIVE

### State and the Level of Comparative Advantage

#### 5.1 Introduction

This chapter is devoted to presenting the state of comparative advantage of selected eight fruits crops among different countries. The analysis presents whether Sri Lanka has a comparative advantage in exporting selected eight fruits crops and compared to other countries individually from 2000 to 2019. Since this study is based on the calculation of five comparative advantage indices, countries are grouped into two categories and mapped, indicating comparative advantaged and disadvantaged countries. This categorization was made for each index individually. For example, separate maps for avocado were constructed for countries with comparative advantages and disadvantages for BRCA, RSCA, NRCA, Vollrath's RCA and AI. The same analysis was adopted for all eight fruit crops. Lastly general conclusion of comparative advantage - "Yes", and "comparative advantage - No" was made as described in section 3.3.1. Once countries having the comparative advantage and disadvantages are identified, the second part of this chapter provides period-based mean score analysis of all five indices. The analysis compares the scores across countries and time to conclude which countries and periods had a stronger or weaker comparative advantage.

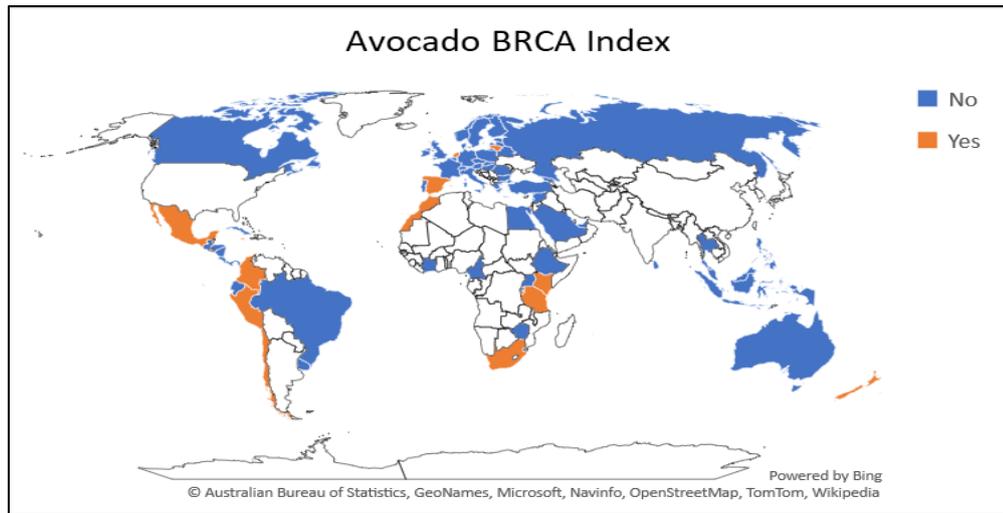
#### 5.2 Comparative Advantage and Disadvantage Countries

The study calculated the countries gaining comparative advantage with five indexes. If a country gains the advantage from three indexes over the five indexes calculated, it was identified as a country that gains the comparative advantage. This identified the countries gaining the comparative advantage, and comparative disadvantage, dividing the countries into main five regions: Africa, America, Asia, Europe, and Oceania.

##### 5.2.1 Avocado

According to the BRCA index calculated for avocado, 18 of 83 countries in name Burundi, Chili, Colombia, Dominica, Israel, Jamaica, Kenya, Lithuania, Mexico, Morocco, Netherland, New Zealand, Peru, Saint Lucia, Saint Vincent, South Africa, Spain and Tanzania are gained the comparative advantage while 66 countries gained a comparative disadvantage. Five countries in the African region were able to gain a comparative advantage, while nine were experiencing comparative disadvantage among the selected 14 countries in the region. Seven countries gained a comparative advantage in the American region among 21 selected countries. In the Asian region, among the selected 16 countries, all the countries have experienced a disadvantage in exporting avocado, according to the BRCA. However, in Europe, four countries could gain the comparative advantage among 31 selected countries, while in Oceania, one gained the advantage over two countries. According to the BRCA index, Sri Lanka

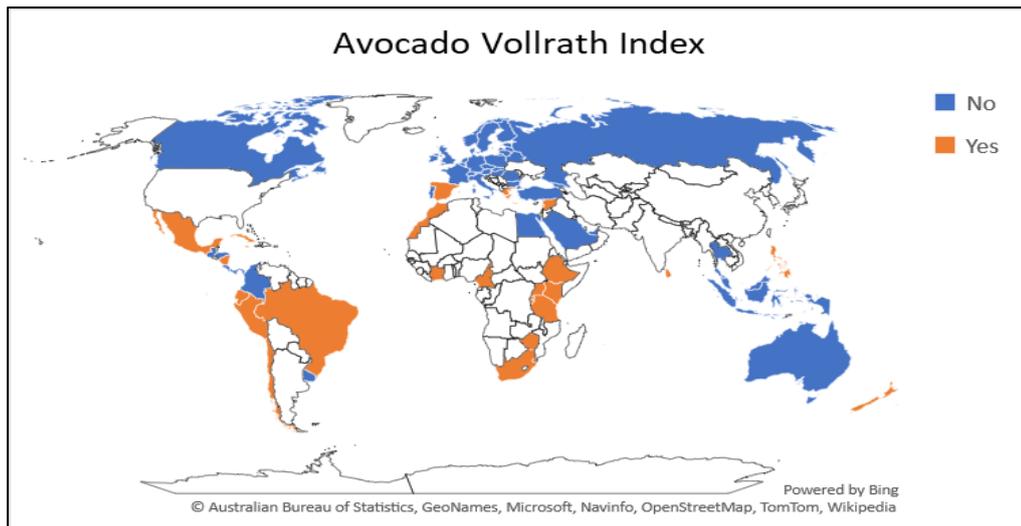
didn't experience comparative advantage. Further, countries in the American region are mostly advantaged in exporting avocado, which is displayed in Map 5.1.



Source: Authors computed from FAO, 2020

#### Map 5.1: Avocado BRCA Index

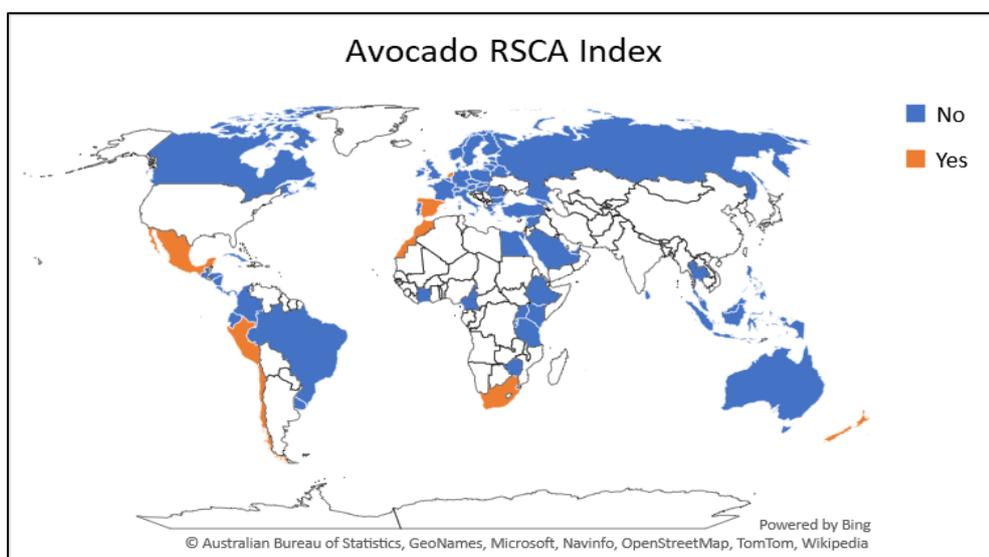
Despite the results of BRCA, Vollrath RCA revealed that 31 countries gained a comparative advantage, whereas 52 countries were experiencing a disadvantage in exporting avocado. Thus, around 37.34% of countries among the selected countries gained an advantage. Reviewing the regional spread of the comparative advantage, 85.71% of countries among chosen countries in the African region gain the advantage, recording the highest number of countries gaining the advantage compared with other regions. Thus, Egypt and Mauritius are the countries that haven't advantage among selected countries. However, 11 countries gain the comparative advantage in the American region among the selected 21 countries, which is higher than the BRCA index results. Brazil, Chili, Cuba, Dominica, Ecuador, Jamaica, Mexico, Nicaragua, Peru, Saint Lucia, Saint Vincent, are among the advantaged countries. In the Asian region, 26.67%, four countries gain the advantage, as Lebanon, Philippines, Sri Lanka and Syrian Arab Republic, which is identified as none of the selected countries gain an advantage according to BRCA. In the European region, countries experiencing comparative disadvantage were recorded as 90.32%, whereas the highest number of countries gaining comparative disadvantage according to the Vollrath RCA index. Whereas Greece, Israel, and Spain are gain the advantage. The analysis revealed that Sri Lanka earned a comparative advantage over avocado exports. Map 5.2 depicts the countries gaining comparative advantage and disadvantage according to the Vollrath RCA index.



Source: Authors computed from FAO, 2021

### Map 5.2: Avocado Vollrath RCA Index

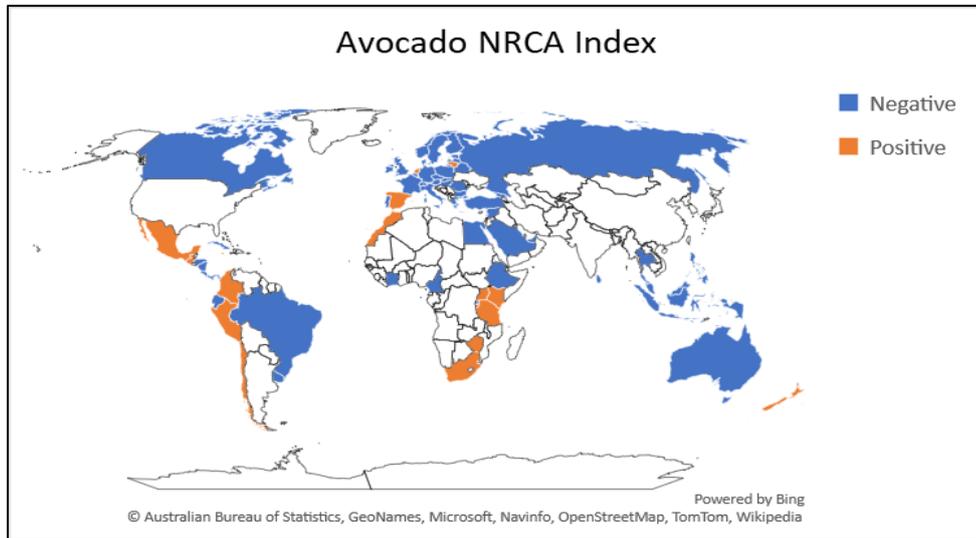
The RSCA index results disclosed that the countries that gain comparative advantage were only 11 among the selected countries, less than the above-reviewed indexes. Whereas, Morocco, South Africa, Israel, Netherland, Spain, New Zealand, Chili, Dominica, Mexico, Peru and Saint Vincent. Hence, moving into the regional spread of the countries gaining the comparative advantage, 14.29% of countries in the African region gain the comparative advantage while 23.8% of countries in the American region and 9.67% of countries in the Europe region gain the advantage. The study revealed that Sri Lanka didn't experience a comparative advantage. Hence, regardless of the results on BRCA and Vollrath RCA, according to the RSCA index, a smaller number of countries gain the advantage, and the dispersion of the region gaining advantage is different in the RSCA index, as the Map 5.3 depicted below.



Source: Authors computed from FAO, 2021

### Map 5.3: Avocado RSCA Index

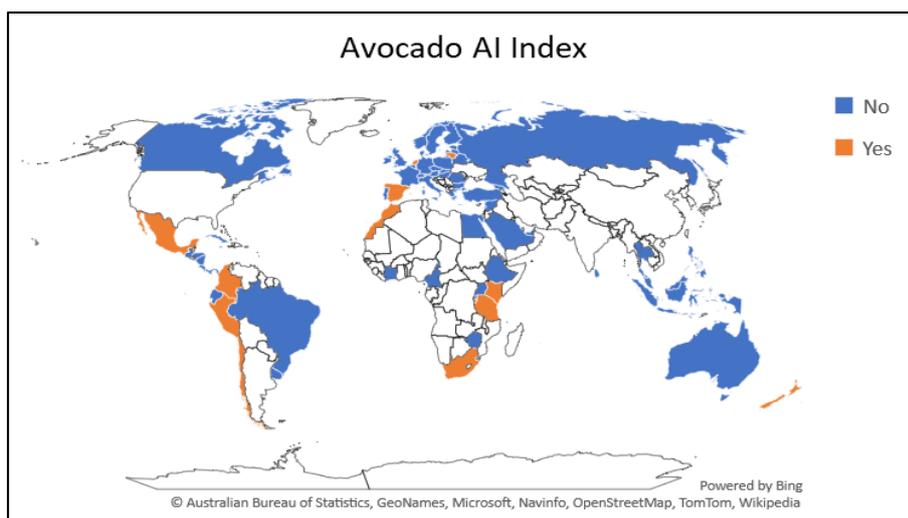
Twenty countries were gaining a comparative advantage according to the NRCA index, while 63 countries experienced a disadvantage over exporting avocado, which is 75.9% among the selected countries shown in Map 5.4. In the African region, proving the result of BRCA and Vollrath RCA, the highest number of countries gaining advantage can be identified, which was 50% among the selected countries. However, 38.9% of countries gained an advantage, higher than that revealed in the RSCA index in the American region. In the European region, 12.9% of countries gained the advantage.



Source: Authors computed from FAO, 2021

#### Map 5.4: Avocado NRCA Index

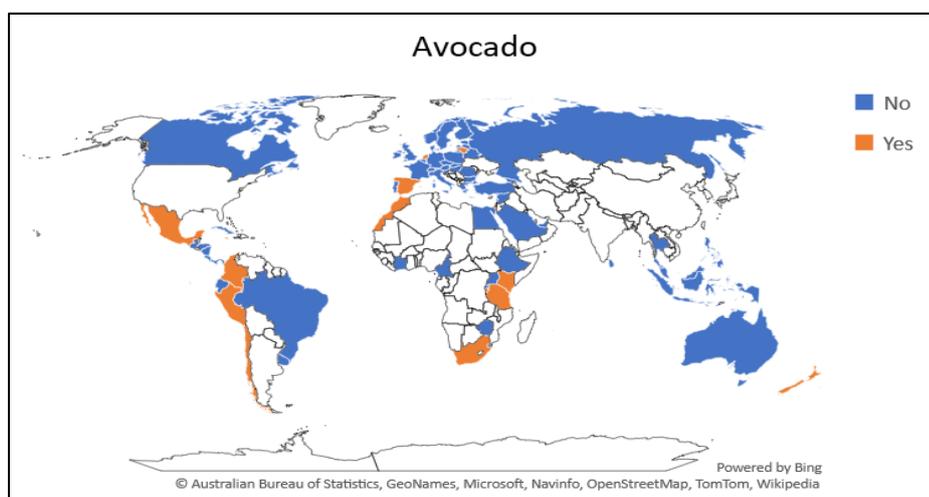
Confirming the results of BRCA and RSCA, in the Asian region, one country has been able to gain a comparative advantage over exporting avocado to the world market. And the results for the Oceania region also represented that one country gained the advantage over the period, proving the reviewed indexes above. The analysis depicted that according to the NRCA index, Sri Lanka didn't experience a comparative advantage.



Source: Authors computed from FAO, 2021

### Map 5.5: Avocado AI Index

The AI index identified that 17 countries gained the advantage that BRCA identified. Thus, 20% of the countries in the analysis gained an advantage over the period. Moving into the regional dispersion of the countries that achieved the comparative advantage over the period, 35.71% of African and 33.3% of countries in the American region experienced the advantage, while 12.9% of countries experienced the advantage in Europe region. As revealed by the above-examined indexes, despite the results of Vollrath RCA, one country could gain the advantage in the Asian region. Thus, validating the results of BRCA, the countries that gained the advantage were the same as the results of the AI index, which is displayed in Map 5.5 on the AI index. Naming, Burundi, Chili, Colombia, Dominica, Israel, Kenya, Lithuania, Mexico, Morocco, Netherland, New Zealand, Peru, Saint Lucia, Saint Vincent, South Africa, Spain, and Tanzania. Further, Sri Lanka could not experience the comparative advantage according to the AI index.



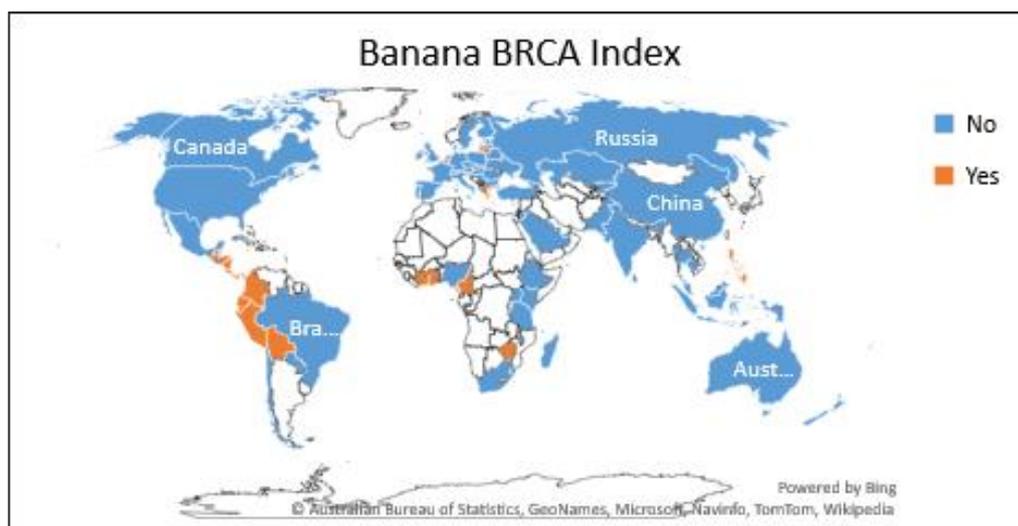
Source: Authors computed from FAO, 2021

### Map 5.6: Avocado overall Comparative Advantage and Disadvantage

Concluding the results from the above five indexes, the study identified that 19 countries gained a comparative advantage from 2000-2019 as they show comparative advantage in at least three indexes out of five, where 21.68% of countries gained the comparative advantage over exporting avocado to the world market. In the African region, 50% of countries were experiencing an advantage while the rest experienced a disadvantage. In the American region, 33.3% of countries gained the advantage, while in Europe, 12.9% gained the advantage, as shown in Map 5.6. Naming the identified countries, Burundi, Chili, Colombia, Dominica, Israel, Jamaica, Kenya, Lithuania, Mexico, Morocco, Netherland, New Zealand, Peru, Saint Lucia, Saint Vincent, South Africa, Spain, and Tanzania can be mentioned. Stating the stance of Asia, regardless of the results from Vollrath RCA, the region does not have a notable advantage over the period. In addition to that as a country in the Asian region, Sri Lanka was also experiencing a disadvantage in exporting avocado to the world market. According to the above five indexes, Sri Lanka only gained the advantage as the Vollrath RCA, and the other indexes recorded a disadvantage for Sri Lanka which can determine that the country wasn't able to gain in exporting avocado to the world market.

### **5.2.2 Banana**

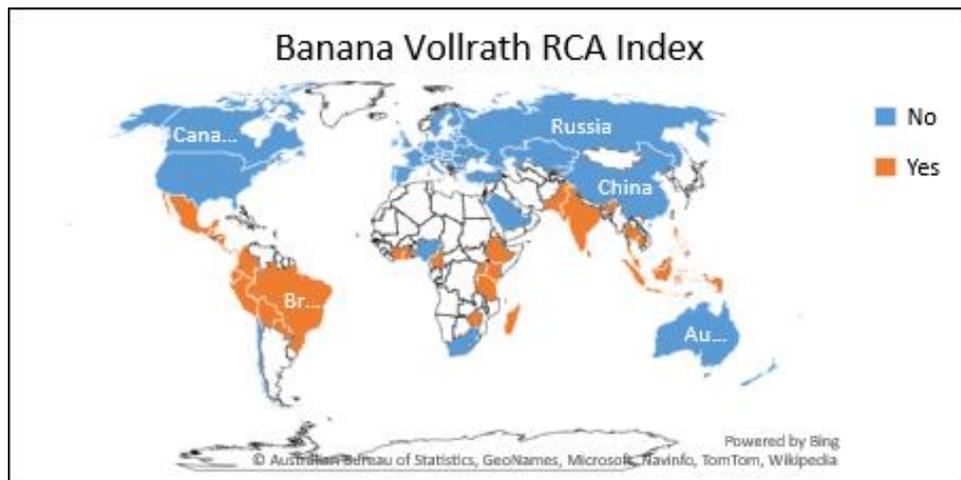
The BRCA values calculated for bananas for the selected 89 countries, 25.84% of countries were able to gain the advantage, while 74.15% of the countries were experiencing a disadvantage in exporting bananas to the world market. The distribution of the countries depicts in Map 5.7. Only four countries (28.57%) in the African region could gain the advantage over the period, while most of the countries experienced a disadvantage in exporting bananas. The American region countries were experiencing highly advantage in exporting bananas which implied that 68.42% of the countries among selected countries in the region were experiencing the advantage. Countries in the European region and Asian region did not have many advantages as 12.5% and 9.52% of countries, respectively, only gained the advantage in exporting bananas according to the BRCA index. In addition, in Oceania, none of a country could gain the advantage over the selected three countries. Hence, the identified countries are Belgium, Belize, Bolivia, Cameroon, Colombia, Costa Rica, Cote d'Ivoire, Ecuador, Ghana, Greece, Guatemala, Honduras, Jamaica, Lebanon, Lithuania, Nicaragua, Panama, Peru, Philippines, Slovenia, St. Lucia, St. Vincent and the Grenadines and Zimbabwe. According to the analysis, Sri Lanka could not gain a comparative advantage.



Source: Authors computed from FAO, 2021

### Map 5.7: Banana BRCA Index

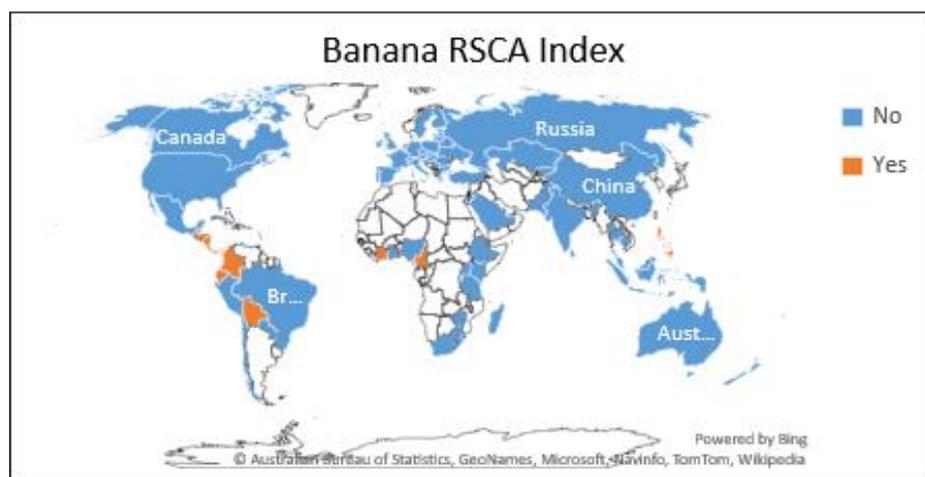
The results of the Vollrath RCA index disclosed that 44.94% of countries in the world were able to gain an advantage much higher than that implied by the BRCA. Further, in the regional analysis, the countries in the African region are highly advantageous in exporting bananas to the world market, where 85.75% of countries in the region gained the advantage over the period. Similarly, 84.2% of the countries in the American region gained a comparative advantage over exporting bananas, being competitive with the African region. However, 47.62% of countries in the Asian region and 3.12% in the European region were able to gain the advantage over exporting bananas, while one country in Oceania was able to gain the advantage over exporting bananas which is shown in Map 5.8. Belgium, Belize, Bolivia, Brazil, Burundi, Cambodia, Cameroon, Colombia, Costa Rica, Cote d'Ivoire, Ecuador, Eswatini, Ethiopia, Fiji, Ghana, Guatemala, Honduras, Hong Kong, India, Indonesia, Jamaica, Kenya, Lebanon, Madagascar, Malaysia, Mexico, Nicaragua, Pakistan, Panama, Paraguay, Peru, Philippines, Rwanda, Sri Lanka, St. Lucia, St. Vincent and the Grenadines, Tanzania, Thailand, Uganda and Zimbabwe are the identified countries. Further, the Vollrath RCA analysis revealed that Sri Lanka experienced a comparative advantage in exporting bananas to the world market.



Source: Authors computed from FAO, 2021

### Map 5.8: Banana Vollrath RCA Index

Map 5.9 depicts the countries experiencing comparative advantage and comparative disadvantage according to the RSCA index calculated for banana. There, 17.98% of the selected countries were experiencing an advantage while most of the countries (82.02%) were experiencing a comparative disadvantage. In the American region, 57.89% of countries gained the advantage, recording the highest number of countries gained the advantage in a region. Further, 14.28% in the African region, 9.52% in the Asian region and 3.22% in the European region countries have gained the advantage according to the RSCA index. Proving the results of BRCA, no country in Oceania gained the advantage. However, despite the result of Vollrath RCA, the RSCA index revealed that Sri Lanka could not gain the comparative advantage.

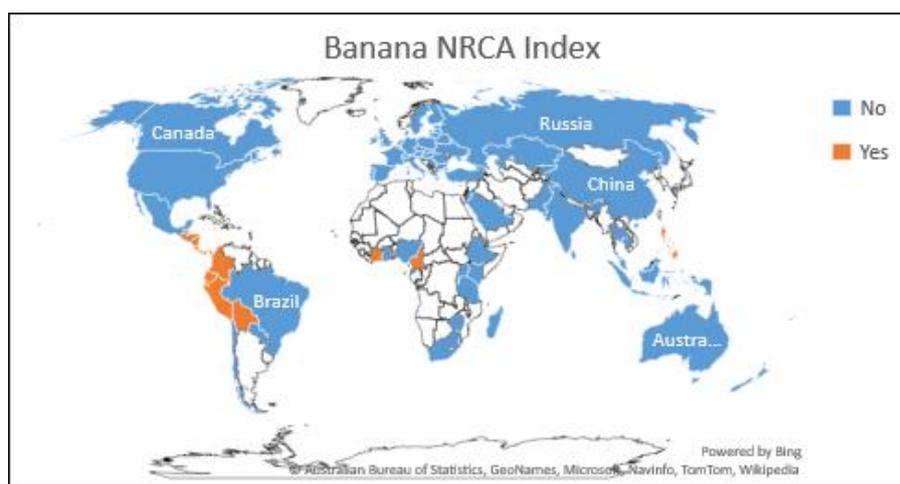


Source: Authors computed from FAO, 2021

### Map 5.9: Banana-RSCA Index

Continuing with the NRCA index, 19 countries gained comparative advantage in the world. The rest of the 70 countries (78.65%) were experiencing disadvantage in exporting banana to the world market. Map 5.10 illustrates the countries experiencing

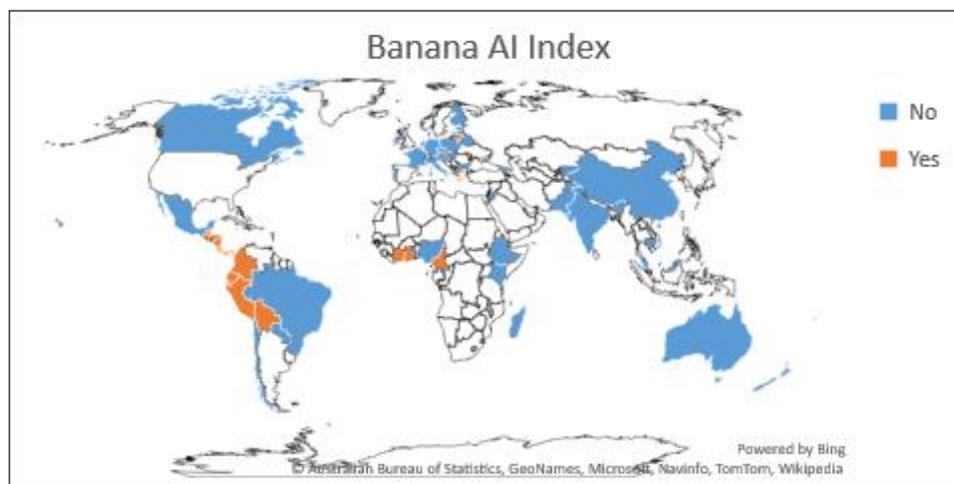
advantage and disadvantage, which can be identified clearly on a regional basis. Proving the results of BRCA and Vollrath RCA, it can be identified that 68.42% of countries in the American region are experiencing a comparative advantage while 14.28% in Africa, 12.5% in Europe, and 9.5% in the Asian region were gaining the advantage over the period. And none of the countries was not able to gain the comparative advantage for banana in Oceania among the selected three countries. Most countries recorded a negative NRCA value, implying a disadvantage for the respective country. Similarly, Sri Lanka could not gain that comparative advantage in exporting banana to the world market.



Source: Authors computed from FAO, 2021

#### **Map 5.10: Banana-NRCA Index**

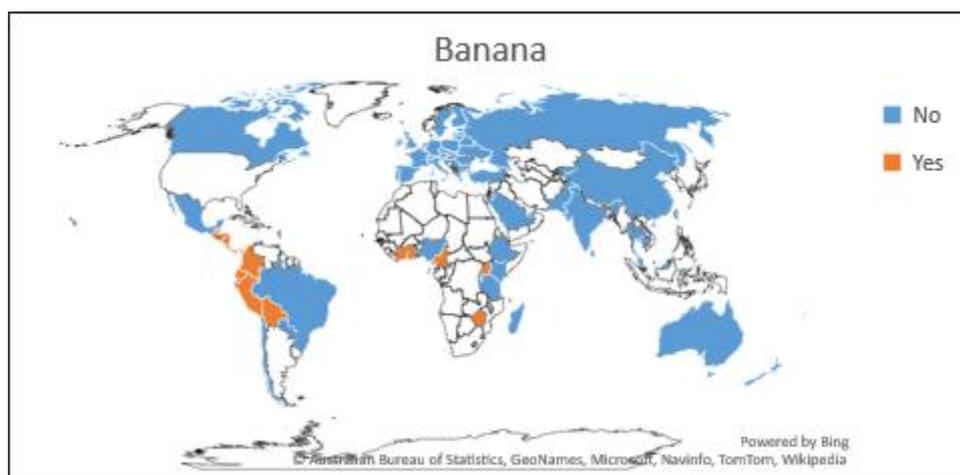
Confirming the results unfolded in BRCA, in the AI index, 23 countries gained the advantage for exporting bananas to the world market, recording 25.84% countries gaining comparative advantage and 74.15% countries experiencing disadvantage for the period of 2000-2019. Similarly, as the results revealed from BRCA, RSCA and NRCA, 68.42% of countries in the American region gained the advantage, while it was 28.5% of countries in Africa, 12.5% of countries in Europe and 9.5% of countries in Asia among the selected countries. Map 5.11 below shows the stance of the selected countries in experiencing comparative advantage and comparative disadvantage based on the analysis of the AI index.



Source: Authors computed from FAO, 2021

### Map 5.11: Banana-AI Index

According to the five indexes reviewed above, 23 countries were able to gain an advantage at least from three indexes. Hence, the overall status of the comparative advantage for exporting bananas to the world market was that 25.84% among selected 89 countries could be considered as gaining the advantage over the period. Regional analysis showed that 73.68% of countries in the American region gained a comparative advantage over the period. Further, 35.71% of countries in the African region, 9.5% in Asia and 3.12% in Europe were experiencing a comparative advantage. As Map 5.12 illustrates, the distribution of the countries gaining comparative advantage can be identified are Belgium, Belize, Bolivia, Cameroon, Colombia, Costa Rica, Cote d'Ivoire, Ecuador, Ghana, Guatemala, Honduras, Jamaica, Lebanon, Nicaragua, Panama, Peru, Philippines, St. Lucia, St. Vincent and the Grenadines and Zimbabwe, and none of the countries in Oceania gained the comparative advantage in the respective period. Regarding the stance of Sri Lanka on gaining a comparative advantage, Sri Lanka passed only the Vollrath RCA index, and according to the BRCA, RSCA, NRCA and AI indexes, Sri Lanka was experiencing a disadvantage in exporting bananas to the world market.

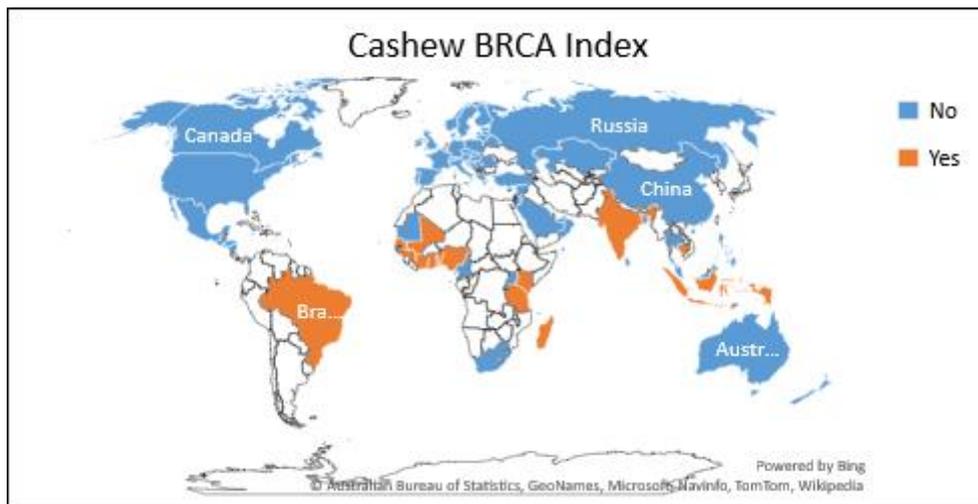


Source: Authors computed from FAO, 2021

**Map 5.12: Banana-Overall Comparative Advantage and Disadvantage**

### 5.2.3 Cashew

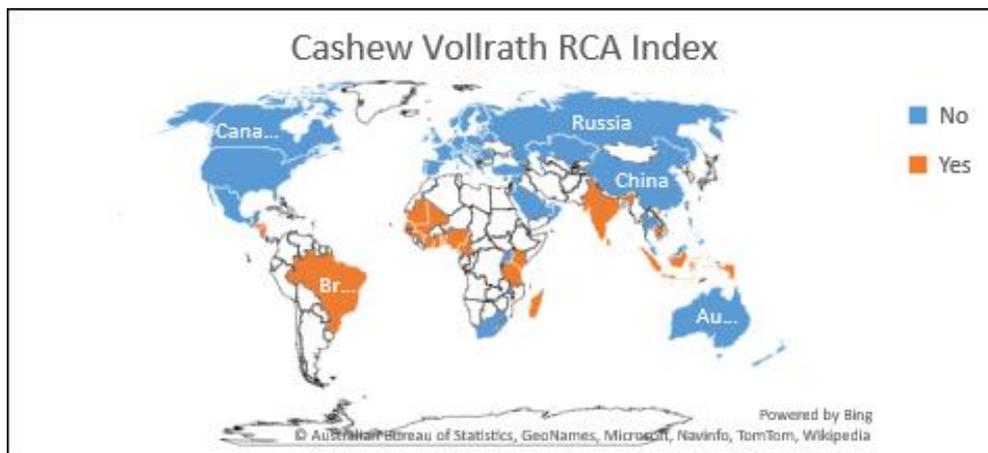
According to the BRCA index, 16 countries (19.27%) gained the comparative advantage among the selected 83 countries. The rest of 80.72% of countries are experiencing a disadvantage in exporting cashew to the world market. Ten of 15 selected countries in the African region were experiencing advantage over the period, which is the highest number of countries gaining the advantage as a region. As 20% in America, 12.5% in Asia, and 3.12% in Europe were revealed as the countries gained a comparative advantage over the period while none of the countries in Oceania among the selected two countries wasn't able to gain the advantage. Map 5.13 denoted the countries that gained a comparative advantage according to the BRCA index, naming, Benin, Brazil, Cambodia, Cote d'Ivoire, Ghana, Guinea, India, Indonesia, Kenya, Madagascar, Mali, Netherlands, Nigeria, Senegal, Tanzania, and Togo. It depicts that African countries are highly advantageous in exporting cashew to the world market. The analysis revealed that Sri Lanka was not able to experience a comparative advantage in exporting cashew.



Source: Authors computed from FAO, 2021

**Map 5.13: Cashew BRCA Index**

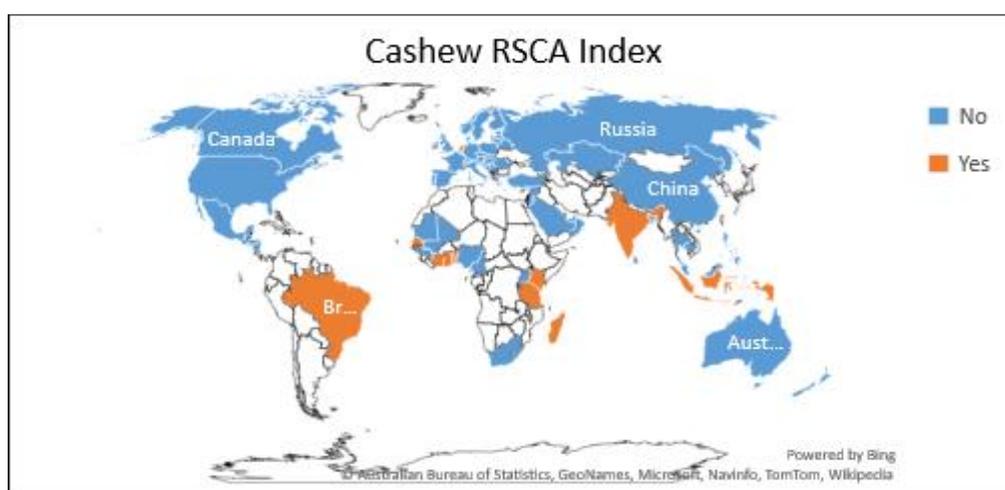
Moving into the Vollrath RCA index calculated for the cashew for selected countries, Map 5.14 presents the analysis. Thus, 26% of countries in the world experienced an advantage higher than that of BRCA. Nearly 80% of the countries in the African region have gained the advantage over the period from 2000 to 2019, while 16.66% of countries in the Asian region and 6.25% of countries in the European region gained the advantage of exporting cashew to the world market. None of the countries selected in Oceania has gained an advantage over exporting cashew. However, the Vollrath RCA index implied that Sri Lanka experienced a comparative advantage.



Source: Authors computed from FAO, 2021

**Map 5.14 : Cashew Vollrath RCA Index**

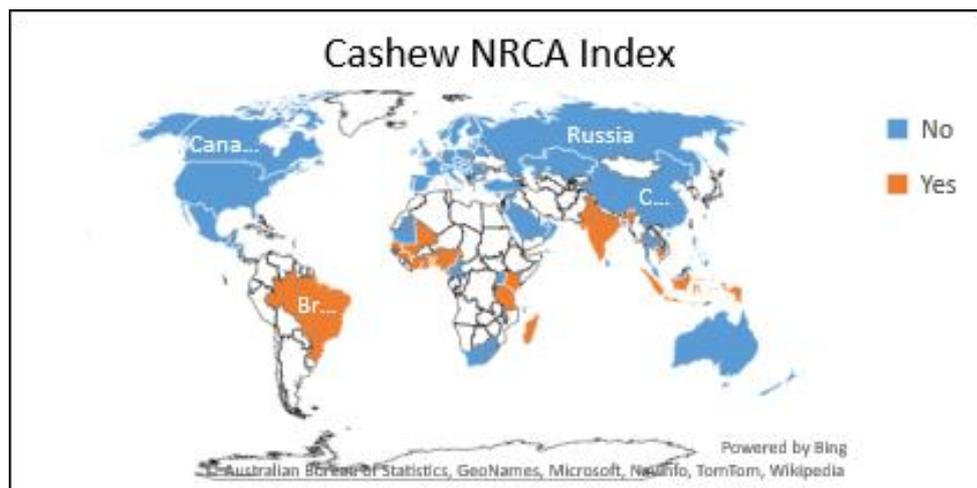
The RSCA index revealed that 12 countries in the world gained a comparative advantage in exporting cashew to the world market. Evidencing the results of BRCA, the highest number of countries were in the African region. Around 53.66% of countries in the African region experienced the comparative advantage, while 10% of the countries in America benefited from the comparative advantage in exporting cashew. In addition, in the Asian region, 8.33% of the countries and 3.12% of the European region experienced a comparative advantage. Thus, proving the results of the BRCA index, the African region countries owned the highest number of countries having a comparative advantage over cashew, as illustrated in Map 5.15 below. The countries identified are Benin, Brazil, Cote d'Ivoire, Ghana, India, Indonesia, Kenya, Madagascar, Netherlands, Senegal, Tanzania and Togo. According to the analysis, Sri Lanka could not gain an advantage in exporting cashew.



Source: Authors computed from FAO, 2021

#### **Map 5.15 : Cashew RSCA Index**

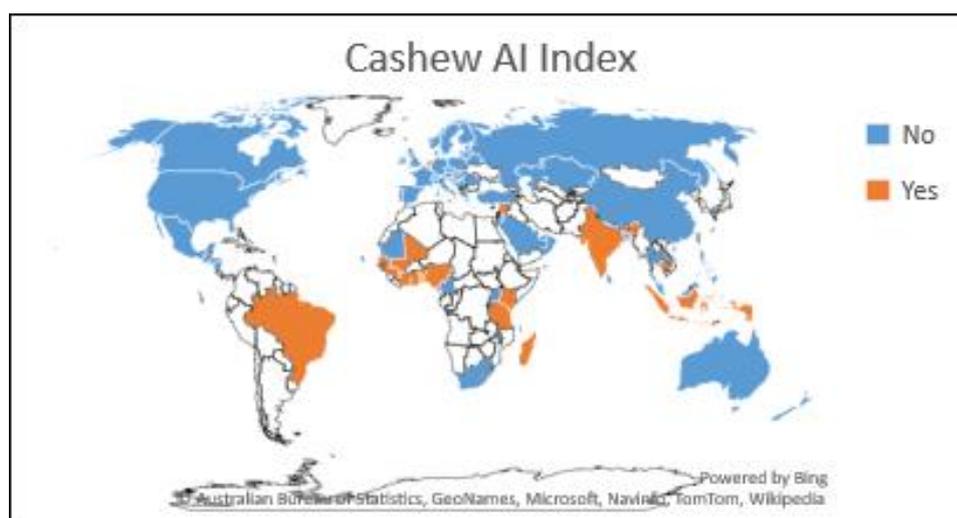
According to the NRCA index, confirming the results of BRCA and RSCA, 19.27% of countries gained advantage over cashew exports. As Map 5.16 demonstrated, the highly advantageous countries were in the African region as 66.66%. Meanwhile, 20% of countries in the American region gained advantage. The NRCA index revealed that Sri Lanka could not gain a comparative advantage.



Source: Authors computed from FAO, 2021

#### Map 5.16 : Cashew NRCA Index

The findings shown in Map 5.17 calculated on the AI index denote that the most advantageous countries were in the African region. The percentage of the countries that gain the advantage in their respective regions are the same as the BRCA, RSCA and NRCA indexes. And in Oceania, none of the countries was able to gain the advantage similarly to above reviewed indexes. The AI index revealed that Sri Lanka wasn't able to gain the comparative advantage.

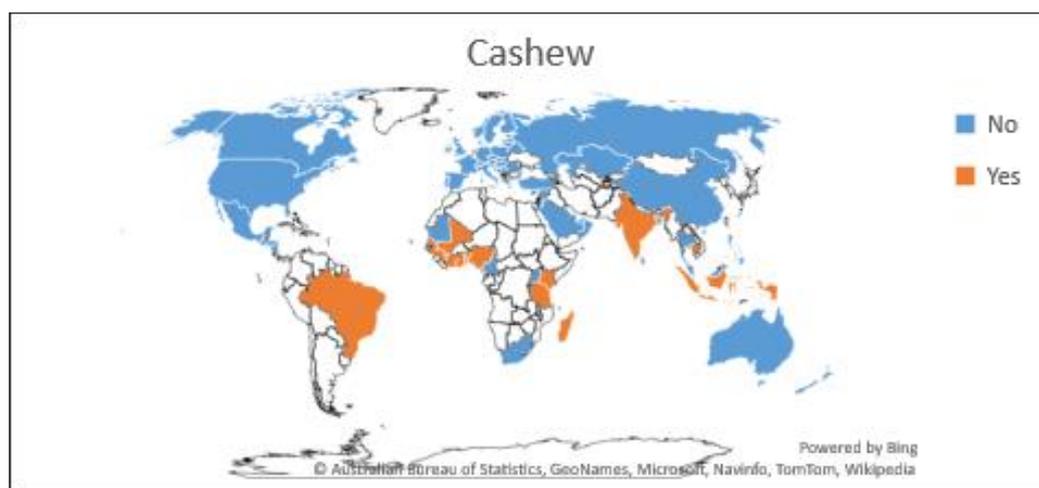


Source: Authors computed from FAO, 2021

#### Map 5.17: Cashew AI Index

Concluding the results on the above indexes, 15 countries among 83 countries could gain the advantage according to the analysis. Hence, 18.07% of countries worldwide gained the advantage while most of the countries (81.92%) did not have an advantage in exporting cashew to the world market. However, as Map 5.18 depicts, 60% of countries in the African region were able to be achieved a comparative advantage in

cashew export. And 20% of the countries in the American region gained advantage in the export market while 12.5% of the countries in the Asian region were benefited. Countries selected in Oceania could not achieve comparative advantage in exporting cashew to the world market. Hence, the countries identified are Benin, Brazil, Cambodia, Cote d'Ivoire, Ghana, Guinea, India, Indonesia, Kenya, Madagascar, Mali, Netherlands, Nigeria, Senegal, Tanzania, and Togo. Moving on to the position of Sri Lanka gaining the comparative advantage in exporting cashew to the world market, only the Vollrath index passed for Sri Lanka, while the BRCA, RSCA, NRCA and the AI indexes imply a disadvantage. In addition to those, considering countries in the Asian region collectively, there was not much advantage for the region, compared with Africa, which is most advantageous on cashew export (Map 5.18).



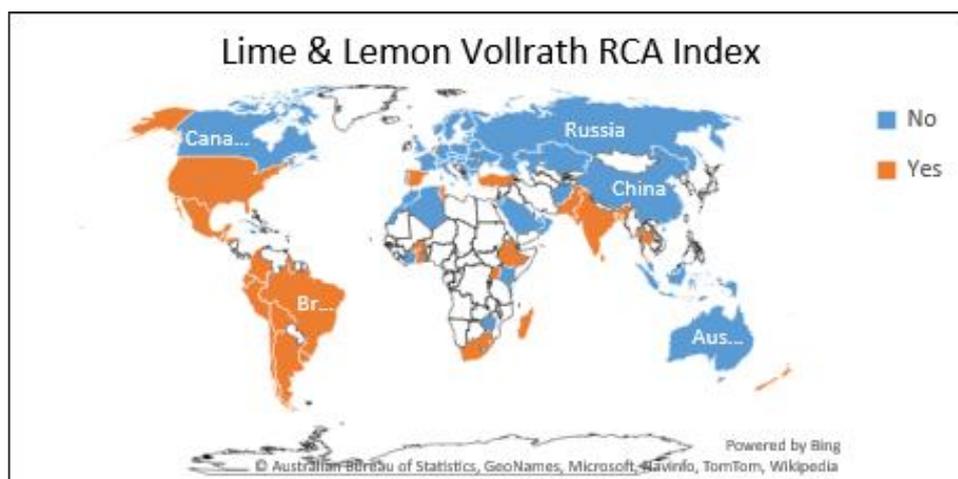
Source: Authors Computed from FAO, 2021

**Map 5.18 : Cashew- Overall Comparative Advantage and disadvantage**

#### 5.2.4 Lime and Lemon

According to the BRCA index, for lime and lemon, among 93 selected countries, there are 22 countries able to attain a comparative advantage over the period. Four countries in the African region were able to be benefited from comparative advantage, while 26.67% of countries were experiencing comparative disadvantage among the selected 15 countries in the region. Nine countries gained an advantage in the American region among 19 selected countries. In the Asian region, among selected 22 countries, four countries gained the comparative advantage over the period where 81.82% of countries have experienced a disadvantage in exporting lime and lemon, according to the BRCA. However, in Europe, five countries gained the advantage among 34 selected countries. Further, in Oceania, none of the countries gained the advantage among the selected three countries from the region. Thus, according to BRCA, countries in the American region are mostly advantaged in exporting lime and lemon, which is displayed in map 5.19. The countries that gained advantage are Argentina, Brazil, Chile, Cyprus, Dominica, Egypt, El Salvador, Greece, Guatemala, Guyana, Jordan, Lebanon, Lithuania, Maldives, Mexico, Morocco, Netherlands,

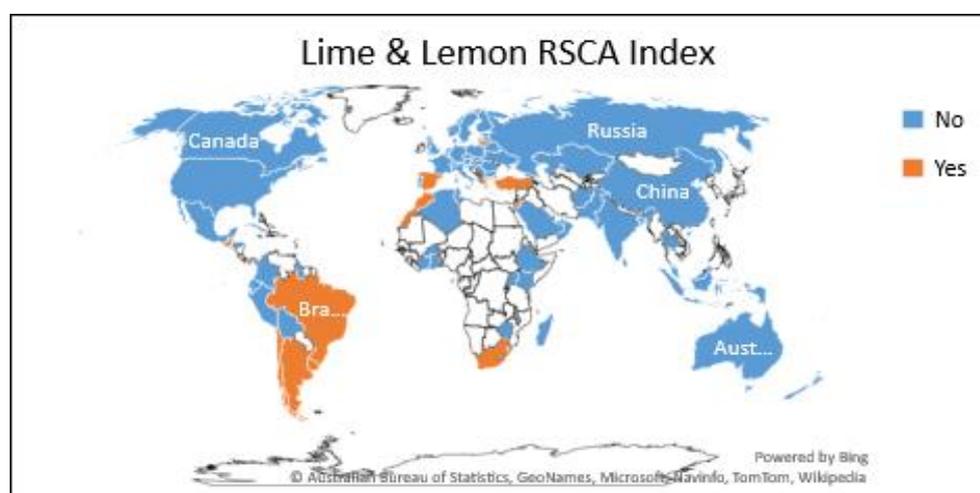




Source: Authors computed from FAO, 2021

### Map 5.20: Lime and Lemon Vollrath RCA Index

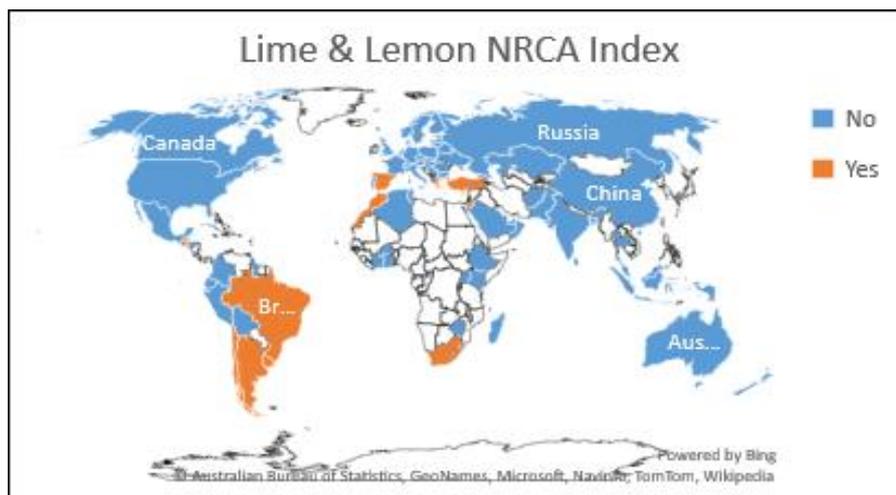
Map 5.21 represents the countries experiencing comparative advantage and comparative disadvantage according to the RSCA index for lime and lemon. There, 20.43% of countries among the selected countries were experiencing the advantage where most of the countries were experiencing the disadvantage around the world. Forty two percent (42.11%) of countries in the American region gained the advantage indicating the highest number of countries gain the advantage in a region. Further, according to the analysis, in the African region, 20.0%, in the Asian region, 18.18%, and in the Europe region, 11.76% countries had experienced the advantage. Proving that the results of BRCA any country in Oceania that could not gain the advantage. Argentina, Brazil, Chile, Cyprus, Dominica, Egypt, El Salvador, Greece, Guatemala, Jordan, Lebanon, Lithuania, Maldives, Morocco, South Africa, Spain, Turkey, Uruguay, and Vanuatu are depicted in below graph as having comparative advantage. The analysis revealed that Sri Lanka could not gain a comparative advantage over exporting lime and lemon.



Source: Authors computed from FAO, 2021

### Map 5.21: Lime and Lemon RSCA Index

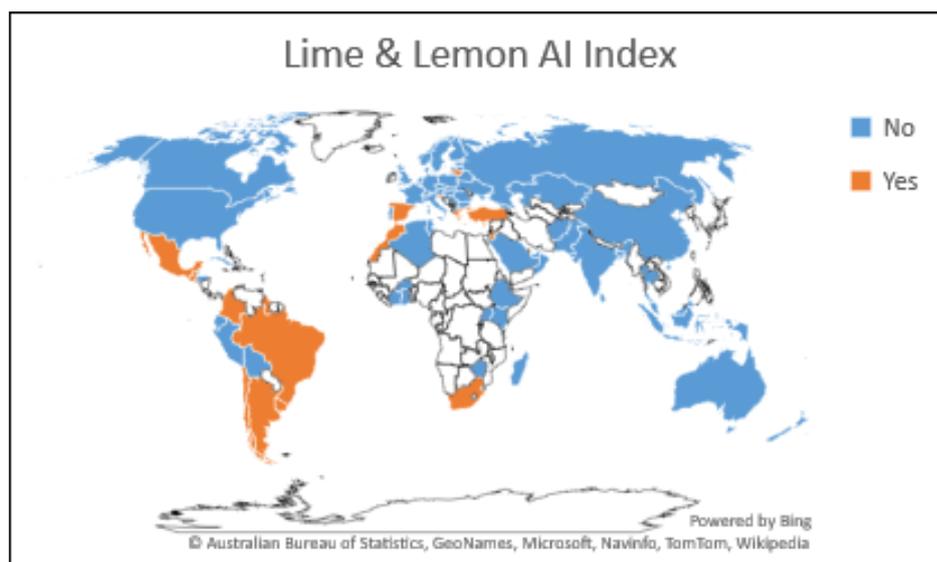
As the NRCA index data disclosed, 8.82% of countries gained a comparative advantage in exporting lime and lemon. Map 5.22 exhibited the highly advantageous countries in the American region as 47.36%, while 26.66% of countries in the African region gained the advantage. In the European region, there were 8.82% of countries gained the advantage, whereas 18.18% of countries gained the advantage in the Asian region. Confirming the results of BRCA and RSCA, in Oceania, none of a country could gain the comparative advantage over exporting lime and lemon to market. Argentina, Brazil, Chile, Cyprus, Dominica, Egypt, Greece, Guatemala, Jordan, Lebanon, Maldives, Morocco, South Africa, Spain, Turkey, Uruguay and Vanuatu are the countries that identified. In addition to that, Sri Lanka was not able to gain the comparative advantage in exporting lime and lemon.



Source: Authors computed from FAO, 2021

#### Map 5.22: Lime and Lemon NRCA Index

Validating the results revealed in BRCA in the AI index, 22 countries were gaining the advantage for exporting lime and lemon to the world market. Thus, 23.65% of countries able to gain a comparative advantage among selected 93 countries. Correspondingly, as the results revealed from BRCA, RSCA and NRCA, there are 47.36% of countries in America benefit while 26.66% of countries in Africa, 18.18% of countries in the Asia and 14.71% of countries in Europe among the selected countries gain the comparative advantage.



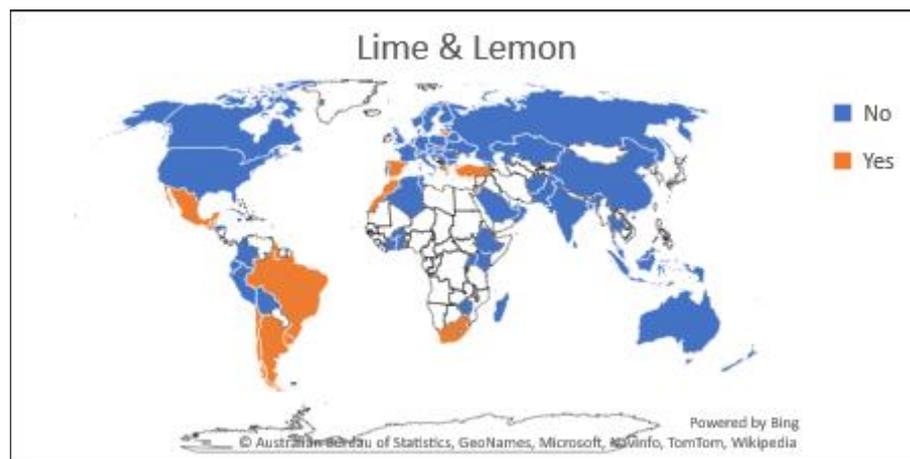
Source:

Authors computed from FAO, 2021

**Map 5.23: Lime and Lemon AI Index**

Map 5.23 above shows selected countries experiencing the comparative advantage as the results of the analysis of the AI index. Furthermore, Sri Lanka wasn't able to experience the comparative advantage in lime and Lemon exports.

Determining the results from the above all indexes, it can be identified that 25 countries gained a comparative advantage between 2000 and 2019. Where 26.88% of countries could gain the comparative advantage over exporting lime and lemon to the world market while 73.11% of countries experienced a disadvantage in exporting, among selected 93 countries for the analysis. In the American region, 47.36% of countries experienced an advantage while the rest of 52.63% of countries experienced a disadvantage. In Africa, 26.66% of countries gained the advantage, while in Asia, 18.18% gained the advantage. As shown in Map 5.24, Argentina, Brazil, Chile, Cyprus, Dominica, Egypt, El Salvador, Greece, Guatemala, Guyana, Jordan, Lebanon, Lithuania, Maldives, Mexico, Morocco, South Africa, Spain, Turkey, Uruguay and Vanuatu are the countries that gain the advantage. Concluding the stance of Asia, despite the results of Vollrath RCA, the region did not have much advantage over the period. Where it belongs to Sri Lanka as the country also experiencing a disadvantage in exporting lime and lemon to the world market. According to the above five indexes, Sri Lanka gained the advantage only according to the Vollrath RCA, and the other indexes recorded a disadvantage for Sri Lanka in benefiting from exporting lime and lemons.

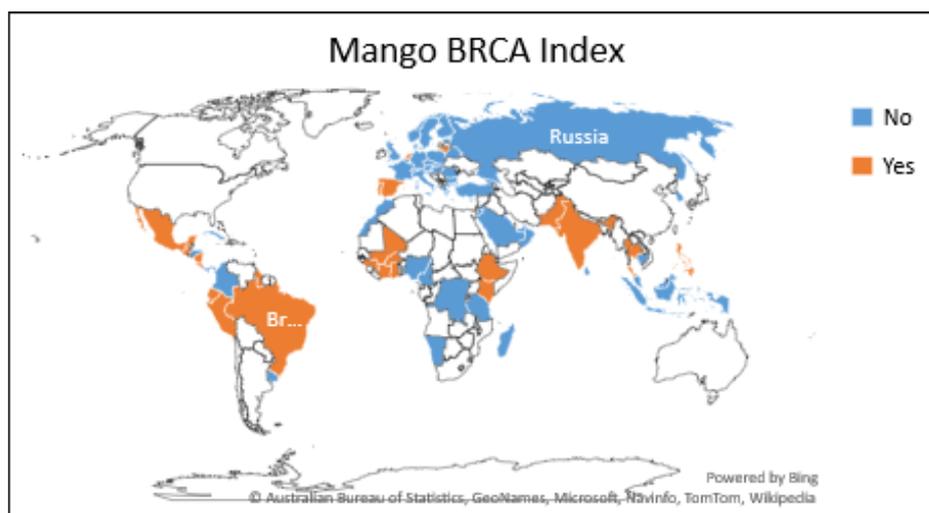


Source: Authors computed from FAO, 2021

**Map 5.24: Lime and Lemon- Overall Comparative Advantage and Disadvantage**

### 5.2.5 Mango

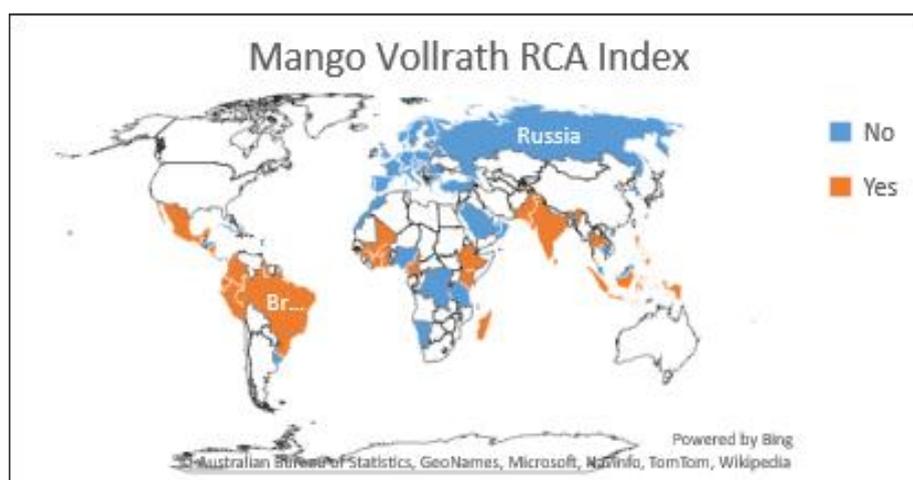
Proceeding with the results of the BRCA index calculated for Mango, only 33.73% of countries could gain the comparative advantage whereas, among selected 83 countries, 28 countries were getting the advantage, and 55 countries were facing a comparative disadvantage. Map 5.25 portrays the countries with comparative advantages and disadvantages that can be identified on a regional basis. Moving into the regional scattering of the countries, the most advantageous countries were in the American region among the selected 18 countries. As 66.66% of the countries in the American region were able to benefit from exporting mango over the study period. Around 46.66% of countries in the African region, 20% in the Asian region and 17.24% in the European region experienced the advantage from 2000 to 2019. Hence, as revealed by the BRCA index, the American regional countries are mostly advantageous compared to the other regions. Brazil, Burkina Faso, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ethiopia, Ghana, Grenada, Guatemala, Guinea, Guyana, India, Israel, Jamaica, Kenya, Lithuania, Luxemburg, Mali, Mexico, Netherlands, Nicaragua, Pakistan, Peru, the Philippines, Portugal, Spain, St. Lucia, St. Vincent and the Grenadines and Thailand can be identified. According to the BRCA analysis, Sri Lanka was not able to gain comparative advantage in exporting mango.



Source: Authors computed from FAO, 2021

#### Map 5.25: Mango BRCA Index

According to the Vollrath index, 30 countries among the selected 83 countries were able to gain the comparative advantage in the reference period. As indicated in Map 5.26, 66.66% of countries among the selected countries in the American region and 60% of the selected countries in the African region gained a comparative advantage. However, only 30% of the countries gained an advantage in the Asian region where 70% of the selected countries were experiencing disadvantages over the period. Notably, to the Vollrath RCA index, none of the countries selected in Europe and Oceania could not gain the advantage for the referenced period. The results revealed that Sri Lanka was able to experience a comparative advantage in the referenced period.

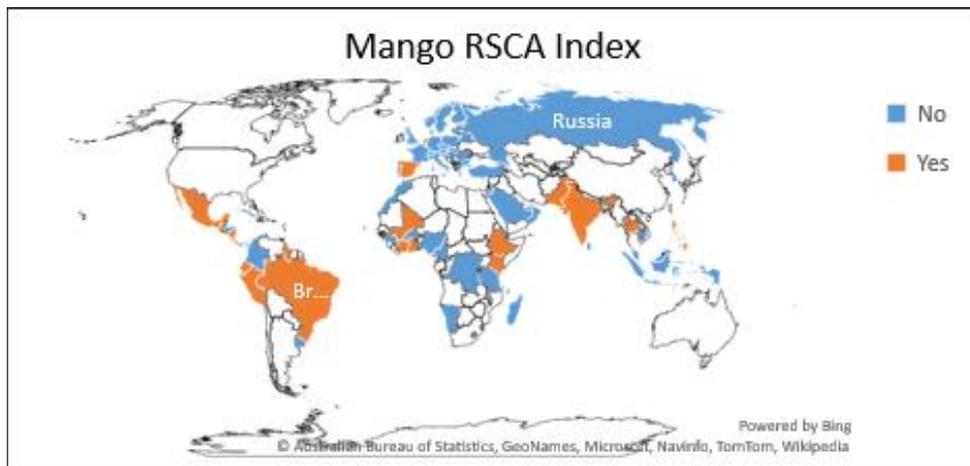


Source: Authors computed from FAO, 2021

#### Map 5.26: Mango Vollrath RCA Index

As illustrated in Map 5.27, the countries experiencing comparative advantage and comparative disadvantage according to the RSCA index for mango were scattered

around the world. The countries are Brazil, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ethiopia, Ghana, Guatemala, Guyana, India, Israel, Jamaica, Kenya, Mali, Mexico, Netherlands, Nicaragua, Pakistan, Peru, Philippines, Spain, St. Lucia, St. Vincent and the Grenadines and Thailand. There, 26.5% of selected countries have experienced an advantage while 73.49% were experiencing a disadvantage. Validating the results revealed by BRCA and Vollrath RCA, the most advantageous region is America, recording 61.11% of countries gaining the comparative advantage. However, only 33.33% of countries in the African region were able to gain the advantage, while 20% of countries in Asia and 6.89% in Europe were able to gain the advantage according to the index. In addition to that, there is not any country in Oceania that was able to experience the comparative advantage over the period. Hence, it is notable that despite the results revealed by BRCA and Vollrath RCA, a smaller number of countries are gained the advantage in the study period. According to the RSCA analysis, Sri Lanka wasn't able to experience the comparative advantage in exporting mango to the world market.

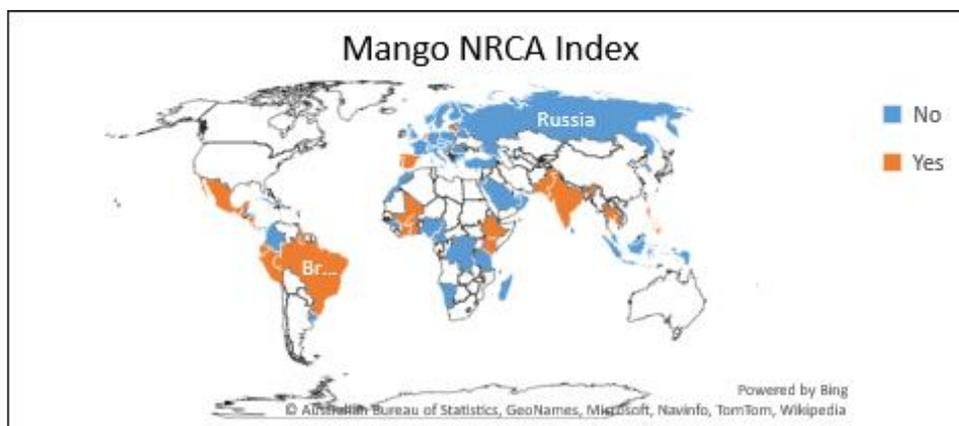


Source: Authors computed from FAO, 2021

#### Map 5.27: Mango RSCA Index

Progressing with the analysis on the NRCA index, 31 countries gained the comparative advantage where the rest of 52 countries, marking 65.06%, gained a disadvantage in exporting mango to the world market. Map 5.28 demonstrate that Brazil, Burkina Faso, Cambodia, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ethiopia, Ghana, Grenada, Guatemala, Guyana, Honduras, India, Israel, Jamaica, Jordan, Kenya, Lithuania, Mali, Mexico, Netherlands, Nicaragua, Pakistan, Peru, the Philippines, Portugal, Spain, St. Lucia, St. Vincent and the Grenadines, and Thailand that achieved the advantage, which can be identified clearly on a regional basis. Confirming the results of the above-examined indexes on mango, it revealed that there were 72.22% of countries in the American region were experiencing the comparative advantage denoting the highest number of countries located in one region. However, in the African region, there are only six countries that gained the advantage which is nearly 33.33% among selected countries in the region, in addition to that 30% of the countries in the Asian region and 13.79% of the countries in the European region was

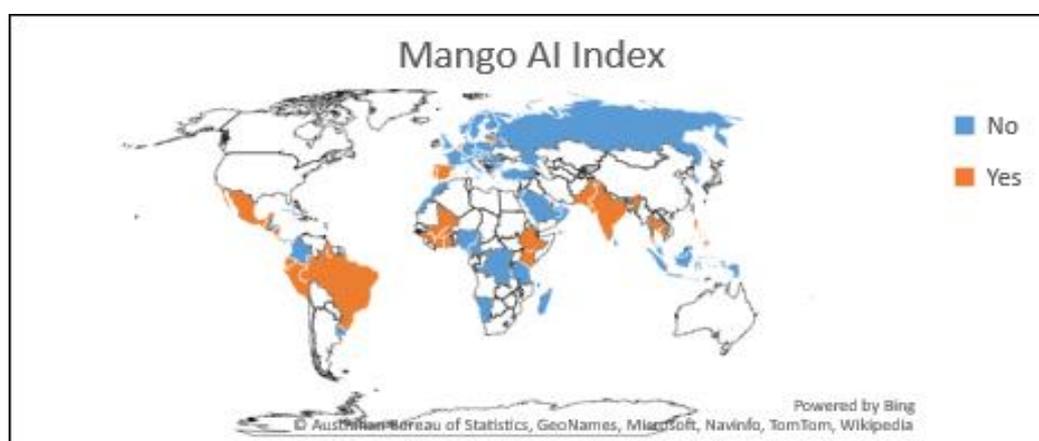
able to benefit in exporting mango, according to NRCA index. And the selected country in Oceania did not gain the comparative advantage for mango for the study period. In addition, Sri Lanka was not able to gain a comparative advantage in exporting mango.



Source: Authors computed from FAO, 2021

#### Map 5.28 : Mango NRCA Index

The Map 5.29 presents the results from AI index, which denoted the advantageous and disadvantageous countries around the world. Proving the results of NRCA, 29 countries gain the advantage while the rest of 54 countries go through a disadvantage over the period. Similarly, moving into the regional dispersion of the above results proved that the results of the above indexes, the American region recorded as the most advantageous region where 66.66% of countries located in the region. About 46.66% countries in the African region and 25% of the countries in the Asian region had comparative advantage. Further, Sri Lanka wasn't able to experience the comparative advantage.

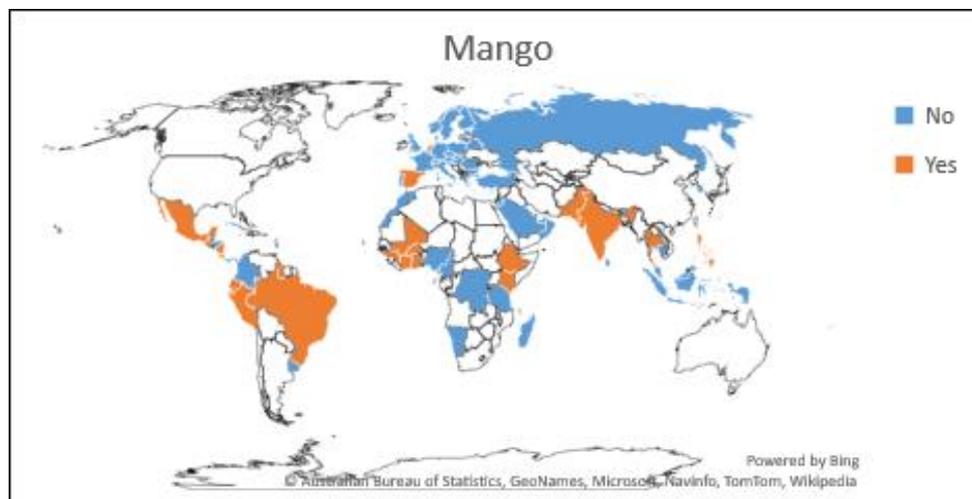


Source: Authors computed from FAO, 2021

#### Map 5.29: Mango AI Index

According to the indexes reviewed above, 29 countries could gain a comparative advantage at least from three indexes. Hence, the status of the comparative

advantage for exporting mango to the world market, 32.53% countries among selected 83 countries can be recognized as the countries that gained the comparative advantage over the period. Detailing the results discovered on the regional basis, 66.66% of countries in the American region gained the comparative advantage over the study period, while in the African region, there are 50.00% of countries gained the advantage. In addition to that, 20% of countries in Asia and 16.66% in Europe experienced a comparative advantage. As Map 5.30 shown, dispersed of the countries gaining comparative advantage can be identified and none of the countries in Oceania can gain the comparative advantage in the respective period. The countries that gain the advantage are Brazil, Burkina Faso, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ethiopia, Ghana, Grenada, Guatemala, Guinea, Guyana, India, Israel, Jamaica, Kenya, Lithuania, Mali, Mexico, Netherlands, Nicaragua, Pakistan, Peru, Philippines, Portugal, Spain, St. Lucia, St. Vincent and the Grenadines and Thailand. Stating the position of Sri Lanka about the gaining comparative advantage over mango, the Vollerath RCA index is the only index that passes for Sri Lanka, and according to the reviewed other indexes, BRCA, RSCA, NRCA, and AI index Sri Lanka came across a disadvantage in exporting mango to the world market.



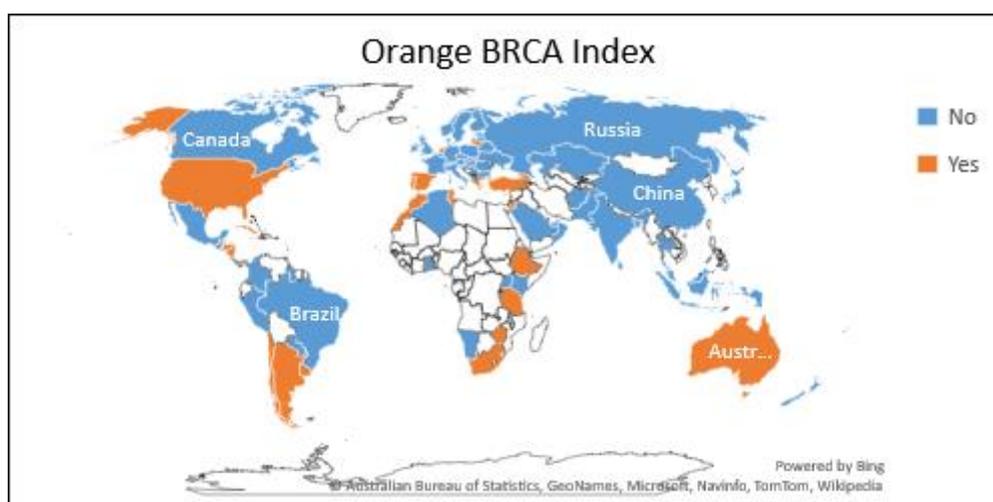
Source: Authors computed from FAO, 2021

**Map 5.30: Mango - Overall Comparative Advantage and Disadvantage**

### 5.2.6 Orange

As the BRCA index calculations for orange among 94 selected countries, it discovered that there were 31 countries able to be experienced comparative advantage over the period while 63 countries were experiencing comparative disadvantage. 57.14% of countries in the African region were able to attain comparative advantage, while 42.85% were experiencing comparative disadvantage among the selected 14 countries in the region. According to the data, ten countries that is around 52.63%, gained the advantage among 19 selected countries in the American region. In the Asian region, the study selected 22 countries, and four countries gained a comparative advantage over the period where 21 countries have experienced a disadvantage in exporting orange according to the BRCA. However, in Europe, seven countries gained

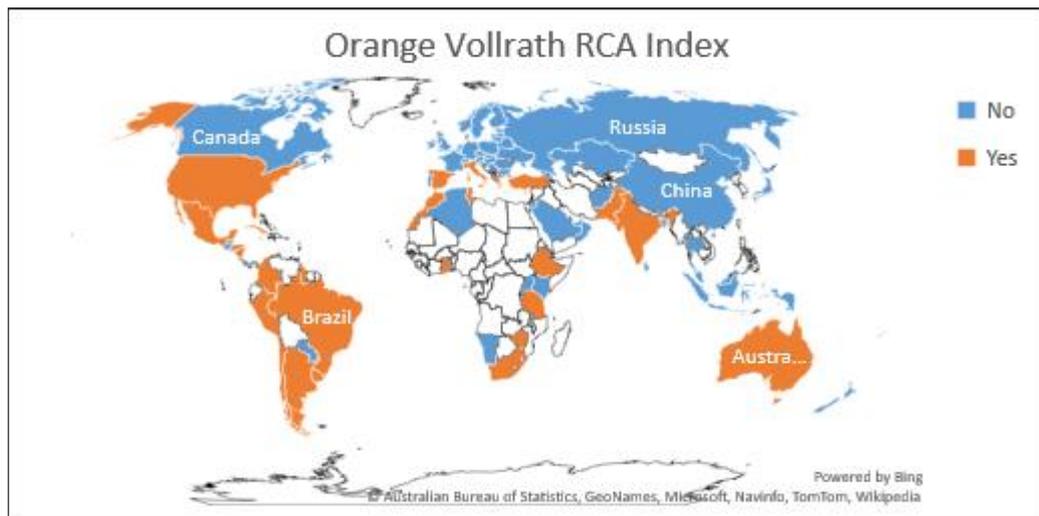
the advantage among 34 selected countries. Furthermore, in Oceania, one country gained the advantage over the selected three countries from the region. The stance of Sri Lanka was identified as a comparative disadvantaged country for the reference period. Accordingly, like the BRCA analysis, countries in the African region are mostly advantaged in exporting orange, which is displayed in Map 5.31. The countries are Argentina, Australia, Belize, Chile, Cuba, Cyprus, Dominica, Egypt, Eswatini, Ethiopia, Georgia, Greece, Honduras, Israel, Jamaica, Jordan, Lebanon, Lithuania, Morocco, Netherlands, Nicaragua, Portugal, South Africa, Spain, Tanzania, Tunisia, Turkey, United States, Uruguay and Zimbabwe.



Source: Authors computed from FAO, 2021

### Map 5.31: Orange BRCA Index

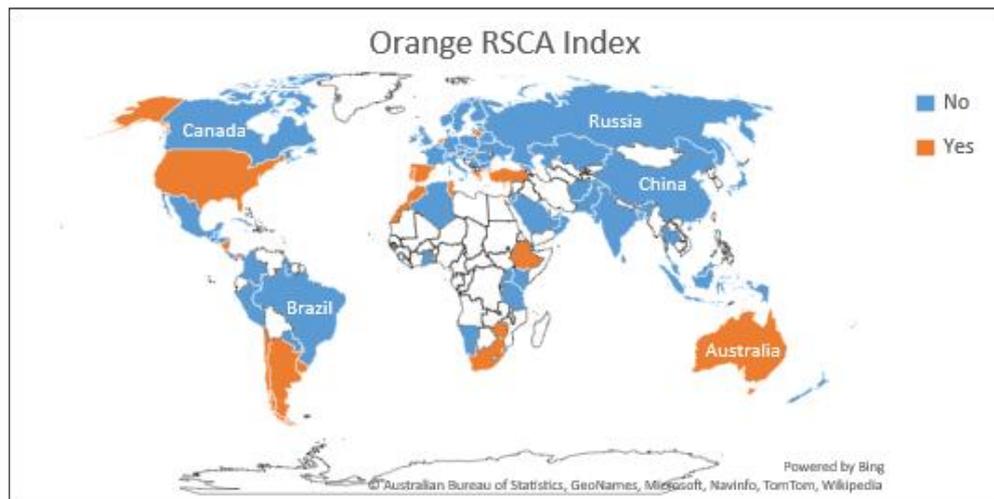
According to the data revealed in the Vollrath RCA index for orange for selected 94 countries, Map 5.32 indicates the results of the analysis. Thus, around 35.10% of countries among the selected countries experience the advantage which is higher than that of BRCA. Thus, moving into the regional dispersion of the countries that gained the advantage, the most advantageous countries were in the African region, remarking 71.42% of selected countries in that region experienced the advantage. Moreover, the analysis found that 68.42% of countries in the American region, 20.83% in the Asian region, 11.76% of countries in Europe, and one country in Oceania gained the advantage over the referenced period. Argentina, Australia, Brazil, Chile, Colombia, Cuba, Cyprus, Dominica, Egypt, Eswatini, Ethiopia, Ghana, Greece, Guyana, Honduras, India, Israel, Italy, Jamaica, Lebanon, Mexico, Morocco, Nicaragua, Pakistan, Peru, South Africa, Spain, Tanzania, Tunisia, Turkey, United States, Uruguay and Zimbabwe are the countries that experience the advantage. Similarly, like the BRCA index, Sri Lanka was in the comparative disadvantaged countries' group.



Source: Authors computed from FAO, 2021

**Map 5.32: Orange Vollrath RCA Index**

The RSCA index discovered that 24 countries gain comparative advantage in orange exporting. Among the selected countries, 50% in the African region and 36.84% of countries in the American region gained the advantage over exporting orange to the world market. Thus, proving the previously reviewed indexes, African region's countries were the most advantageous in exporting orange, as depicted in Map 5.33. In addition, 17.64% of the European region countries and 12.5% of the Asian region experienced the advantage. However, Sri Lanka wasn't able to gain the comparative advantage revealed by above indexes.

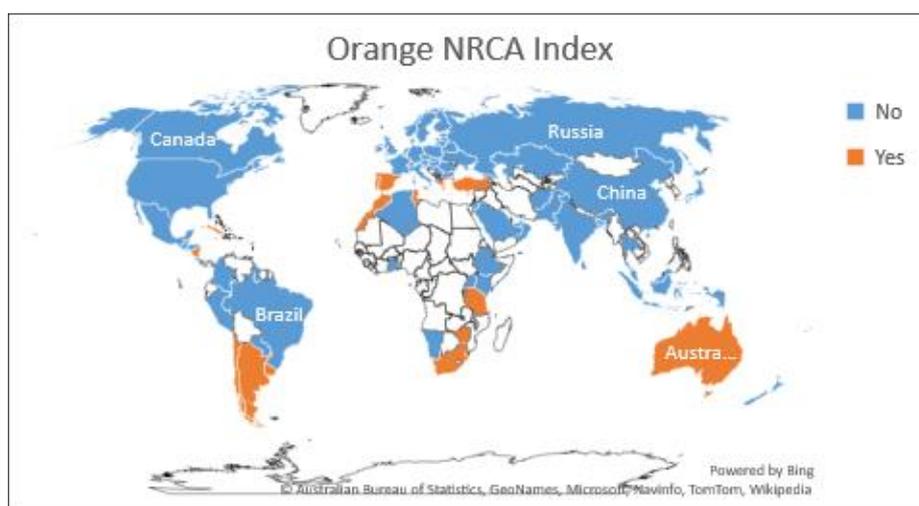


Source: Authors computed from FAO, 2021

**Map 5.33: Orange RSCA Index**

Proceeding with the NRCA index on orange, 22 countries gained a comparative advantage in the world market. The remaining 72 countries, indicating 76.59%, gained a disadvantage over exporting orange to the world market. Map 5.34 illustrates the countries with the advantage and the disadvantage, which can be discovered clearly

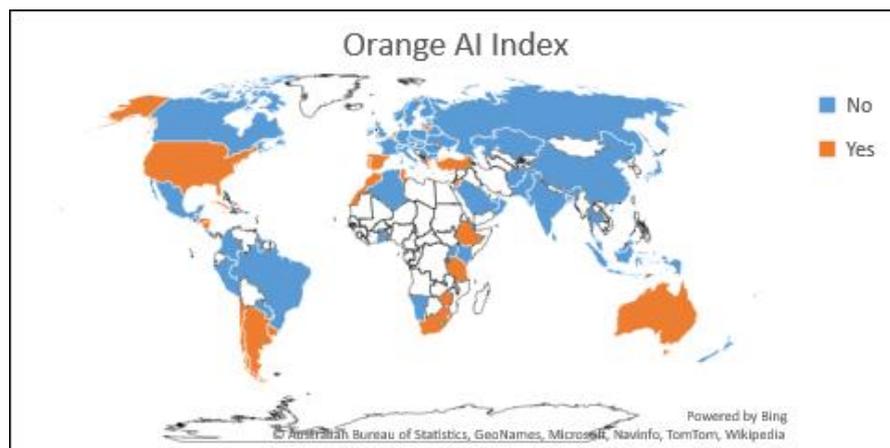
on a regional basis. Proving the results of the RSCA index, it can be identified 50% of countries in the African region were experiencing a comparative advantage. In the American region, there were 42.10% of countries among the selected countries were gained the advantage, while 57.89% of countries in the region experienced a disadvantage in exporting orange to the world market. Further, the analysis found that 11.76% among selected countries in the European region and 8.33% among selected countries in the Asian region were able to gain the advantage over the study period, where only one country in Oceania was able to be benefited. Naming the countries experienced the advantage are Argentina, Australia, Belize, Chile, Cuba, Cyprus, Dominica, Egypt, Eswatini, Greece, Jamaica, Lebanon, Morocco, Nicaragua, Portugal, South Africa, Spain, Tanzania, Tunisia, Turkey, Uruguay and Zimbabwe. According to the NRCA analysis, Sri Lanka was also unable to gain the advantage.



Source: Authors computed from FAO, 2021

#### Map 5.34: Orange NRCA Index

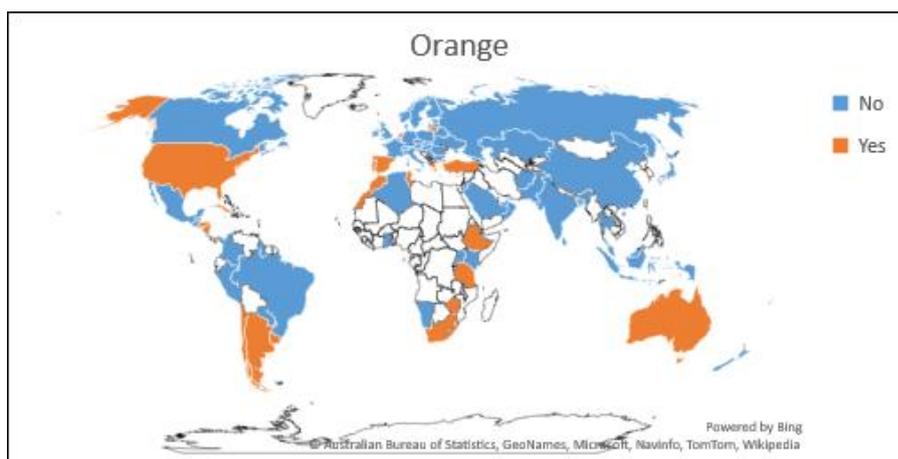
Verifying the results revealed in BRCA, according to the AI Index, 31 countries gained the advantage for exporting orange for the study period. Map 5.35 further indicated that 31.91% of countries gained a comparative advantage and 68.08% of countries gaining a disadvantage for the period of 2000-2019. As results revealed from BRCA, RSCA and NRCA indexes, there were 57.14% of countries in Africa gained the advantage denoting the highest number of countries in one region. Further, confirming the results of BRCA in the five regions was similar to the number of countries gaining the advantage. The analysis grouped Sri Lanka among the comparative disadvantaged countries.



Source: Authors computed from FAO, 2021

### Map 5.35: Orange AI Index

According to the above five reviewed indexes, it can be detected that 31 countries gained a comparative advantage from 2000 to 2019 in the overall context. It was indicating that 32.97% of countries among 94 selected countries were able to achieve a comparative advantage in exporting oranges to the world market, while 74.46% of countries experienced a disadvantage in exporting oranges among the selected 94 countries in the present study. Remarking the highest number of advantageous countries, 57.14% of countries represented in the African region were highly advantageous throughout the period. In the American region, 52.63% of countries have achieved the advantage while the rest of 47.36% among selected countries experienced a disadvantage on exporting oranges. In Europe, 17.64% of countries gained the advantage, whilst in Asia, 12.5% gained the advantage, which is demonstrated in Map 5.36. Argentina, Australia, Belize, Chile, Cuba, Cyprus, Dominica, Egypt, Eswatini, Ethiopia, Greece, Honduras, Israel, Jamaica, Lebanon, Lithuania, Morocco, Netherlands, Nicaragua, Portugal, South Africa, Spain, Tanzania, Tunisia, Turkey, United States, Uruguay and Zimbabwe are displayed below as countries that experienced comparative advantage. Identifying the position of Asia, despite the results of Vollrath RCA, the region does not have many advantages over the period. Where it belongs to Sri Lanka, as the country also experienced a disadvantage in exporting oranges to the world market throughout the period. In concluding reviewed indexes on Sri Lanka, all the five indexes recorded a comparative disadvantage for the country between 2000 and 2019.

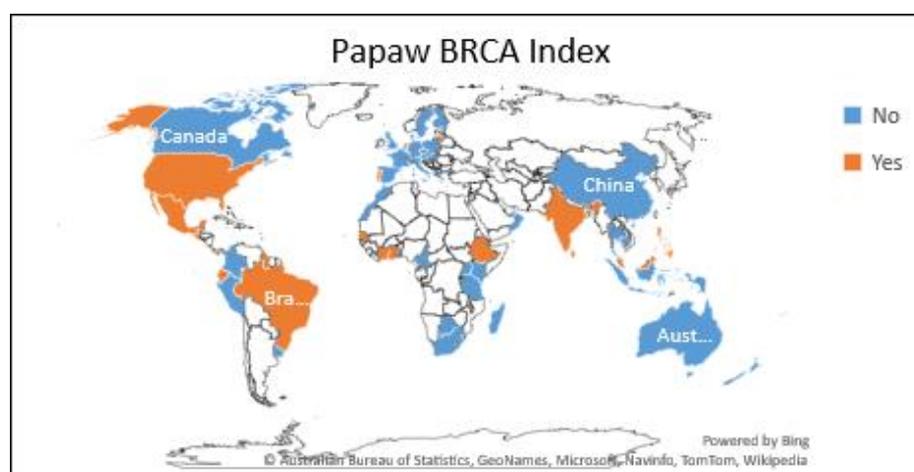


Source: Authors computed from FAO, 2021

**Map 5.36: Orange - Overall Comparative Advantage and Disadvantage**

### 5.2.7 Papaw

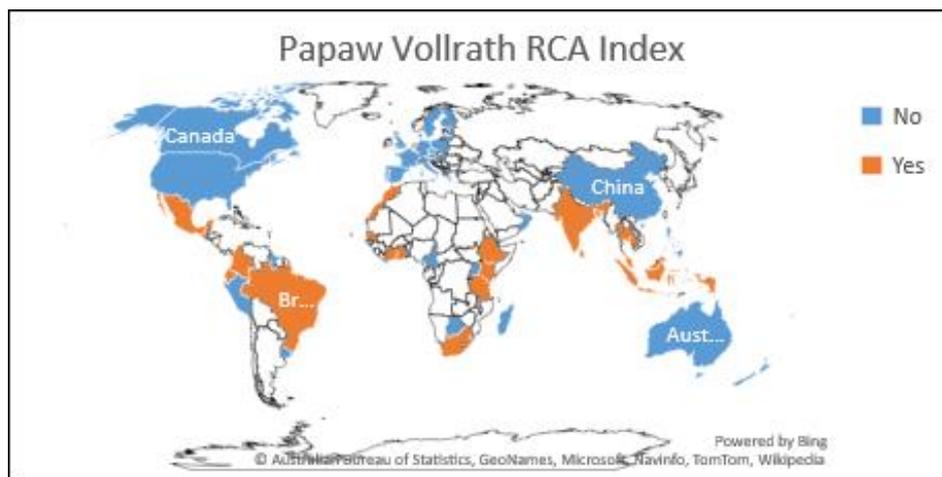
As per the findings on the BRCA index calculated for papaw, the American region recorded the highest number of advantageous countries, observing 61.53% countries among 13 selected countries were able to gain the comparative advantage over the period while in the African region 35.71% countries were gained the comparative advantage. In addition, 26.66% of countries among 15 selected countries in the Asian region gained a comparative advantage. There were 20% of countries in the European region gained the advantage. In addition, one country among selected three countries in Oceania also gained the comparative advantage over the period. The output is demonstrated in the Map 5.37 where 33.84% of countries among the selected 65 countries could attain the advantage over the period according to the BRCA index. Thus, the countries are Brazil, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ethiopia, Fiji, Ghana, Guatemala, Guyana, India, Jamaica, Lithuania, Luxembourg, Malaysia, Mexico, Netherlands, Philippines, Portugal, Senegal, Sri Lanka and United States.



Source: Authors computed from FAO, 2021

**Map 5.37: Papaw BRCA Index**

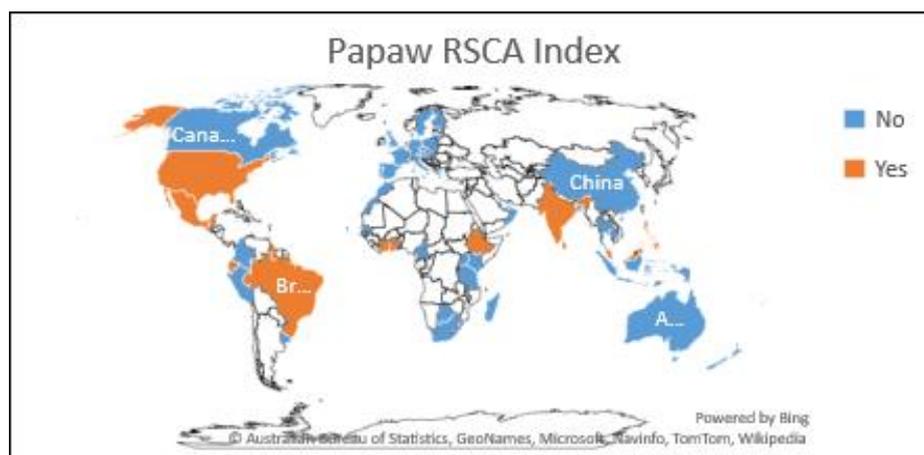
Supporting the results that unfolded in the BRCA index, the Vollrath index also revealed that 61.53% of countries among 13 selected countries in the American region were highly advantageous in exporting papaw to the world market. Further, in the African region, 57.14% of countries were able to gain the advantage whilst 53.33% of countries in the Asian region earned the advantage over the period. As specified in the Map 5.38, the countries gained the advantage (40% of the selected countries) are Bangladesh, Brazil, Cambodia, Colombia, Costa Rica, Cote d'Ivoire, Ecuador, Ethiopia, Fiji, Ghana, Guatemala, India, Indonesia, Israel, Jamaica, Kenya, Malaysia, Mexico, Morocco, Netherlands, Senegal, South Africa, Sri Lanka, Tanzania, Thailand and Trinidad and Tobago, while 60% of the selected countries came across a disadvantage over the period. The analysis revealed that Sri Lanka was able to experience a comparative advantage.



Source: Authors computed from FAO, 2021

#### Map 5.38: Papaw Vollrath RCA Index

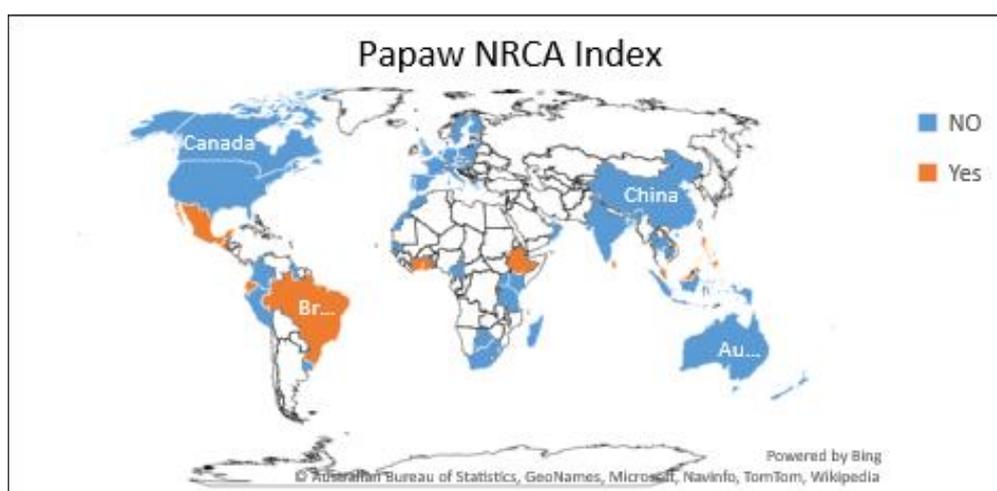
Map 5.39 signifies the countries go through comparative advantage and comparative disadvantage according to the RSCA index for papaw. The advantaged countries are Brazil, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ethiopia, Fiji, Ghana, Guatemala, Guyana, India, Jamaica, Luxembourg, Malaysia, Mexico, Netherlands, Philippines, Sri Lanka and United States. Hence, 29.23% of selected countries gained the advantage, whereas 70.76% of countries were experiencing the disadvantage of exporting papaw to the world market. Validating the result revealed in the BRCA and Vollrath RCA, the American region countries gained the advantage mostly, as 61.53% of the countries gained the advantage in the region. In addition, 28.57% of countries in the African region, 26.66% in the Asian region and 10% in Europe among selected countries in the respective region were able to attain a comparative advantage over the study period. Further, one country among the selected three countries in Oceania experienced the advantage. According to the RSCA analysis, Sri Lanka was able to experience a comparative advantage in the referenced period.



Source: Authors computed from FAO, 2021

### Map 5.39: Papaw RSCA Index

Continuing with the NRCA index on papaw, 17 countries earned the comparative advantage in the world market. Thus, the countries are Brazil, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ethiopia, Fiji, Ghana, Guatemala, Hong Kong, Jamaica, Malaysia, Mexico, Philippines, Sri Lanka, Trinidad, Tobago and United States and the rest of the 48 countries, indicating 73.84%, gained a disadvantage over the period. Map 5.40 demonstrates the countries with the advantage and the disadvantage. The results of the evaluated indexes above indicate that the American region is the most advantageous, where 69.23% of selected countries in the region gained the advantage in exporting oranges. The Asian region recorded 26.66% among the selected 15 countries were advantageous, while 21.42% of African countries gained the advantage over the period. Furthermore, the analysis categorized Sri Lanka among the countries that gained a comparative advantage.

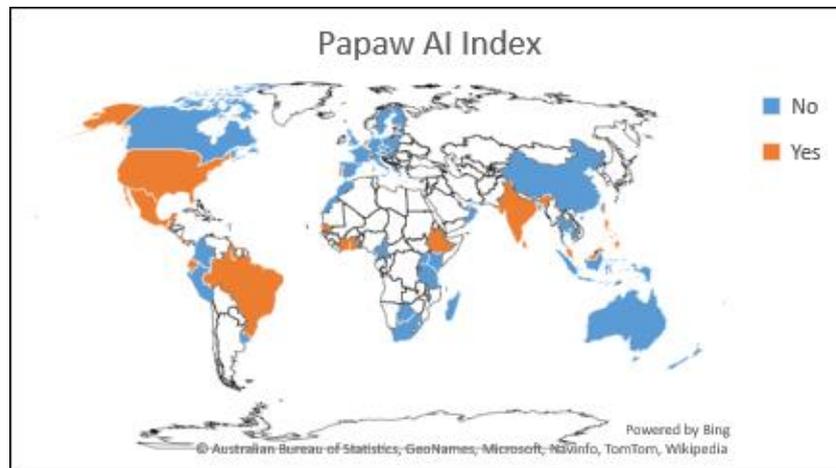


Source: Authors computed from FAO, 2021

### Map 5.40: Papaw NRCA Index

As the results unfold in BRCA; in the AI index, 22 countries were gaining the advantage for exporting papaw to the world market. Stating 33.84% of countries

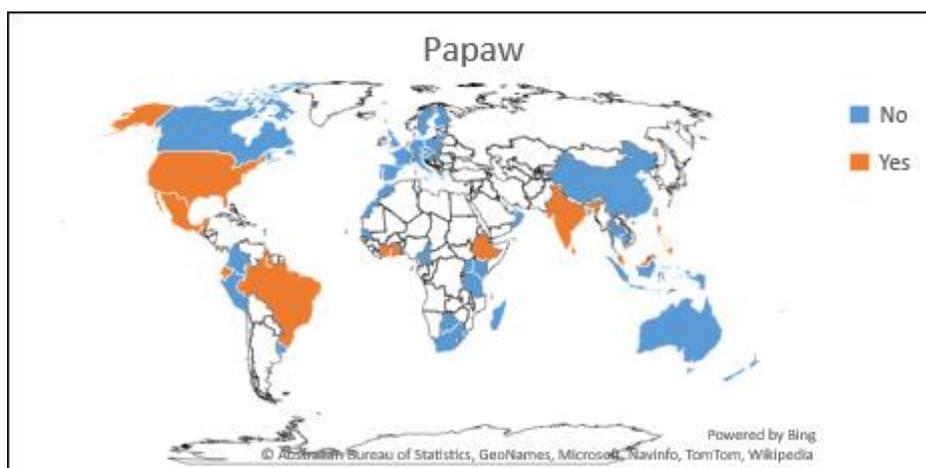
gained a comparative advantage while 66.15% of the countries gained a disadvantage for the period of 2000-2019. Correspondingly, as the results revealed from BRCA, Vollrath RCA, and RSCA, 61.53% of countries in the American region gained the advantage, while 35.71% of countries in Africa, 26.66% of countries in Asia and 20% of countries in Asia among the selected countries gain the advantage which is illustrated in the Map 5.41. Furthermore, Sri Lanka was able to gain a comparative advantage according to the results of AI index.



Source: Authors computed from FAO, 2021

#### Map 5.41: Papaw AI Index

According to the above assessed indexes, it can be discovered that 22 countries gained an advantage by exporting papaw to the world market. Stating that 33.84% of countries among 65 selected countries achieved the comparative advantage in exporting papaw to the world market while 66.15% of countries experienced a comparative disadvantage in exporting papaw among the selected 65 countries in the present study. Stating the highest number of advantageous countries and proving the results of BRCA, Vollrath RCA, RSCA, and AI indexes, 69.23% of selected countries in the American region gained the advantage throughout the period. In the African region, 35.71% of countries had attained the advantage while the rest of the selected countries experienced the disadvantage in exporting papaws. In Asia, 26.66% of countries gained the advantage, whilst in Europe 20% gained the advantage that is exhibited in the Map 5.42. Thus, the countries depicted below are Brazil, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ethiopia, Fiji, Ghana, Guatemala, Guyana, India, Jamaica, Luxembourg, Malaysia, Mexico, Netherlands, Philippines, Senegal, Sri Lanka, Trinidad and Tobago and United States as advantaged countries. Emphasizing the position of Asia, the indexes were remarking advantage over a few countries, indicating that Sri Lanka experienced an advantage in exporting papaw to the world market through the period as all the five indexes passed for the country.



Source: Authors computed from FAO, 2020

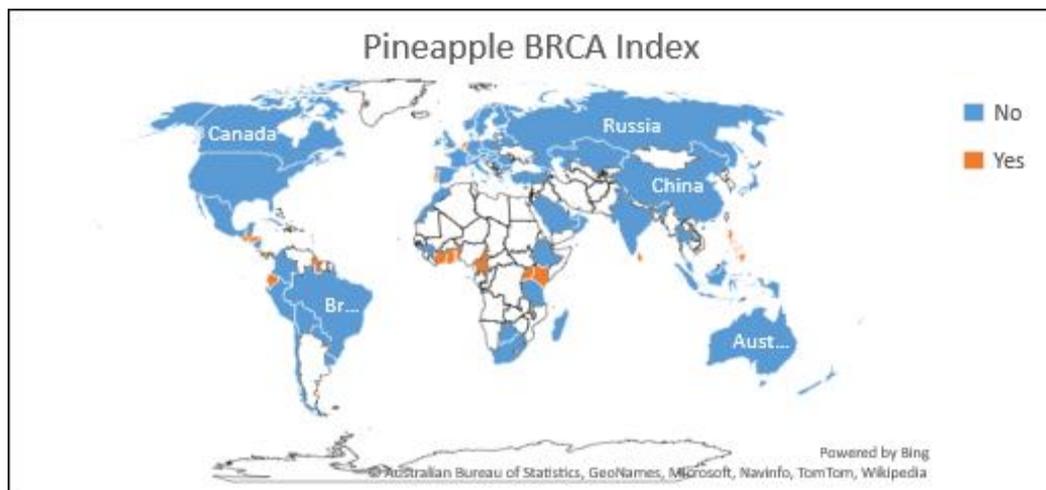
#### **Map 5.42: Papaw-Overall Comparative Advantage and Disadvantage**

Moving further, considering the varieties of the papaw exported by the countries that gain comparative advantage in the Asian region, Malaysia as a leading competitor in the region, the country had developed and introduced several new breeding to enhance the production. According to the Sekeli et al. (2018), the country initially planted papaw as a smallholder crop and after 15 years of breeding and selection, the Malaysian Agricultural Research and Development Institute (MARDI) introduced a new variety Backcross Solo, which was the main reason behind papaw as a plantation crop in Malaysia. Initially, Sunrise Solo cultivated, a variety that contained excellent eating qualities was cultivated in Malaysia. However, it possessed a poor yield and small fruit size. With the development of the breeding, the Backcross Solo contains the features of Sunrise Solo and local adaptability and a large fruit size than Sunrise Solo. Increasing the export qualities of the Papaw the MARDI developed another variety named Eksotika Papaw in 1987 robust the growth abilities with a wide range of soil types. The fruit possesses the qualities like high sugar content and pleasant aroma with orange-red flesh that enhance the export capability. Philippines is another leading papaw exporter in the Asian region, several varieties are grown. Naming Solo, Morado, Red Royale, Carinosa, Red Lady, Sinta and Cavite Special can be identified. The main variety grown in the Philippines is the Solo papaw (Chua, 2018).

In addition to that Costa Rica developed a papaw variety to combat several challenges including increasing the export performance too. Thus, a new variety as Pococi which is identical to the country the National Institute for Agricultural Technology in collaboration with the University of Costa Rica was developed. The fruit contains the qualities like desirable aroma and flavour with internal red colour fruit with yellow colour peel. Moreover, local varieties like Lucia, Maradol and some other local varieties are also cultivated in Costa Rica (Salazar et al., 2010). Considering the study by Honor et al. (2019) on the short cycle papaw grown in continental Europe, the common varieties in the region are BH-65, Tainung 1, Red Lady and Siluet.

### 5.2.8 Pineapple

According to the BRCA index calculations for pineapple among 90 selected countries, it found that 19 countries were able to be specialized in exporting, gaining a comparative advantage over the period, while 71 countries were experiencing a comparative disadvantage. Forty seven percent (47.36%) of African countries specialized in exporting, while 22.63% of the countries were experiencing comparative disadvantage among the selected 19 countries in the region. As per the BRCA analysis in the American region, five countries that is around 26.31% countries gained the advantage among 19 selected countries. The study selected 18 countries in the Asian region. Two countries gained a comparative advantage over the period where the majority, 16 countries, have experienced a disadvantage in exporting pineapple, according to the BRCA. However, in Europe, three countries gained the advantage among 28 selected countries, while in Oceania, none of a country gained the advantage among the selected three countries from the region. Hence, as the BRCA analysis countries in the African region are mostly advantaged in exporting pineapple that is presented in the Map 5.43. Thus, the advantaged countries are Belgium, Benin, Cameroon, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ghana, Guatemala, Guyana, Honduras, Kenya, Mauritius, Netherlands, the Philippines, Portugal, Sri Lanka, Togo and Uganda.

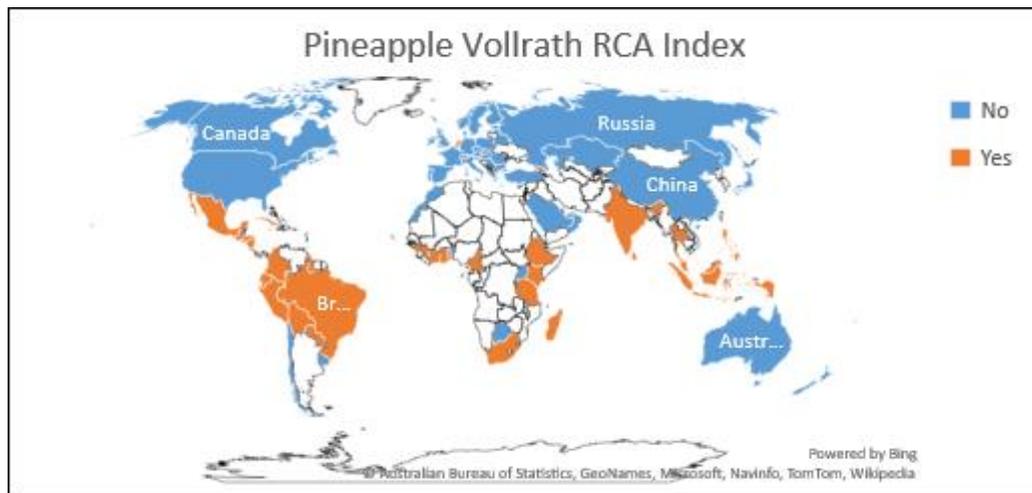


Source: Authors computed from FAO, 2021

#### Map 5.43: Pineapple BRCA Index

Proving the results that unfolded in BRCA, according to the Vollrath index, 14 countries among the selected 19 countries in the African region. In the American region 73.68%, of the countries gained the advantage while the rest of 26.31% selected countries weren't able to gain the advantage over exporting pineapple. Thirty three percent (33.33%) of the countries in Asia and 9.67% of the countries in Europe gained the comparative advantage in the referenced period. Furthermore, in Oceania, one country among the three selected countries could gain the advantage in exporting pineapple to the world market. Therefore, 38 countries among 90 selected countries for the study were able to be specialized in exporting pineapple and the Map 5.44

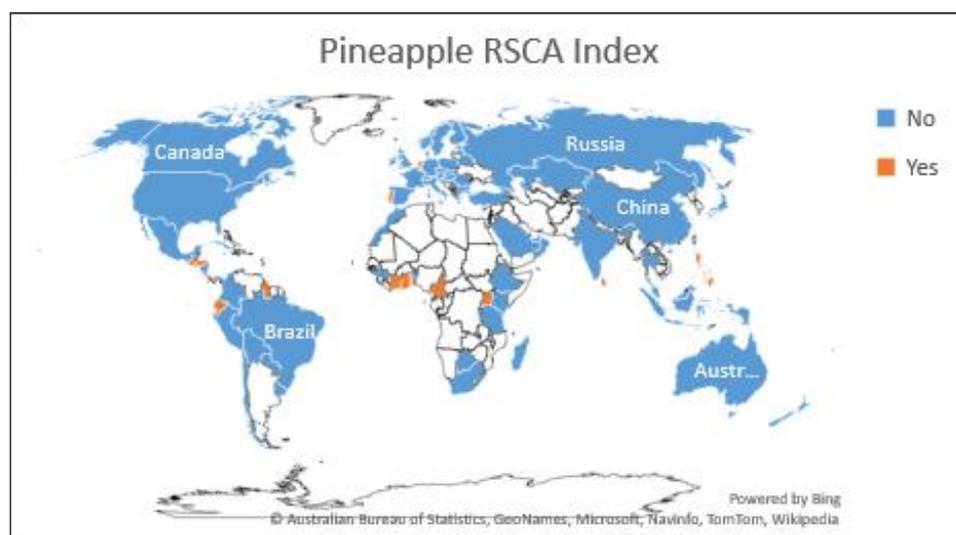
exhibited the scatter of the advantage countries as in Vollrath RCA. Furthermore, Sri Lanka was able to experience a comparative advantage in exporting pineapple.



Source: Authors computed from FAO, 2021

#### Map 5.44: Pineapple Vollrath RCA Index

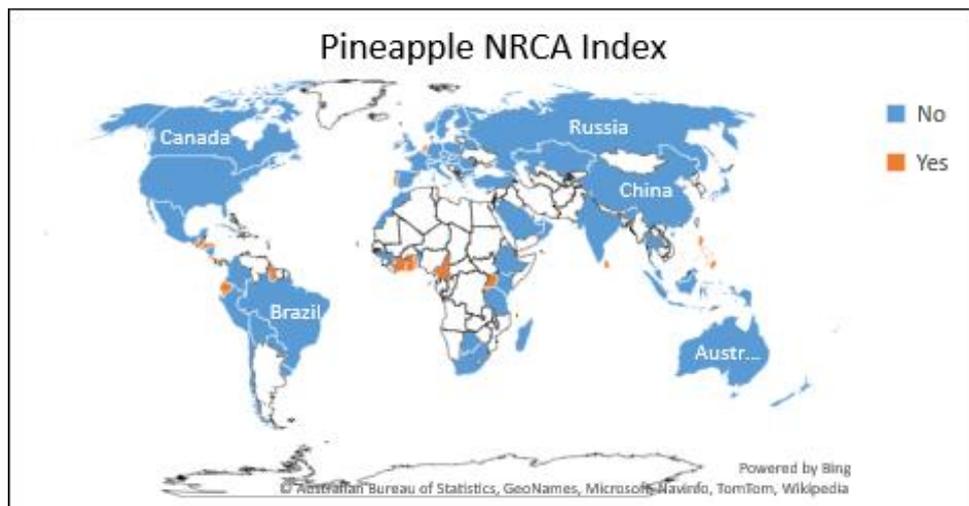
The RSCA index discovered that 17 countries gain comparative advantage in pineapple exporting. Among the selected countries, 36.84% in the African region and 26.31% in the American region gain the advantage of exporting pineapple to the world market. Thus, proving the previously reviewed indexes, African region's countries were the most advantageous in exporting pineapple, as depicted in the Map 5-45. In addition to that, in the European region, 9.67% of the countries and 11.11% of countries in the Asian region experienced the advantage. Hence, the countries are Belgium, Cameroon, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ghana, Guatemala, Guyana, Honduras, Mauritius, Netherlands, Philippines, Portugal, Sri Lanka, Togo and Uganda.



Source: Authors computed from FAO, 2021

#### Map 5.45: Pineapple RSCA Index

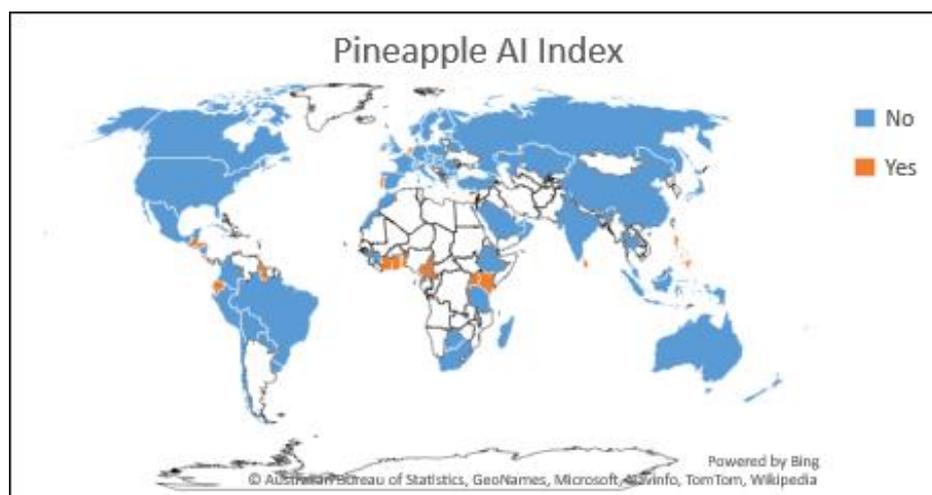
Continuing with the analysis on the NRCA index, 20 countries gained the comparative advantage in the world market where the rest of the 70 countries, indicating 77.77% of countries gained a disadvantage in exporting pineapple to the market. Map 5.46 demonstrates the countries that achieved advantages and disadvantages over exporting pineapple to the world market. Confirming the results of the above examined indexes on pineapple, it can be identified that 36.84% of countries in the African region were experiencing the comparative advantage as representing the highest number of countries located in one region. However, in the American region, only two countries gained the advantage recording 26.31% among the selected countries, in addition to that 11.11% of the countries in the Asian region and 9.67% of the countries in the European region was able to be benefited in exporting pineapple according to the NRCA index. Among the selected three countries in Oceania, one country could gain the comparative advantage for pineapple in the study period. Furthermore, the results revealed that Sri Lanka was able to gain a comparative advantage.



Source: Authors computed from FAO, 2021

#### Map 5.46: Pineapple NRCA Index

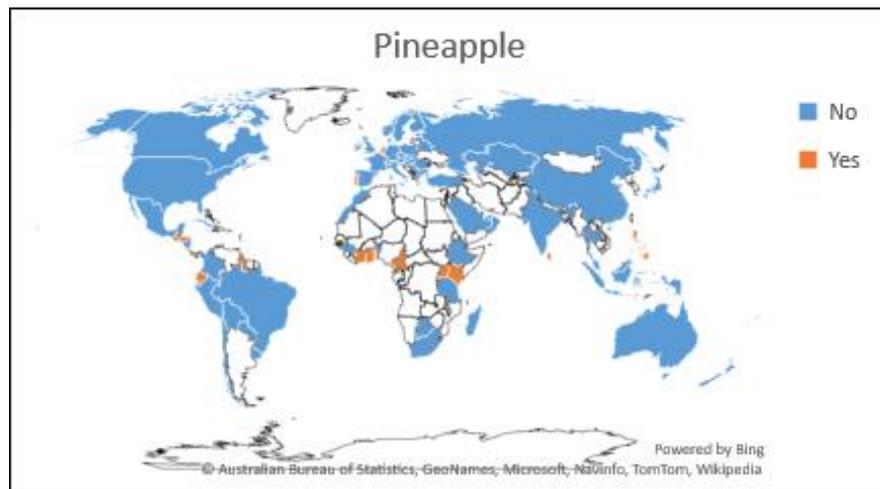
Confirming the results unfolding in BRCA, in the AI index, 19 countries gained the advantage for exporting pineapples to the world market recording 21.11% of countries gained a comparative advantage, and 78.88% of countries gained disadvantage from 2000 to 2019. Similarly, as the results revealed from BRCA, RSCA and NRCA there are 26.31% of countries in the American region were gaining the advantage while 47.36% of the countries in Africa, 11.11% countries in Asia and 9.6% of countries in Europe among the selected countries able to being specialized in pineapple exports. The analysis grouped Sri Lanka as a comparative advantaged country. In addition, the other countries are Belgium, Benin, Cameroon, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ghana, Guatemala, Guyana, Honduras, Kenya, Mauritius, Netherlands, Philippines, Portugal, Togo and Uganda. Below, Map 5.47 shows the position of the selected countries in experiencing advantage as the analysis of the AI index.



Source: Authors computed from FAO, 2021

#### **Map 5.47: Pineapple AI Index**

Ascertaining the results from the above-reviewed indexes, it can be revealed that 18 countries gained a comparative advantage throughout the study. Where 20% of the countries were able to gain a comparative advantage over exporting pineapple to the world market while 80% of countries experience a disadvantage in exporting pineapples among selected 90 countries for the present study. In the African region, 42.10% of countries experienced an advantage while the rest, 57.89%, experienced a disadvantage. In America, 26.31% of the countries gained the advantage, while in Asia, 11.11% gained the advantage. The above evaluations are illustrated in the Map 5.48. Determining the status of Asia, despite the results of Vollrath RCA, the region did not have much advantage over the period. However, among the two countries experiencing the advantage, Sri Lanka was able to attain the advantage over the period in exporting pineapple to the world market. According to the above five indexes, Sri Lanka passes all of the indexes on comparative advantage, being the only country that passes all the indexes for the region. The rest of the countries are Belgium, Cameroon, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ghana, Guatemala, Guyana, Honduras, Kenya, Mauritius, Netherlands, Philippines, Portugal, Togo and Uganda.



Source: Authors computed from FAO, 2021

#### **Map 5.48: Pineapple- Overall Comparative Advantage and Disadvantage**

UNCTAD Trust Fund on Market Information on Agricultural Commodities (2016) reviewed on the most often cultivated pineapple varieties which are highly catered in the world market. Smooth Cayenne was the commonly grown variety in most parts of the world as it has the potential of high yields, small amounts of spines, good conceivability, and good organoleptic qualities. However, new pineapple breedings were introduced for commercial purposes. Thus, the variety named Extra Sweet or MD2 was introduced as a semi-spiny variety with good yields, a mild sweet flavour, being a top-rated variety cultivated for commercial purposes. In addition to that, the variety named Queen or Victoria around Indian Ocean countries, Champaka in Asian countries and Sugarloaf or bottle pineapple in West Africa (Togo and Benin) are some other popular varieties around the world.

Considering the countries that highly gained the comparative advantage in exporting pineapple, the range of varieties cultivated in Ghana are Cayenne (a variety with sweet-sour, light yellow flesh, deep orange, big, cylindrical fruit), Queen or Victoria (conical, small, yellow fruit, having yellow flesh with sweet and pleasant aroma), Sugarloaf (mildly sweet, heavy, large fruit), Variegated (sweet, white-fleshed), Pernambuco (sweet and medium-sized), Baby (very sweet), MD2 (rich with vitamin C), and Red Spanish (medium-sized and light yellow flesh). Thus, with a high range of varieties, the country was able to export significant amounts to the world market by specializing the pineapple exports (Ravry and Danielou, 2005). Furthermore, as identified by Market Intelligence Team (2021) in Costa Rica the varieties that were most exported by Costa Rica were Extra Sweet or MD2, and the Smooth Cayenne. Gaining the advantage of the suitable conditions to the production of pineapple compared to the other major agriculture export productions, the country was able to gain the advantage over the pineapple exports.

Concluding the above findings, it revealed that the Sri Lanka gain advantage on exporting papaw and pineapple. Considering the analysis of comparative advantage

indexes these two fruits were passed three indexes among the selected fruit varieties. Thus, despite that Sri Lanka exporting these 8 fruit varieties the country has most advantage on papaw and pineapple.

**Table 5.1: Summary Table of Sri Lanka Comparative Advantage or Disadvantage on Selected Fruits**

<b>Fruit</b>	<b>Advantage / Disadvantage</b>
Avocado	Disadvantage
Banana	Disadvantage
Cashew	Disadvantage
Lime and Lemon	Disadvantage
Mango	Disadvantage
Orange	Disadvantage
Papaw	Advantage
Pineapple	Advantage

Source: Authors calculations from FAO, 2021

### 5.3 Level of Comparative Advantage

#### 5.3.1 Avocado

The average, minimum and maximum comparative advantage index values of avocados between 2000 and 2019 for all five indexes are integrated into Table 5.2 below. The table shows the variation of the calculated index values among different comparative advantage indexes and countries in different regions. Regarding the average BRCA indices, among all avocado exports, the top spot of specialization was occupied by Domenica (117.57), a country belonging to the American region. Followed by Domenica, Peru (28.43), Mexico (19.46), Chili (25.25), and Saint Vincent (19.79) were the leading specialized countries for avocado in the American region. Down to the African region, Kenya gained the highest specialization (17.99) in the region, followed by South Africa (5.24). In the Asian region, Israel (11.31) was the only country that specialized, while Sri Lanka (0.015) was not a specialized country for avocado export according to the BRCA index. In Europe, except Lithuania (1.16), Netherland (2.79) and Spain (4.75), all other countries show a comparative disadvantage. In Oceania, New Zealand (11.34) has a comparative advantage, but Australia does not.

According to the Vollrath RCA index, the higher index values are viewed in two countries, Israel (9.48) in the Asian region and Kenya (9.1) in the African region. Similarly, Ethiopia (5.49), Rwanda (4.35), South Africa (3.1), Tanzania (7.1), Uganda (7.27), and Zimbabwe (3.33) have a comparative advantage for avocados. In the American region, Brazil (3.18), Chili (4.81), Cuba (2.86), Ecuador (2.14), Jamaica (5.35), Mexico (7.62), Peru (7.76), Saint Vincent (6.39), and Saint Lucia (2.75) had experience comparative advantage. In the Asian region, in addition to Israel, the Philippines (1.63) and Syria (7.83) are viewed as comparative advantaged countries. In Europe, most

countries show a comparative disadvantage in avocado exports as the Vollrath RCA index values take negative signs. Meanwhile, New Zealand (6.37) in Oceania had a comparative advantage in avocado exports.

The results of RSCA index values indicate the smaller number of countries had comparative advantage compared to the BRCA and Vollrath's indexes. In the African region, only two countries, namely South Africa (0.56) and Morocco (0.028). In the American region, Domenica (0.456), Mexico (0.808), Peru (0.827), Chili (0.727), and Saint Vincent (0.418) experienced the comparative advantage for avocado exports. However, Israel (0.687) in the Asian region and Netherland (0.387) in Europe, and New Zealand (0.735) had a comparative advantage in avocado exports.

The highest NRCA index value of 577.78 was observed for Mexico, which belongs to the American region. Chili, Colombia, Domenica, Guatemala, and Peru had been experiencing comparative advantage in the American region. Guatemala had the lowest NRCA index value (0.060). Among the African countries are Burundi, Kenya, Morocco, South Africa, Tanzania, and Zimbabwe. The lowest and the highest NRCA index values in the African region were viewed for Burundi (0.026) and South Africa (23.76), respectively. In the Asian region, except Israel (37.23), all other countries had comparative disadvantage in avocado exports. In the European region, only Lithuania (0.614), Netherland (125.77), and Spain (81.64) were experienced a comparative advantage in the avocado exports. With regard to Oceania, New Zealand has the comparative advantage in avocado exports, and this result is consistent with BRCA, Vollrath, RCA and RSCA.

Moving into the Additive RCA index, the highest value (9.035) was denoted for Domenica in the American region. Chili, Peru, Saint Lucia, and Saint Vincent were the rest of the American region's countries having a comparative advantage, and their AI index values ranged between 0.095 (Saint Lucia) and 4.73 (Peru). Among the countries in the African region, Kenya had the highest AI index value (4.345). Burundi (0.25), Morocco (0.305), South Africa (0.455), and Tanzania (0.188) also had the comparative advantage of avocado exports as the AI index values take positive signs. The results of the AI index for Asia, Europe, and Oceania were consistent with the results of all other indexes discussed above. In Asia, only Israel had a comparative advantage (0.953). Sri Lanka also has a comparative disadvantage (-0.133) in the AI index. In the European region, Netherland (0.317) and Spain (0.432) and New Zealand (1.198) in Oceania are viewed as a comparative advantage of avocado exports.

The conclusion from the analysis of all five RCA indexes for avocado exports is that most of the countries had been experiencing comparative advantage belonging to African and American regions, while few countries were located in Asian and European regions. The evidence proved that Sri Lanka was a comparative disadvantageous country in avocado exports. According to the empirical evidence, Mexico, as one of the leading avocado exporters to the world market, is also revealed by the present study Valencia and Rivas-tovar (2015) and Vargas-canales et al. (2020) investigated the Mexican avocado in the world market. The analysis revealed that there should be

a strong concentration and reconfiguration in terms of the specialization of the industry. Moreover, the Mexican avocado industry was under-organized, and despite being a leading exporter to the world market, the country was unable to achieve the maximum. Further, as the country has already gained an advantage over the industry, the specialization should be focused on natural conditions, technological change and market demand. The USA is one of the potential economies for Mexican avocado exports (Peterson and Orden, 2008). Further, Njuguna (2018) consider the Kenyan avocado industry as identified by the present study. It stated that the county has to increase its performance to gain a competitive advantage. Thus, marketing strategies have to be utilized. Confirming the above findings Amare et al. (2019) concluded that there is an offsetting effect from quality requirements, higher prices and lower volumes from the export market.

**Table 5.2: Mean, Maximum and Minimum Comparative Advantage Scores of Avocado, 2000-2019 (NRCA values in  $10^{-7}$ , AI values in  $10^{-3}$ )**

Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
<b>Africa</b>															
Burundi	0	7.462	1.546	-	-	-	-1.000	0.764	-0.273	-0.009	0.195	0.026	-0.106	1.887	0.250
Cameroon	0	0.316	0.025	-	-	-	-1.000	-0.520	-0.958	-0.399	-0.132	-0.266	-0.333	-0.044	-0.135
Côte d'Ivoire	0	0.040	0.007	-0.211	3.061	2.033	-1.000	-0.923	-0.986	-0.982	-0.298	-0.727	-0.330	-0.047	-0.135
Egypt	0	0.176	0.030	-1.980	3.097	-0.076	-1.000	-0.701	-0.945	-2.329	-0.370	-1.467	-0.327	-0.047	-0.132
Eswatini	0	2.111	0.661	0.912	2.584	1.750	-1.000	0.357	-0.371	-0.148	0.312	-0.004	-0.129	0.109	-0.028
Ethiopia	0	0.207	0.027	5.320	5.658	5.489	-1.000	-0.657	-0.951	-0.258	-0.035	-0.136	-0.315	-0.047	-0.130
Kenya	0	68.005	17.999	6.864	10.563	9.092	-1.000	0.971	-0.314	-0.470	59.657	14.164	-0.118	19.255	4.345
Mauritius	0	0.108	0.024	-2.868	0.414	-1.140	-1.000	-0.805	-0.955	-0.228	-0.119	-0.168	-0.331	-0.047	-0.133
Morocco	0	6.810	2.055	-2.342	3.033	0.803	-1.000	0.744	0.028	-1.662	26.267	4.797	-0.106	1.670	0.305
Rwanda	0	1.584	0.147	4.354	4.354	4.354	-1.000	0.226	-0.847	-0.055	0.235	-0.008	-0.273	0.196	-0.092
South Africa	0	12.541	5.236	1.955	5.703	3.059	-1.000	0.852	0.563	-2.301	51.436	23.763	-0.050	0.940	0.455
United republic of Tanzania	0	10.249	1.190	4.549	8.333	7.066	-1.000	0.822	-0.457	-0.351	8.616	0.580	-0.116	3.105	0.188
Uganda	0	3.995	0.264	7.271	7.271	7.271	-1.000	0.600	-0.814	-0.201	2.167	0.000	-0.321	1.005	-0.062
Zimbabwe	0	2.170	0.590	0.131	7.045	3.332	-1.000	0.369	-0.451	-0.222	0.975	0.057	-0.106	0.336	-0.005
<b>America</b>															
Barbados	0	1.215	0.324	-6.507	1.574	-0.609	-1.000	0.097	-0.591	-0.039	-0.003	-0.021	-0.336	0.023	-0.100
Brazil	0	0.269	0.157	-1.939	7.003	3.179	-1.000	-0.576	-0.736	-16.293	-3.917	-9.834	-0.284	-0.043	-0.112
Canada	0	0.058	0.005	-11.707	-2.818	-8.387	-1.000	-0.891	-0.990	-36.554	-18.708	-29.317	-0.336	-0.046	-0.137
Chili	0	56.765	25.253	2.162	7.042	4.813	-1.000	0.965	0.727	-1.474	276.814	115.409	-0.050	6.984	2.941
Colombia	0	6.652	1.114	-6.455	8.986	-1.023	-1.000	0.739	-0.556	-4.613	43.060	4.343	-0.117	1.897	0.196
Costa Rica	0	0.268	0.086	-6.147	-2.943	-4.708	-1.000	-0.577	-0.848	-0.879	-0.335	-0.614	-0.332	-0.039	-0.125
Cuba	0	0.043	0.010	2.142	3.404	2.860	-1.000	-0.917	-0.980	-0.494	-0.108	-0.247	-0.324	-0.047	-0.135
Dominica	0	316.91	117.568	0.000	0.000	-	-1.000	0.994	0.456	-0.004	0.986	0.329	-0.129	23.198	9.035
Ecuador	0	2.001	0.395	-1.461	5.231	2.145	-1.000	0.334	-0.565	-1.877	0.345	-0.862	-0.323	0.048	-0.104
Guatemala	0	3.089	0.845	-1.304	1.491	-0.284	-1.000	0.511	-0.204	-0.605	3.450	0.060	-0.159	0.402	-0.021
Honduras	0	1.038	0.081	-7.403	-1.366	-5.418	-1.000	0.019	-0.900	-0.624	0.919	-0.374	-0.306	0.013	-0.112
Jamaica	0	4.831	0.966	4.303	7.328	5.348	-1.000	0.657	-0.286	-0.150	0.378	-0.004	-0.223	0.260	-0.026
Mexico	0	25.606	19.463	4.540	12.831	7.619	-1.000	0.925	0.808	-12.768	1593.579	577.784	-0.050	6.752	2.646

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Nicaragua	0	0.730	0.287	-0.082	3.345	1.718	-1.000	-0.156	-0.595	-0.333	-0.050	-0.173	-0.312	-0.021	-0.106
Panama	0	0.116	0.012	-7.753	-0.413	-2.793	-1.000	-0.792	-0.977	-1.224	-0.065	-0.657	-0.324	-0.047	-0.135
Saint Lucia	0	14.580	2.580	1.271	5.058	2.750	-1.000	0.872	-0.078	-0.017	0.048	0.006	-0.194	0.677	0.095
Saint Vincent Trinidad and Tobago	0	40.802	16.787	4.961	6.856	6.397	-1.000	0.952	0.418	-0.004	0.114	0.055	-0.129	3.427	1.715
United State of America	0	0.071	0.010	-6.067	0.848	-2.203	-1.000	-0.868	-0.980	-1.439	-0.278	-0.787	-0.335	-0.044	-0.136
Uruguay	0	0.562	0.295	-3.059	-1.356	-2.197	-1.000	-0.281	-0.561	-81.583	-31.905	-56.529	-0.243	-0.031	-0.094
Asia	0	0.007	0.002	-4.806	-3.774	-4.302	-1.000	-0.987	-0.997	-0.697	-0.143	-0.436	-0.336	-0.047	-0.137
Bahrain	0	0.021	0.003	-7.424	-0.017	-3.616	-1.000	-0.958	-0.994	-1.683	-0.428	-1.047	-0.336	-0.047	-0.136
Brunei	0	0.028	0.003	-12.256	-3.209	-5.599	-1.000	-0.945	-0.993	-0.998	-0.279	-0.559	-0.333	-0.047	-0.136
Hong Kong	0	0.230	0.045	-8.400	-0.235	-3.254	-1.000	-0.626	-0.922	-40.496	-14.653	-26.429	-0.289	-0.047	-0.125
Indonesia	0	0.018	0.005	-3.503	5.111	-0.080	-1.000	-0.965	-0.991	-15.575	-4.399	-9.957	-0.335	-0.047	-0.136
Israel	0	30.648	11.308	7.173	10.647	9.481	-1.000	0.937	0.687	-2.410	63.013	37.234	-0.050	1.705	0.953
Lebanon	0	1.022	0.582	-1.177	3.573	1.911	-1.000	0.011	-0.322	-0.245	0.495	-0.042	-0.138	0.007	-0.043
Malaysia	0	0.002	0.000	-7.027	-3.035	-4.953	-1.000	-0.996	-0.999	-18.954	-6.752	-13.638	-0.335	-0.047	-0.137
Philippines	0	0.058	0.011	-1.050	4.901	1.626	-1.000	-0.890	-0.979	-5.211	-2.431	-3.769	-0.332	-0.045	-0.135
R Korea	0	0.000	0.000	-14.749	-12.678	-13.612	-1.000	-1.000	-1.000	-46.419	-11.546	-31.255	-0.336	-0.047	-0.137
Saudi	0	0.007	0.001	-7.565	-2.463	-5.259	-1.000	-0.986	-0.998	-29.809	-5.190	-17.081	-0.336	-0.047	-0.137
Singapore	0	0.012	0.007	-3.486	-2.112	-2.795	-1.000	-0.977	-0.987	-31.563	-9.282	-22.814	-0.332	-0.047	-0.136
Sri Lanka	0	0.105	0.015	0.000	0.000	-	-1.000	-0.810	-0.973	-0.847	-0.361	-0.625	-0.329	-0.047	-0.133
Syrian Arab republic	0	2.727	0.366	7.534	8.126	7.830	-1.000	0.463	-0.731	-1.183	0.506	-0.399	-0.336	0.344	-0.045
Thailand	0	0.000	0.000	-8.627	-1.607	-5.806	-1.000	-0.999	-1.000	-19.403	-4.985	-12.930	-0.336	-0.047	-0.137
Turkey	0	0.020	0.004	-3.565	2.163	-0.991	-1.000	-0.962	-0.991	-13.329	-2.132	-8.598	-0.332	-0.047	-0.136
UAE	0	0.066	0.017	-3.962	-1.817	-2.815	-1.000	-0.876	-0.967	-28.720	-3.716	-16.535	-0.331	-0.045	-0.134
Europe															
Austria	0.013	0.086	0.047	-3.543	-1.558	-2.343	-0.975	-0.842	-0.911	-13.553	-5.115	-10.193	-0.312	-0.046	-0.129
Belarus	0	0.060	0.007	-6.520	-1.804	-3.795	-1.000	-0.887	-0.987	-3.535	-0.562	-1.864	-0.332	-0.047	-0.135
belgium	0	1.035	0.331	-1.054	0.090	-0.427	-1.000	0.017	-0.537	-33.410	1.563	-17.070	-0.230	0.002	-0.091
Bulgaria	0	0.016	0.002	-8.118	-2.816	-5.007	-1.000	-0.969	-0.995	-2.577	-0.372	-1.532	-0.333	-0.047	-0.136
Czechia	0	0.068	0.028	-2.589	-1.190	-1.839	-1.000	-0.874	-0.947	-13.787	-2.233	-8.953	-0.321	-0.047	-0.132
Denmark	0	0.228	0.071	-5.300	-2.027	-3.597	-1.000	-0.629	-0.873	-8.377	-3.914	-6.237	-0.286	-0.047	-0.123
Austria	0.013	0.086	0.047	-3.543	-1.558	-2.343	-0.975	-0.842	-0.911	-13.553	-5.115	-10.193	-0.312	-0.046	-0.129

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Belarus	0	0.060	0.007	-6.520	-1.804	-3.795	-1.000	-0.887	-0.987	-3.535	-0.562	-1.864	-0.332	-0.047	-0.135
belgium	0	1.035	0.331	-1.054	0.090	-0.427	-1.000	0.017	-0.537	-33.410	1.563	-17.070	-0.230	0.002	-0.091
Bulgaria	0	0.016	0.002	-8.118	-2.816	-5.007	-1.000	-0.969	-0.995	-2.577	-0.372	-1.532	-0.333	-0.047	-0.136
Czechia	0	0.068	0.028	-2.589	-1.190	-1.839	-1.000	-0.874	-0.947	-13.787	-2.233	-8.953	-0.321	-0.047	-0.132
Denmark	0	0.228	0.071	-5.300	-2.027	-3.597	-1.000	-0.629	-0.873	-8.377	-3.914	-6.237	-0.286	-0.047	-0.123
Estonia	0	0.014	0.003	-5.153	-3.972	-4.428	-1.000	-0.973	-0.995	-1.289	-0.294	-0.854	-0.332	-0.047	-0.136
Finland	0	0.019	0.004	-7.184	-4.301	-5.592	-1.000	-0.963	-0.992	-7.403	-3.312	-5.129	-0.331	-0.047	-0.136
France	0	1.731	0.701	-1.889	-1.063	-1.489	-1.000	0.268	-0.241	-28.771	16.199	-10.379	-0.202	0.035	-0.060
Georgia	0	0.201	0.026	-2.214	-0.240	-0.788	-1.000	-0.666	-0.953	-0.220	-0.024	-0.117	-0.310	-0.047	-0.129
Germany	0	0.168	0.097	-2.065	-1.150	-1.644	-1.000	-0.713	-0.824	-105.519	-39.231	-79.412	-0.305	-0.040	-0.123
Greece	0	1.247	0.404	-1.072	2.027	0.265	-1.000	0.110	-0.499	-2.269	0.113	-1.274	-0.296	0.017	-0.097
Hungary	0	0.122	0.014	-3.161	-0.464	-1.925	-1.000	-0.783	-0.975	-9.071	-2.164	-6.333	-0.328	-0.047	-0.133
Ireland	0	0.012	0.003	-5.921	-3.893	-5.339	-1.000	-0.977	-0.994	-12.859	-5.941	-8.981	-0.334	-0.047	-0.136
Italy	0	0.916	0.119	-2.858	0.201	-1.776	-1.000	-0.044	-0.840	-40.919	-8.467	-29.280	-0.327	-0.008	-0.124
Latvia	0	0.769	0.306	-5.036	-0.571	-1.929	-1.000	-0.130	-0.619	-0.771	0.893	-0.207	-0.140	-0.046	-0.071
Lithuania	0	3.687	1.161	-5.768	0.841	-1.353	-1.000	0.573	-0.271	-1.097	4.987	0.614	-0.256	0.310	0.003
Luxembourg	0	0.909	0.146	-3.978	-0.105	-1.996	-1.000	-0.047	-0.809	-1.925	1.363	-0.986	-0.297	-0.030	-0.098
Netherlands	0	4.262	2.759	-0.290	0.220	-0.058	-1.000	0.620	0.387	-17.892	475.567	125.767	-0.050	1.095	0.317
Norway	0	0.005	0.001	-10.159	-6.198	-7.350	-1.000	-0.990	-0.997	-13.171	-4.543	-8.623	-0.335	-0.047	-0.137
Poland	0	0.114	0.036	-5.241	-1.323	-2.492	-1.000	-0.796	-0.933	-17.005	-2.437	-10.628	-0.317	-0.047	-0.130
Portugal	0	0.449	0.110	-5.166	0.222	-1.301	-1.000	-0.381	-0.818	-4.456	0.130	-2.984	-0.268	-0.047	-0.114
Romania	0	0.055	0.008	-8.035	-0.943	-3.391	-1.000	-0.895	-0.984	-6.106	-0.799	-3.517	-0.335	-0.047	-0.136
Russian Federation	0	0.002	0.000	-10.510	-5.880	-7.409	-1.000	-0.997	-0.999	-40.619	-7.818	-25.392	-0.335	-0.047	-0.137
Slovakia	0	0.055	0.007	-7.399	-1.345	-4.185	-1.000	-0.895	-0.987	-6.742	-0.908	-4.398	-0.333	-0.047	-0.135
Slovenia	0	1.664	0.440	-4.444	0.129	-0.807	-1.000	0.249	-0.487	-2.080	1.726	-0.682	-0.180	0.063	-0.067
Spain	0	8.104	4.746	0.368	2.518	1.216	-1.000	0.780	0.564	-8.845	175.542	81.641	-0.050	0.817	0.432
Sweden	0	0.105	0.024	-6.975	-2.963	-4.585	-1.000	-0.809	-0.955	-14.048	-5.746	-10.538	-0.324	-0.047	-0.133
Switzerland	0	0.004	0.001	-8.323	-5.174	-6.224	-1.000	-0.992	-0.997	-27.395	-6.178	-16.217	-0.335	-0.047	-0.137
United Kingdom of Great Britain and Northern Ireland	0	0.165	0.079	-3.409	-2.147	-2.741	-1.000	-0.717	-0.856	-38.928	-19.542	-29.169	-0.308	-0.043	-0.127
<b>Oceania</b>															
Australia	0.116	0.333	0.210	-2.621	-1.183	-1.983	-0.792	-0.500	-0.657	-17.092	-3.999	-9.954	-0.295	-0.038	-0.111
New Zealand	0	17.628	11.343	4.340	10.274	6.374	-1.000	0.893	0.735	-1.021	51.744	25.303	-0.050	2.323	1.198

Authors computed from FAO, 2021

### 5.3.2 Banana

The level of comparative advantage of bananas from 2000 to 2019 is integrated into Table 5.3. According to the BRCA index values, most of the banana exporters with comparative advantage were in the American region. Comparatively, higher mean BRCA index values were identified for Belize (127.85), Costa Rica (149.45), Ecuador (232.03), Guatemala (101.85), and Saint Lucia (271.68), and Saint Vincent (248.07). With regards to the African region, only four countries, namely Cameroon (39.51), Cote d'Ivoire (22.99), Ghana (2.55), and Zimbabwe (1.097), had the comparative advantage as their BRCA index values were greater than 1. In the Asian region, only the Philippines had the positive values for the BRCA index and the highest was for the Philippines (21.088). In Europe, Belgium, Costa Rica, Greece, Lithuania, and Slovenia had positive BRCA index values, and Costa Rica (149.45) was the highest among them. BRCA index values in Australia, Fiji, and New Zealand is less than 1.

Vollrath RCA indexes showed different results than the BRCA index values in African and American regions. According to Vollrath index values, except for Nigeria and South Africa, all other countries in the African region had a comparative advantage in avocado exports as the index values take positive signs. Rwanda got the lowest among the positive index values in the African region. The highest index value was viewed for Cote d'Ivoire (10.94), followed by Cameroon (9.74). In the Asian region, Cambodia, Hong Kong, India, Indonesia, Lebanon, Malaysia, Pakistan, Philippines, Sri Lanka and Thailand had a comparative advantage in banana exports, and their Vollrath RCA index values ranged between 1.206 (Indonesia) and 10.51 (Philippines). Sri Lanka's index value was 4.81. In the European region, only Belgium and Costa Rica had a comparative advantage while Costa Rica got the highest (8.28). Further, in Oceania, Fiji had a comparative advantage (3.24) for banana exports.

Moving to RSCA index values, only two countries in the African region, Cameroon (0.85) and Cote d'Ivoire (0.82), had a comparative advantage as their RSCA index values got positive signs. However, most of the American region's countries, namely Belize, Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Nicaragua, Panama, Saint Lucia, and Saint Vincent, had comparative advantage according to RSCA index values, and the positive index values ranged between 0.487 and 0.991. Further, index values of Colombia, Costa Rica, Ecuador, and Guatemala were very close to 1. In contrast, all the countries except Lebanon (0.375) and the Philippines (0.897) in Asia, and all the countries except Belgium (0.667) and Costa Rica (0.987) in Europe had a comparative disadvantage in banana exports.

The results of NRCA indexes indicated very similar results to the RSCA index results. The only difference is that Peru was newly added to the American region's country list having a comparative advantage. Results of the AI index were also similar to the RSCA and NRCA except for Zimbabwe (0.036), included in the country list that had been experiencing comparative advantage in the African Region.

The conclusion is that most countries with a comparative advantage of banana exports were in the American region. Only Cameroon and Cote d'Ivoire belong to the African region, while Lebanon and the Philippines in the Asian region experiencing the comparative advantage. Belgium and Costa Rica were the two European region countries with a comparative advantage in Bananas exports. Sri Lanka had a comparative disadvantage in banana exports. However, there is empirical evidence for the above findings as to the American region, and Asian region countries were mentioned. Thus, Abdlemagid et al. (2021) assessed the efficiency of banana production in Sudan, highlighting comparative advantage for the country. Policy analysis matrix, Domestic cost ratio, and Private cost ratio were used in the study, revealing that it was not efficiently utilized. The policy analysis matrix for assessing the competitiveness of bananas in Jamaica Hyatt (2008) revealed that the country had some comparative advantage in efficiently using local resources. Von et al. (2006) investigated the competitiveness of the countries in the European Union market, and Colombia, Costa Rica, and Ecuador gained the comparative advantage in the market. Moreover, according to the review of the competitiveness of Banana, in context of Association of South East Asian Nation (ASEAN) community, Lapiña et al. (2020) there is a favourable natural environment for banana and the domestic resource cost ratio depicted that there was an ability for a domestic production for the cost-competitive market, especially Philippines own around 45% of the share among the ASEAN countries. It was one of the leading quality product exporters (World Bank, 2010) in the world market. Further, Suntharalingam et al. (2006) concluded that Malaysian exports gained a competitive advantage over China and Indonesia but not the Philippines, India and Thailand. However, Hanemann (2006) and Periyakuruppan (2013) stated that there is no comparative advantage for Indian bananas in the export market.

**Table 5.3 Mean, Maximum and Minimum Comparative Advantage Scores of Banana, 2000-2019 (NRCA values in  $10^{-7}$ , AI values in  $10^{-3}$ )**

Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
<b>Africa</b>															
Burundi	0.000	1.252	0.492	5.503	6.530	5.924	-1.000	0.112	-0.488	-0.128	-0.029	-0.071	-0.641	0.116	-0.282
Cameroon	0.000	79.858	39.515	9.737	9.754	9.745	-1.000	0.975	0.852	-4.332	90.705	52.784	-0.473	47.941	21.542
Côte d'Ivoire	0.000	31.532	22.984	7.812	12.038	10.936	-1.000	0.939	0.823	-12.427	109.231	76.871	-0.537	17.143	12.007
Eswatini	0.000	4.084	0.710	-0.044	2.971	0.980	-1.000	0.607	-0.400	-1.848	0.883	-1.112	-0.620	2.024	-0.128
Ethiopia	0.000	2.171	0.659	3.915	9.855	7.485	-1.000	0.369	-0.332	-2.774	-0.045	-1.360	-0.656	0.554	-0.199
Ghana	0.000	14.365	2.546	-2.404	8.309	4.754	-1.000	0.870	-0.151	-12.297	21.430	-0.357	-0.641	8.331	0.920
Kenya	0.000	0.055	0.019	-2.305	3.247	0.938	-1.000	-0.896	-0.963	-5.879	-1.644	-4.269	-0.653	-0.434	-0.541
Madagascar	0.000	0.039	0.011	1.355	1.355	1.355	-1.000	-0.925	-0.978	-2.953	-0.454	-1.472	-0.648	-0.446	-0.545
Nigeria	0.000	0.000	0.000	-6.325	-1.507	-4.221	-1.000	-1.000	-1.000	-111.307	-17.248	-57.471	-0.656	-0.446	-0.551
Rwanda	0.000	1.172	0.267	-3.329	4.074	0.611	-1.000	0.079	-0.691	-1.039	-0.012	-0.399	-0.623	0.080	-0.412
South Africa	0.002	0.124	0.036	-3.177	2.032	-1.018	-0.996	-0.779	-0.933	-104.237	-27.529	-66.761	-0.639	-0.428	-0.530
Tanzania	0.001	0.957	0.106	1.112	8.073	3.620	-0.999	-0.022	-0.872	-4.851	-0.695	-2.853	-0.621	-0.026	-0.487
Uganda	0.078	3.909	0.723	1.020	7.072	4.447	-0.855	0.593	-0.399	-2.831	1.125	-1.283	-0.553	1.813	-0.137
Zimbabwe	0.000	18.327	1.097	-1.108	6.645	3.410	-1.000	0.897	-0.659	-3.744	14.950	-1.589	-0.621	9.043	0.036
<b>America</b>															
Belize	0.000	214.628	127.846	5.700	8.059	6.879	-1.000	0.991	0.590	-0.366	39.093	20.459	-0.648	129.571	68.734
Bolivia	1.393	8.169	4.851	7.819	9.722	8.805	0.164	0.782	0.623	0.464	15.095	5.119	0.245	4.379	2.102
Brazil	0.084	0.867	0.395	3.674	9.471	6.915	-0.845	-0.071	-0.461	-224.422	-6.681	-136.499	-0.576	-0.085	-0.336
Canada	0.000	0.000	0.000	-12.365	-10.222	-11.331	-1.000	-1.000	-1.000	-457.029	-242.183	-367.858	-0.656	-0.446	-0.551
Chili	0.000	0.019	0.005	-11.026	-3.964	-6.713	-1.000	-0.963	-0.991	-77.926	-17.291	-53.482	-0.651	-0.441	-0.549
Colombia	25.697	59.115	39.103	4.104	8.858	7.603	0.925	0.967	0.948	318.154	727.326	442.088	11.683	36.226	21.315
Costa Rica	112.482	168.401	149.447	4.990	10.635	8.277	0.982	0.988	0.987	367.089	845.035	540.067	61.160	102.475	81.616
Ecuador	180.639	290.151	232.030	6.706	15.236	11.362	0.989	0.993	0.991	893.965	1643.553	1301.411	85.953	185.118	129.101
Guatemala	78.411	129.004	101.854	5.309	8.916	7.310	0.975	0.985	0.980	171.780	466.720	301.142	35.526	74.986	55.838
Honduras	0.000	89.235	44.046	4.899	8.315	6.175	-1.000	0.978	0.655	-7.654	313.986	110.215	-0.482	57.154	24.232
Jamaica	0.000	23.122	2.755	2.609	2.609	2.609	-1.000	0.917	-0.578	-2.318	28.129	1.218	-0.641	14.329	1.013
Mexico	0.132	0.926	0.511	5.965	10.273	7.265	-0.767	-0.039	-0.381	-305.342	-125.766	-224.805	-0.556	-0.049	-0.268
Nicaragua	1.311	19.928	11.247	2.819	6.942	5.274	0.134	0.904	0.760	-2.658	18.837	9.710	0.139	12.261	5.938
Panama	0.000	277.018	68.799	2.621	13.476	7.668	-1.000	0.993	0.830	-10.543	227.507	90.609	-0.482	172.054	40.170
Paraguay	0.000	2.327	0.768	-3.873	9.596	3.694	-1.000	0.399	-0.286	-9.073	-0.907	-3.751	-0.640	0.871	-0.114
Peru	0.000	7.444	2.297	9.602	12.222	10.665	-1.000	0.763	-0.212	-44.261	59.380	1.454	-0.600	3.653	0.770
Saint Lucia	0.000	814.624	271.681	2.092	5.820	4.058	-1.000	0.998	0.492	-0.206	33.866	10.999	-0.620	507.167	156.621
Saint Vincent	0.000	715.604	248.072	10.438	11.132	10.785	-1.000	0.997	0.487	-0.047	25.267	5.284	-0.648	435.043	132.746

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
United State of America	0.000	0.659	0.463	-1.269	-0.537	-0.885	-1.000	-0.205	-0.382	-1383.705	-402.845	-949.736	-0.459	-0.152	-0.299
<b>Asia</b>															
Cambodia	0.000	5.084	0.401	2.389	9.630	7.348	-1.000	0.671	-0.804	-9.658	11.622	-3.892	-0.648	2.680	-0.295
China	0.003	0.026	0.013	-5.111	-2.514	-3.458	-0.993	-0.948	-0.974	-2386.297	-234.969	-1392.657	-0.647	-0.442	-0.544
Hong Kong	0.004	0.045	0.021	0.457	3.385	2.054	-0.991	-0.915	-0.959	-544.680	-181.117	-373.204	-0.653	-0.430	-0.540
India	0.063	0.373	0.184	7.223	10.671	8.769	-0.881	-0.456	-0.700	-291.447	-34.501	-174.474	-0.588	-0.372	-0.447
Indonesia	0.000	0.087	0.020	-3.670	6.522	1.206	-1.000	-0.840	-0.962	-194.717	-54.960	-124.009	-0.647	-0.441	-0.540
Jordan	0.000	1.232	0.165	-4.805	2.365	-2.463	-1.000	0.104	-0.803	-8.038	0.027	-5.462	-0.645	0.139	-0.461
Kazakhstan	0.000	0.005	0.001	-9.876	-5.338	-6.740	-1.000	-0.990	-0.998	-82.946	-8.289	-44.721	-0.653	-0.445	-0.551
R Korea	0.000	0.007	0.002	-17.229	-8.158	-11.679	-1.000	-0.987	-0.996	-580.388	-143.298	-390.475	-0.656	-0.445	-0.550
Kuwait	0.000	0.716	0.123	-5.671	-1.358	-2.974	-1.000	-0.166	-0.826	-114.101	-14.747	-55.108	-0.656	-0.173	-0.480
Lebanon	0.000	9.214	3.432	3.423	7.607	5.189	-1.000	0.804	0.375	-4.634	7.231	1.198	-0.656	4.994	1.299
Malaysia	0.048	0.146	0.081	-0.611	5.215	2.585	-0.908	-0.745	-0.852	-233.165	-71.048	-164.697	-0.624	-0.410	-0.506
Pakistan	0.010	2.782	0.975	3.349	10.282	7.466	-0.981	0.471	-0.254	-18.741	-5.136	-11.095	-0.628	0.843	-0.022
Philippine	12.287	41.956	21.088	9.326	11.844	10.515	0.849	0.953	0.897	157.704	952.443	382.207	5.713	26.871	11.072
Saudi	0.000	0.073	0.019	-6.001	-3.346	-4.529	-1.000	-0.865	-0.962	-371.378	-64.954	-212.227	-0.650	-0.434	-0.541
Singapore	0.000	0.002	0.001	-8.048	-4.087	-5.224	-1.000	-0.996	-0.999	-398.487	-116.805	-288.105	-0.656	-0.445	-0.551
Sri Lanka	0.000	0.928	0.084	2.953	6.670	4.811	-1.000	-0.037	-0.903	-10.846	-4.492	-7.760	-0.643	-0.044	-0.499
Thailand	0.037	0.427	0.121	1.376	7.163	2.867	-0.929	-0.401	-0.791	-228.778	-58.886	-153.909	-0.615	-0.255	-0.486
Turkey	0.000	1.179	0.060	-10.269	0.103	-6.902	-1.000	0.082	-0.943	-169.992	-26.617	-104.631	-0.644	0.117	-0.512
UAE	0.000	0.107	0.019	-3.939	-2.217	-3.082	-1.000	-0.806	-0.965	-370.893	-44.563	-212.633	-0.648	-0.440	-0.541
<b>Europe</b>															
Austria	0.025	0.314	0.204	-3.591	-1.113	-1.660	-0.952	-0.523	-0.669	-168.336	-49.496	-126.252	-0.625	-0.306	-0.443
Belarus	0.000	0.217	0.031	-7.512	-0.901	-4.867	-1.000	-0.644	-0.948	-44.171	-6.416	-23.398	-0.655	-0.430	-0.533
Belgium	2.551	6.922	5.268	-0.164	0.676	0.243	0.437	0.748	0.667	-37.803	867.083	437.280	1.018	3.064	2.289
Bulgaria	0.000	0.743	0.141	-5.536	-0.150	-2.847	-1.000	-0.148	-0.797	-31.888	-4.656	-18.222	-0.632	-0.117	-0.480
Cyprus	0.000	0.181	0.022	-4.529	-1.311	-3.080	-1.000	-0.693	-0.961	-4.819	-0.809	-1.892	-0.656	-0.446	-0.539
Croatia	0.075	2.441	0.798	-3.213	-0.139	-1.254	-0.860	0.419	-0.233	-60.267	37.988	-30.995	-0.645	-0.280	-0.490
Czechia	0.000	0.007	0.002	-17.229	-8.158	-11.679	-1.000	-0.987	-0.996	-580.388	-143.298	-390.475	-0.614	0.416	-0.276
Denmark	0.005	0.350	0.160	-5.264	-1.466	-2.395	-0.990	-0.482	-0.734	-106.267	-48.978	-82.803	-0.642	-0.335	-0.467
Estonia	0.000	0.228	0.030	-8.395	-1.563	-4.861	-1.000	-0.629	-0.947	-16.318	-3.670	-10.639	-0.655	-0.354	-0.537

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Finland	0.000	0.125	0.030	-9.540	-2.550	-5.293	-1.000	-0.778	-0.946	-92.504	-40.875	-63.891	-0.641	-0.443	-0.533
France	0.381	0.959	0.601	-0.956	0.114	-0.296	-0.448	-0.021	-0.259	-482.122	-126.583	-356.607	-0.406	-0.020	-0.226
Georgia	0.040	2.401	0.989	-4.028	0.341	-1.445	-0.924	0.412	-0.190	-2.752	0.243	-1.041	-0.599	0.865	-0.003
Germany	0.230	0.785	0.473	-1.756	-0.484	-1.016	-0.627	-0.120	-0.375	-1377.136	-364.878	-915.489	-0.495	-0.099	-0.300
Greece	0.107	2.626	1.201	-2.680	0.047	-0.746	-0.806	0.448	-0.006	-21.179	5.927	-12.686	-0.572	0.725	0.109
Hungary	0.000	0.881	0.188	-5.298	0.553	-2.289	-1.000	-0.063	-0.758	-117.944	-26.659	-75.962	-0.643	-0.057	-0.455
Ireland	0.008	1.176	0.185	-4.496	0.597	-1.970	-0.983	0.081	-0.734	-161.227	-54.639	-102.980	-0.639	0.081	-0.453
Italy	0.094	0.738	0.360	-2.657	-0.643	-1.511	-0.827	-0.151	-0.500	-497.473	-60.494	-346.964	-0.553	-0.163	-0.352
Kyrgyzstan	0.000	0.095	0.019	-4.384	-3.226	-3.751	-1.000	-0.826	-0.965	-1.975	-0.457	-1.303	-0.648	-0.403	-0.541
Latvia	0.006	2.733	0.880	-5.551	0.163	-1.686	-0.988	0.464	-0.269	-9.626	-0.364	-5.390	-0.622	0.982	-0.069
Lithuania	0.430	2.519	1.072	-0.991	0.300	-0.439	-0.399	0.432	-0.046	-27.415	7.306	-12.505	-0.374	0.912	0.058
Luxembourg	0.007	0.170	0.034	-3.834	-0.800	-2.621	-0.985	-0.709	-0.935	-24.600	-6.671	-16.476	-0.629	-0.433	-0.531
Netherlands	0.117	1.596	0.635	-1.392	0.256	-0.230	-0.791	0.230	-0.313	-560.810	-153.261	-367.222	-0.530	0.391	-0.192
Poland	0.139	1.776	0.364	-2.587	-0.074	-1.753	-0.756	0.280	-0.542	-227.262	-7.454	-125.516	-0.537	0.405	-0.355
Portugal	0.075	2.441	0.798	-3.213	-0.139	-1.254	-0.860	0.419	-0.233	-60.267	37.988	-30.995	-0.565	0.933	-0.112
Romania	0.000	0.125	0.015	-9.962	-1.894	-6.372	-1.000	-0.779	-0.973	-76.334	-9.988	-44.139	-0.647	-0.397	-0.544
Russian Federation	0.002	0.220	0.092	-7.562	-3.249	-4.342	-0.995	-0.639	-0.837	-500.606	-94.648	-306.118	-0.629	-0.386	-0.499
Serbia	0.000	0.399	0.068	-6.087	-1.785	-3.982	-1.000	-0.430	-0.920	-18.580	0.000	-8.505	-0.631	-0.290	-0.498
Slovakia	0.016	0.972	0.349	-4.484	-0.396	-1.366	-0.969	-0.014	-0.510	-78.237	-7.745	-48.233	-0.613	-0.013	-0.361
Slovenia	0.015	2.616	1.227	-4.410	0.310	-0.876	-0.971	0.447	-0.060	-25.038	8.482	-12.945	-0.638	1.003	0.113
Spain	0.164	0.843	0.377	-0.815	0.617	-0.217	-0.718	-0.085	-0.468	-292.691	-17.405	-200.104	-0.481	-0.098	-0.343
Sweden	0.209	0.811	0.515	-2.231	-0.843	-1.285	-0.654	-0.104	-0.339	-157.078	-24.540	-105.684	-0.493	-0.108	-0.272
Switzerland	0.000	0.001	0.000	-11.314	-6.699	-8.643	-1.000	-0.998	-1.000	-343.371	-77.242	-203.166	-0.656	-0.446	-0.551
Ukraine	0.000	0.031	0.006	-11.221	-4.392	-7.652	-1.000	-0.940	-0.989	-65.502	-13.983	-40.926	-0.656	-0.432	-0.549
United Kingdom	0.008	0.183	0.076	-5.116	-2.074	-3.337	-0.984	-0.690	-0.864	-507.242	-261.293	-389.736	-0.643	-0.381	-0.511
<b>Oceania</b>															
Australia	0.000	0.002	0.001	-5.344	1.153	-1.600	-1.000	-0.997	-0.999	-260.736	-60.795	-164.768	-0.655	-0.446	-0.551
Fiji	0.000	0.349	0.052	1.069	5.831	3.242	-1.000	-0.482	-0.916	-1.305	-0.493	-0.809	-0.649	-0.301	-0.524
New Zealand	0.000	0.004	0.001	-10.344	-6.125	-7.890	-1.000	-0.992	-0.998	-39.893	-12.759	-27.703	-0.655	-0.445	-0.551

Source: Authors Computed from FAO, 2021

### 5.3.3 Cashew

The comparative advantage index values of cashew were reported in to Table 5.4. According to the BRCA index values, except Bosnia, Herzegovina (0.060), Cameroon (0.010), Mauritania (0.010), South Africa (0.019), and Uganda (0.007), all other countries in the African region had the comparative advantage of cashew exports. The highest BRCA index value was noted for Tanzania (350.48), followed by Cote d'Ivoire (198.85) and Benin (197.25). Moving to the American region, Brazil (10.078) and Guinea (27.824) had a comparative advantage. Among Asian countries, Cambodia (7.36), India (36.107), and Indonesia (3.727) were experienced the comparative advantage. Netherland was the only country having a comparative advantage in cashew exports in the European region.

Considering the Vollrath RCA index values, the result for the African region was more or less similar to that of BRCA. However, Cameroon and Mauritania were additionally included in the list of comparative advantage countries in the African region. A comparative advantage could be viewed with the highest Vollrath RCA value of 10.66 for Tanzania, followed by Cote d'Ivoire at 10.42. In the American region, Brazil (4.711), El Salvador (1.82), Guinea (10.37), and Nicaragua (1.43) had a comparative advantage as the Vollrath RCA index values take a positive sign. In the Asian region, Cambodia (4.12), India (0.87), Indonesia (3.84) and Sri Lanka (1.13) had the comparative advantage in cashew exports.

The RSCA index values reported in Table 5.4 indicate that Benin, Cote d'Ivoire, Ghana, Kenya, Madagascar, Senegal, Tanzania and Togo in the African region have a comparative advantage, and higher RSCA index values were reported for Benin (0.791), Cote d'Ivoire (0.986), and Tanzania (0.993). In the American region, only Brazil had a comparative advantage (0.712), while it was in India (0.916) and Indonesia (0.545) in the Asian Region.

The estimated NRCA index values for the African region realized that comparative advantage and disadvantage countries were similar to in BRCA index. The index values of Cote d'Ivoire and Tanzania are higher than those of the rest countries. As in the BRCA index, only the two countries, Brazil and Guinea, had the comparative advantage while it is higher in Brazil. Among Asian countries, Cambodia, India, and Indonesia had the comparative advantage, and India got the highest. Netherland in the European region also experienced a comparative advantage (5.79) for cashew exports.

The AI index values also support the same conclusion made in the BRCA and NRCA analysis. Among the African region's countries that have a comparative advantage, Tanzania (51.31), Cote d'Ivoire (33.75) and Benin (27.02) had higher index values. Similarly, Guinea (6.42) in the American region, and India (4.31) in the Asian region got the highest AI index values. According to the AI index value, the Netherlands (0.18) also had the comparative advantage of cashew exports.

To conclude the comparative advantage indices analysis of cashew exports, most of the cashew exporters from African region had the comparative advantage. In addition to that, Brazil and Guinea from the American region, Cambodia, India and Indonesia from the Asian region, and Netherland from the European region had the comparative advantage in cashew exports. Sri Lanka was recorded as a comparative disadvantage country in the case of cashew exports. Proving that of the above results, the previous studies elaborated on the countries that could gain a comparative advantage in the cashew market. Thus, India, as a leading exporters in the cashew market, gains a high comparative advantage among the five major competitors (Guledgudda et al., 2020; Mouzam, 2020). Further, there was a significant comparative advantage for Vietnam and the Cote d'Ivoire over India for the Asia and US markets. The country shown a comparative advantage among all other competitors except Vietnam in the EU market. Correspondingly, Bannor et al. (2019) study on the Ghanaian cashew sector comparative advantage assessment utilizing the domestic resource cost ratio, thus, it indicates a greater comparative advantage for the Ghanaian cashew industry. As one of the important export commodities in Tanzania, a study by Mitchell (2004) analyzed Tanzania's cashew industry and discovered that there is a comparative advantage, and the industry had the opportunity to expand. Another study on the African region country, Alawode and Adeniranye (2020) and Oluyole et al. (2017) on Nigeria, according to the RCA values, recorded a high value with a greater possibility of comparative advantage. Further, the study focused on the instability of the RCA index in Nigeria. It revealed that the world price of Nigeria's cashew, inflation rate, export quantity and production quantity significantly influence the competitiveness of Nigerian cashew.

However, Alidou et al. (2017) observed the comparative advantage of the main export crops in Benin, and as one of the main export commodities in Benin, the country has a comparative advantage over Nigeria. Thus, the Benin cashew was more comparative than the Nigerian cashew and able to produce cashew at a lower opportunity cost. In addition to that Bojang and Gibba( 2021) study on the global competitiveness of the West African cashew exporters, Benin, Burkina Faso, Cote d'Ivoire, Gambia, Ghana, Guinea-Bissau, Mali, Nigeria and Senegal counted as the countries with a remarkable surplus in exporting cashew to the world market. The RSCA indices for 2008 to 2017 revealed the above findings and the countries were able to strengthen the level of competitiveness during the period. Indonesia is a quality cashew nut exporter with a 1.2% share of the global market. Fauziyah et al. (2017) and Mani et al. (2017) assessed the competitiveness of Indonesian cashew nuts in the global market, and the country has a comparative advantage in producing cashew nuts but the country has not been able to process optimally.

Table 5.4: Mean, Maximum and Minimum Comparative Advantage Scores of Cashew, 2000-2019 (NRCA values in  $10^{-7}$ , AI values in  $10^{-3}$ )

Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
<b>Africa</b>															
Benin	0.000	320.610	197.249	9.106	11.938	10.729	-1.000	0.994	0.791	-0.305	69.278	25.239	-0.110	44.318	27.021
Bosnia and Herzegovina	0.000	0.278	0.060	-3.193	0.737	-0.701	-1.000	-0.565	-0.895	-1.487	-0.218	-0.867	-0.263	-0.085	-0.135
Cameroon	0.000	0.086	0.010	2.634	4.105	3.507	-1.000	-0.842	-0.982	-1.135	-0.379	-0.761	-0.272	-0.089	-0.143
Cote d'Ivoire	65.369	405.011	198.853	8.594	14.090	10.419	0.970	0.995	0.986	48.304	680.605	224.797	6.442	102.609	33.759
Ghana	0.000	321.517	72.468	3.233	13.550	8.077	-1.000	0.994	0.479	-2.769	609.218	83.635	-0.120	88.378	12.951
Kenya	0.000	17.546	5.993	-2.758	8.520	4.384	-1.000	0.892	0.331	-1.327	5.996	1.274	-0.166	1.941	0.585
Madagascar	0.000	9.553	4.905	6.805	8.086	7.463	-1.000	0.810	0.482	-0.178	1.080	0.386	-0.141	1.047	0.518
Mali	0.000	7.196	2.104	2.834	6.640	4.376	-1.000	0.756	-0.119	-0.588	2.358	0.231	-0.193	1.481	0.258
Mauritania	0.002	0.031	0.010	0.860	0.860	0.860	-0.996	-0.939	-0.981	-0.595	-0.068	-0.315	-0.288	-0.088	-0.144
Nigeria	0.000	26.690	5.546	6.008	10.545	8.399	-1.000	0.928	-0.440	-25.125	182.049	23.676	-0.141	7.407	1.180
Senegal	0.011	79.927	11.538	2.508	11.689	7.064	-0.979	0.975	0.264	-0.549	30.954	3.212	-0.119	14.403	1.831
South Africa	0.002	0.038	0.019	-5.806	-2.613	-3.926	-0.997	-0.927	-0.963	-23.517	-6.323	-15.151	-0.281	-0.086	-0.142
Tanzania	144.526	1026.567	350.478	7.339	12.952	10.664	0.986	0.998	0.993	18.958	302.229	104.033	12.735	144.305	51.312
Togo	0.000	49.271	8.533	0.945	7.919	4.395	-1.000	0.960	0.045	-0.193	6.234	0.779	-0.141	11.541	1.484
Uganda	0.000	0.040	0.007	-2.383	1.079	-1.175	-1.000	-0.923	-0.987	-0.751	-0.087	-0.366	-0.288	-0.089	-0.144
<b>America</b>															
Brazil	1.815	21.272	10.078	1.252	10.367	4.711	0.289	0.910	0.712	7.198	242.025	94.111	0.235	2.852	1.056
Canada	0.018	0.135	0.060	-3.986	-1.550	-2.740	-0.964	-0.763	-0.889	-100.113	-52.920	-80.412	-0.259	-0.087	-0.135
El Salvador	0.118	2.083	0.854	0.298	4.694	1.820	-0.789	0.351	-0.166	-1.220	0.690	-0.597	-0.227	0.152	-0.040
Guatemala	0.000	1.033	0.165	-5.680	4.427	-1.560	-1.000	0.016	-0.802	-2.411	0.019	-1.588	-0.287	0.005	-0.124
Guinea	0.000	197.700	27.824	8.794	11.472	10.372	-1.000	0.990	-0.132	-0.418	80.989	11.122	-0.128	54.237	6.424
Jamaica	0.000	0.271	0.046	-4.171	0.647	-1.507	-1.000	-0.574	-0.923	-0.528	-0.218	-0.324	-0.288	-0.089	-0.136
Mexico	0.000	0.455	0.077	-6.174	2.182	-0.540	-1.000	-0.375	-0.872	-99.787	-33.994	-62.831	-0.285	-0.064	-0.136
Nicaragua	0.004	0.488	0.111	-0.758	3.769	1.432	-0.991	-0.344	-0.819	-1.109	-0.185	-0.656	-0.282	-0.060	-0.132
Trinidad and Tobago	0.000	0.293	0.030	-7.653	-2.344	-5.527	-1.000	-0.546	-0.949	-4.060	-0.717	-2.213	-0.286	-0.071	-0.142
United States	0.052	0.150	0.091	-3.575	-2.534	-3.018	-0.901	-0.739	-0.835	-348.237	-131.075	-253.995	-0.267	-0.077	-0.133
<b>Asia</b>															
Bangladesh	0.000	0.069	0.012	-3.391	1.233	-1.096	-1.000	-0.870	-0.977	-8.471	-1.317	-4.364	-0.269	-0.089	-0.143

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Bahrain	0.000	0.020	0.006	-7.366	-4.257	-5.279	-1.000	-0.960	-0.989	-4.749	-1.208	-2.962	-0.283	-0.089	-0.144
Cambodia	0.000	89.221	7.358	0.485	6.997	4.117	-1.000	0.978	-0.467	-2.002	134.972	10.366	-0.247	21.093	1.690
China	0.000	0.013	0.002	-7.935	-3.501	-5.697	-1.000	-0.974	-0.996	-541.142	-53.864	-315.549	-0.288	-0.089	-0.145
Hong Kong SAR, China	0.010	0.152	0.035	-2.115	-1.033	-1.531	-0.980	-0.736	-0.934	-122.387	-35.918	-83.694	-0.284	-0.084	-0.141
India	8.863	78.279	36.107	0.126	1.716	0.867	0.797	0.975	0.916	235.582	693.336	438.631	1.622	10.628	4.308
Indonesia	1.958	6.277	3.727	1.821	7.047	3.843	0.324	0.725	0.545	-13.583	38.902	16.842	0.167	0.598	0.355
Iran, Islamic Rep.	0.000	0.167	0.011	-9.474	0.694	-3.693	-1.000	-0.713	-0.980	-28.591	-5.564	-16.196	-0.282	-0.089	-0.143
Jordan	0.000	1.330	0.263	-4.160	0.413	-1.658	-1.000	0.142	-0.651	-1.613	-0.411	-1.133	-0.254	0.079	-0.102
Kazakhstan	0.000	0.020	0.002	-7.817	-3.026	-4.841	-1.000	-0.961	-0.996	-18.725	-1.871	-10.087	-0.288	-0.089	-0.145
Korea, Dem. People's Rep.	0.000	0.004	0.000	-14.167	-8.785	-10.450	-1.000	-0.993	-0.999	-130.749	-32.585	-88.177	-0.288	-0.089	-0.145
Kuwait	0.000	0.130	0.025	-7.851	-2.588	-4.343	-1.000	-0.770	-0.953	-25.756	-3.329	-12.866	-0.277	-0.089	-0.140
Latvia	0.072	0.991	0.388	-2.103	0.367	-0.576	-0.865	-0.004	-0.480	-3.082	-0.375	-1.701	-0.232	-0.001	-0.096
Lebanon	0.048	0.826	0.289	-4.909	-0.934	-3.182	-0.908	-0.095	-0.591	-1.167	-0.096	-0.674	-0.259	-0.029	-0.105
Malaysia	0.000	0.004	0.001	-8.271	-3.929	-6.420	-1.000	-0.993	-0.999	-53.586	-19.052	-38.508	-0.288	-0.089	-0.145
Oman	0.000	0.074	0.007	-6.883	-2.102	-4.271	-1.000	-0.863	-0.986	-12.018	-2.399	-6.532	-0.280	-0.089	-0.144
Philippines	0.000	0.307	0.073	-5.983	2.693	-1.421	-1.000	-0.530	-0.879	-15.176	-6.422	-10.515	-0.277	-0.070	-0.137
Saudi Arabia	0.000	0.014	0.003	-8.393	-4.566	-5.848	-1.000	-0.973	-0.994	-83.956	-14.738	-48.175	-0.286	-0.088	-0.145
Singapore	0.001	0.142	0.025	-6.091	-0.795	-3.086	-0.999	-0.751	-0.954	-89.858	-23.859	-64.419	-0.288	-0.086	-0.142
Sri Lanka	0.000	2.554	0.995	-0.766	4.535	1.128	-1.000	0.437	-0.146	-2.107	0.519	-1.053	-0.205	0.154	-0.020
Syrian Arab Republic	0.000	10.301	0.528	-6.512	1.935	-2.646	-1.000	0.823	-0.887	-3.338	3.473	-1.215	-0.270	2.682	0.006
Thailand	0.000	0.081	0.014	-8.739	0.796	-4.716	-1.000	-0.851	-0.974	-52.308	-14.069	-36.104	-0.274	-0.089	-0.142
Turkey	0.000	0.201	0.015	-5.172	-0.933	-3.209	-1.000	-0.665	-0.974	-38.233	-6.010	-24.222	-0.287	-0.089	-0.143
United Arab Emirates	0.000	1.853	0.733	-2.149	0.275	-0.429	-1.000	0.299	-0.390	-81.054	8.426	-26.559	-0.141	0.141	-0.018
<b>Europe</b>															
Austria	0.014	0.229	0.126	-1.591	-0.198	-0.673	-0.973	-0.628	-0.784	-37.906	-14.464	-29.086	-0.247	-0.079	-0.126
Belarus	0.000	0.880	0.156	-5.801	-0.382	-1.662	-1.000	-0.064	-0.795	-9.800	-1.587	-4.818	-0.239	-0.022	-0.115
Belgium	0.215	0.904	0.434	9.047	10.789	9.930	-0.646	-0.050	-0.407	-91.912	-29.509	-64.900	-0.193	-0.017	-0.082
Croatia	0.000	0.100	0.020	-4.479	-0.862	-2.270	-1.000	-0.818	-0.962	-3.622	-0.960	-2.406	-0.271	-0.089	-0.141
Czech Republic	0.010	0.111	0.046	-3.184	-1.064	-1.950	-0.980	-0.800	-0.913	-42.775	-6.239	-26.119	-0.275	-0.083	-0.139
France	0.012	0.039	0.018	-3.635	-2.604	-3.177	-0.977	-0.925	-0.965	-132.994	-67.673	-107.269	-0.285	-0.087	-0.143
Germany	0.021	0.634	0.222	-2.945	-0.451	-1.483	-0.959	-0.224	-0.665	-300.123	-117.004	-224.124	-0.177	-0.067	-0.106
Greece	0.080	1.482	0.623	-2.389	0.315	-0.734	-0.852	0.194	-0.322	-7.054	-0.766	-4.221	-0.222	0.049	-0.068

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Honduras	0.000	0.956	0.280	-3.130	3.492	1.127	-1.000	-0.023	-0.622	-1.728	-0.666	-1.175	-0.208	-0.005	-0.102
Hungary	0.000	0.014	0.004	-5.901	-2.052	-3.221	-1.000	-0.972	-0.991	-26.863	-6.106	-18.458	-0.285	-0.088	-0.144
Ireland	0.000	0.017	0.003	-5.080	-2.225	-4.163	-1.000	-0.967	-0.995	-36.656	-16.767	-25.422	-0.287	-0.087	-0.145
Italy	0.029	0.215	0.121	-2.242	0.098	-0.952	-0.943	-0.646	-0.788	-112.020	-50.575	-88.755	-0.263	-0.070	-0.129
Lithuania	0.019	1.554	0.710	-2.510	0.602	-0.295	-0.963	0.217	-0.240	-5.069	-0.810	-2.629	-0.138	0.101	-0.032
Luxembourg	0.002	2.082	0.301	-7.494	0.074	-3.861	-0.996	0.351	-0.700	-5.562	-0.418	-3.330	-0.266	0.119	-0.108
Moldova	0.000	0.134	0.013	-3.039	0.605	-1.451	-1.000	-0.763	-0.977	-0.597	-0.102	-0.348	-0.282	-0.089	-0.143
Netherlands	1.379	3.060	2.243	-0.806	0.486	-0.104	0.159	0.507	0.372	-43.129	92.559	5.788	0.045	0.352	0.176
Norway	0.000	0.022	0.004	-5.792	-3.241	-4.286	-1.000	-0.957	-0.991	-37.204	-12.821	-24.327	-0.288	-0.089	-0.144
North Macedonia	0.000	0.178	0.019	-5.679	-0.426	-3.541	-1.000	-0.697	-0.965	-1.544	-0.242	-0.767	-0.288	-0.083	-0.143
Poland	0.000	0.034	0.014	-4.002	-1.805	-2.945	-1.000	-0.934	-0.972	-56.997	-6.876	-32.345	-0.279	-0.086	-0.143
Portugal	0.004	0.241	0.032	-4.107	-0.155	-2.866	-0.992	-0.611	-0.943	-14.731	-5.158	-10.498	-0.287	-0.067	-0.142
Portugal	0.004	0.241	0.032	-4.107	-0.155	-2.866	-0.992	-0.611	-0.943	-14.731	-5.158	-10.498	-0.287	-0.067	-0.142
Romania	0.000	0.159	0.016	-7.258	0.836	-3.203	-1.000	-0.725	-0.971	-17.252	-2.255	-9.963	-0.288	-0.083	-0.144
Russian Federation	0.000	0.017	0.003	-7.941	-3.440	-5.769	-1.000	-0.967	-0.994	-114.409	-22.066	-71.591	-0.288	-0.088	-0.145
Serbia	0.000	0.055	0.012	-4.727	-1.200	-3.040			-0.983	-4.176	0.000	-1.949	-0.288	-0.089	-0.155
Slovak Republic	0.000	0.204	0.074	-2.594	-0.242	-1.198			-0.867	-18.968	-2.563	-12.107	-0.258	-0.079	-0.134
Slovenia	0.000	0.148	0.019	-4.990	-0.685	-3.102			-0.965	-9.226	-1.900	-5.859	-0.271	-0.089	-0.141
Spain	0.015	0.166	0.054	-3.248	-1.008	-2.218	-0.970	-0.716	-0.900	-72.173	-24.492	-52.098	-0.269	-0.084	-0.137
Sweden	0.006	0.243	0.037	-4.418	-0.553	-2.709	-0.988	-0.610	-0.933	-40.013	-16.285	-30.177	-0.276	-0.086	-0.139
Switzerland	0.002	0.025	0.009	-4.641	-2.271	-3.422	-0.996	-0.951	-0.982	-77.052	-17.367	-45.648	-0.287	-0.088	-0.144
United Kingdom	0.060	0.532	0.189	-2.634	-0.357	-1.578	-0.887	-0.306	-0.695	-109.616	-56.289	-82.944	-0.234	-0.051	-0.118
<b>Oceania</b>															
Australia	0.005	0.133	0.040	-5.557	-3.044	-4.218	-0.991	-0.766	-0.925	-58.435	-13.122	-36.648	-0.281	-0.082	-0.140
New Zealand	0.000	0.797	0.065	-7.474	-1.180	-4.338	-1.000	-0.113	-0.907	-8.956	-2.857	-6.108	-0.283	-0.020	-0.138

Source: Authors Computed from FAO, 2021

### 5.3.4 Lime and Lemmon

The results of the RCA indices of lime and lemon are presented in Table 5.5. Accordingly, BRCA index values realize that Egypt (3.66), Guyana (1.36), Morocco (2.27), and South Africa (10.91) in the African region have the comparative advantage in lime and lemon exports, while South Africa got the highest. Argentina, Brazil, Chile, Domenica, El Salvador, Guatemala, Mexico, Uruguay, and Vanuatu enjoy the comparative advantage in the American region. Their RAC index values ranged between 1.22 (El Salvador) and 26.14 (Argentina). Five Asian countries, namely Jordan (4.59), Lebanon (7.7), Maldives (5.99), and Turkey (15.00), had a comparative advantage in lime and lemon exports, and among them, Turkey had the highest BRCA index value. Four European region countries, namely, Greece (2.51), Lithuania (1.72), Cyprus (17.35) and Spain (14.66), had the comparative advantage according to BRCA index values, and among them, Cyprus got the highest.

Moving to Vollrath RCA index values, Burkina Faso (3.46), Egypt (7.96), Ethiopia (5.13), Guyana (2.45), South Africa (6.93), Tunisia (4.36), and Uganda (1.16) had a comparative advantage in lime and lemon. Their index values ranged from 1.16 (Uganda) to 7.96 (Egypt). Except for Canada (-8.82), and Cuba (-0.69), all other countries in the American region, had a comparative advantage in export of lime and lemon. The minimum index value was for the USA (0.064), while the maximum was for Mexico (7.94). Eight Asian countries, namely Bangladesh (2.71), India (7.15), Israel (3.27), Lebanon (4.33), Pakistan (2.26), Sri Lanka (3.94), Thailand (0.64), and Turkey (5.99) viewed as comparative advantaged countries in lime and lemon exports as Vollrath RCA index values take positive signs. Meanwhile, Netherland (8.06) and Spain (2.52) from the European region and French Polynesia from Oceania had experienced a comparative advantage.

According to the RSCA index values, a smaller number of countries in the African region showed a comparative advantage in lime and lemon exports. They are Egypt (0.329), Morocco (0.370), and South Africa (0.813). Seven countries in the American region, namely Argentina, Chile, Domenica, El Salvador, Guatemala, Uruguay and Vanuatu, got positive signs for RSCA index values, implying the comparative advantage in those countries. The minimum and the maximum RSCA values were realized for El Salvador (0.002) and Argentina (0.921), respectively. Jordan, Lebanon, Maldives, and Turkey in the Asian region are viewed as the comparative advantaged countries in lime and lemon exports, and their RSCA index values ranged between 0.431 (Jordan) and 0.863 (Turkey). Only three countries in the European region, namely Germany, Lithuania and Spain viewed as having a comparative advantage. However, except for Spain (0.870), the RSCA index values of the other two countries were less than 0.237. The countries with comparative advantage according to the NRCA and AI indexes are also more or less similar to the results of RSCA.

Moving further, the empirical studies proved the above results, whereas analysis study done by the Fidan (2009) revealed the analysis between Turkey and EU-15 member countries by comparing the citrus sector competitiveness according to the RCA index

and revealed that there is a favourable climate to the enhancement of Turkey's export and the competitive power is greater than Spain, Italy, Greece, and Portugal. However, according to the study by Tebogo Bruce Seleka and Obi (2018) done by adopting the NRCA index for 1961- 2013 to observe the comparative advantage between the top citrus exporters in the world market and draws suggestions for South Africa's citrus industry. Thus, the study revealed Spain was the most competitive citrus exporter throughout the review period. Further, South Africa improved its rank steadily, surpassing Italy and Morocco. In addition, a study by Koplun et al. (2005) discovered that the competitive environment in the global market has changed significantly recently. Further, the study identified factors affecting the performance of the fresh lemon industry, and according to the RSCA index, Argentina, Mexico, South Africa, and Spain are gained the advantage. In addition to that, the study assessed the strength of the countries by comparing the international market share of the countries and concluded that the Spain and Argentina dominate the world trade. As identified by several studies, Spain as a leading lime and lemon exporter Market News Services (2008) emphasize the stance of Spain as gaining top share in the export market.

**Tablem 5.5: Mean, Maximum and Minimum Comparative Advantage Scores of Lime and Lemon, 2000-2019 (NRCA values in  $10^{-7}$ , AI values in  $10^{-3}$ )**

Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
<b>Africa</b>															
Algeria	0.000	0.004	0.001	-7.246	0.142	-2.395	-1.000	-0.992	-0.999	-13.553	-3.217	-7.738	-0.215	-0.098	-0.137
Burkina Faso	0.000	0.357	0.034	2.078	5.003	3.460	-1.000	-0.474	-0.945	-0.548	-0.036	-0.248	-0.207	-0.072	-0.132
Cote d'Ivoire	0.000	0.011	0.003	-4.267	-2.216	-3.225	-1.000	-0.979	-0.995	-2.213	-0.664	-1.643	-0.214	-0.098	-0.137
Egypt, Arab Rep.	0.000	8.856	3.657	6.302	10.114	7.958	-1.000	0.797	0.329	-5.033	14.776	4.066	-0.132	0.972	0.405
Eswatini	0.000	3.901	0.864	-3.459	2.625	0.540	-1.000	0.592	-0.369	-0.338	0.381	-0.132	-0.214	0.514	-0.018
Ethiopia	0.000	1.384	0.541	3.640	6.676	5.135	-1.000	0.161	-0.368	-0.482	0.029	-0.246	-0.177	0.049	-0.067
Ghana	0.000	1.222	0.128	-2.355	5.236	1.002	-1.000	0.100	-0.846	-2.667	0.073	-1.311	-0.215	0.028	-0.121
Guyana	0.000	8.641	1.360	-1.848	4.999	2.456	-1.000	0.793	-0.137	-0.235	0.553	-0.049	-0.141	0.907	0.033
Kenya	0.000	0.510	0.087	-1.875	1.481	-0.522	-1.000	-0.324	-0.866	-1.048	-0.294	-0.721	-0.200	-0.087	-0.122
Madagascar	0.000	0.085	0.031	-0.975	2.378	0.382	-1.000	-0.844	-0.942	-0.524	-0.083	-0.259	-0.205	-0.098	-0.132
Morocco	1.455	3.171	2.270	-3.164	-2.420	-2.735	0.185	0.521	0.370	-20.453	143.783	29.902	0.050	0.468	0.187
South Africa	5.927	17.638	10.907	4.815	9.949	6.930	0.711	0.893	0.813	25.447	151.071	66.969	0.551	3.261	1.467
Tunisia	0.000	1.173	0.296	2.326	6.882	4.364	-1.000	0.080	-0.634	-2.811	-0.198	-1.832	-0.161	0.037	-0.091
Uganda	0.000	0.998	0.114	1.160	1.160	1.160	-1.000	-0.001	-0.862	-0.594	-0.069	-0.257	-0.177	0.000	-0.116
Zimbabwe	0.000	15.678	0.994	-1.403	1.580	-0.091	-1.000	0.880	-0.674	-0.699	4.835	-0.161	-0.205	1.632	-0.025
<b>America</b>															
Argentina	15.672	42.390	26.146	3.664	10.152	6.491	0.880	0.954	0.921	75.092	226.425	125.088	1.937	5.411	3.340
Belize	0.000	9.409	0.824	-0.499	4.311	2.207	-1.000	0.808	-0.544	-0.106	0.282	-0.043	-0.213	0.935	-0.038
Bolivia	0.000	2.075	0.435	-2.642	3.627	1.479	-1.000	0.350	-0.586	-1.785	0.692	-0.691	-0.177	0.219	-0.063
Brazil	0.758	2.853	2.006	3.041	6.281	4.269	-0.138	0.481	0.314	-9.372	23.959	4.110	-0.027	0.277	0.142
Canada	0.000	0.002	0.000	-10.331	-6.042	-8.823	-1.000	-0.995	-0.999	-81.503	-43.183	-65.591	-0.215	-0.098	-0.137
Chile	0.000	9.270	5.383	1.589	5.361	3.185	-1.000	0.805	0.596	-3.111	51.960	20.317	-0.110	1.442	0.645
Colombia	0.093	3.690	0.919	-1.368	5.197	2.464	-0.830	0.574	-0.208	-9.118	6.737	-2.546	-0.101	0.477	0.009
Cuba	0.000	0.542	0.053	-2.071	0.585	-0.692	-1.000	-0.297	-0.917	-1.102	-0.131	-0.543	-0.196	-0.051	-0.130
Dominica	0.000	40.458	13.980	1.465	1.465	1.465	-1.000	0.952	0.274	-0.006	0.320	0.077	-0.138	4.598	1.490
Ecuador	0.039	1.621	0.532	-1.445	5.388	1.182	-0.925	0.237	-0.416	-4.324	0.566	-2.072	-0.183	0.070	-0.074
El Salvador	0.361	3.061	1.211	1.648	6.727	3.894	-0.470	0.508	0.002	-0.764	0.751	-0.250	-0.122	0.272	0.018
Guatemala	2.018	9.327	3.772	4.298	8.591	6.016	0.337	0.806	0.549	0.286	3.722	1.309	0.207	0.935	0.356
Honduras	0.000	0.826	0.229	2.607	5.325	3.714	-1.000	-0.095	-0.667	-1.365	-0.121	-0.920	-0.141	-0.019	-0.103
Mexico	0.000	5.652	1.366	1.534	10.762	7.938	-1.000	0.699	-0.209	-3.705	3.601	-0.582	-0.125	0.520	0.055
Peru	0.005	1.559	0.459	-0.140	8.138	4.242	-0.991	0.218	-0.454	-6.857	-1.127	-3.451	-0.116	0.099	-0.065
United States	0.652	1.235	0.879	-0.741	0.801	0.064	-0.211	0.105	-0.070	-185.971	9.121	-104.365	-0.072	0.025	-0.020

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Uruguay	8.977	26.944	13.519	2.388	5.963	4.094	0.800	0.928	0.853	3.385	9.647	5.909	1.034	2.915	1.654
Vanuatu	0.000	180.393	20.439	2.791	8.903	5.535	-1.000	0.989	0.035	-0.009	1.113	0.102	-0.129	24.774	2.724
Venezuela, RB	0.000	0.390	0.054	4.322	4.800	4.511	-1.000	-0.439	-0.909	-16.657	-2.945	-8.814	-0.214	-0.068	-0.131
<b>Asia</b>															
Afghanistan	0.000	0.094	0.009	-3.156	-1.497	-2.333	-1.000	-0.828	-0.984	-0.150	-0.012	-0.075	-0.214	-0.098	-0.136
Bahrain	0.000	0.288	0.116	-4.912	-1.585	-3.055	-1.000	-0.552	-0.802	-3.684	-0.875	-2.200	-0.180	-0.087	-0.121
Bangladesh	0.000	0.047	0.011	1.096	6.259	2.714	-1.000	-0.910	-0.979	-6.565	-1.040	-3.451	-0.207	-0.098	-0.135
China	0.000	0.346	0.068	-9.316	0.770	-3.141	-1.000	-0.486	-0.884	-395.686	-42.641	-234.762	-0.166	-0.098	-0.125
Hong Kong SAR, China	0.058	0.557	0.150	-2.561	-0.515	-1.389	-0.890	-0.284	-0.752	-89.914	-28.109	-60.748	-0.161	-0.066	-0.115
India	0.111	0.344	0.223	4.755	9.501	7.155	-0.801	-0.488	-0.639	-52.171	-5.020	-29.991	-0.182	-0.073	-0.108
Indonesia	0.002	0.040	0.018	-3.857	0.141	-2.205	-0.996	-0.923	-0.966	-34.800	-9.550	-22.079	-0.211	-0.097	-0.135
Israel	0.000	0.438	0.181	0.606	5.079	3.267	-1.000	-0.391	-0.713	-11.277	-3.957	-7.966	-0.177	-0.073	-0.111
Jordan	0.240	15.130	4.589	-2.549	1.613	-0.005	-0.614	0.876	0.431	-1.239	4.837	1.168	-0.135	1.571	0.414
Kazakhstan	0.000	0.017	0.003	-9.075	-3.750	-5.997	-1.000	-0.967	-0.994	-14.793	-1.464	-7.966	-0.213	-0.098	-0.137
Kuwait	0.000	0.099	0.018	-8.757	-3.753	-5.396	-1.000	-0.820	-0.965	-20.348	-2.630	-10.195	-0.203	-0.098	-0.134
Lebanon	0.000	19.186	7.704	2.436	9.610	4.327	-1.000	0.901	0.548	-0.826	4.833	1.516	-0.177	2.022	0.787
Malaysia	0.034	0.123	0.057	-2.855	0.149	-1.118	-0.934	-0.781	-0.892	-41.547	-13.881	-29.462	-0.207	-0.091	-0.130
Maldives	1.018	8.655	5.994	-2.138	1.067	0.015	0.009	0.793	0.681	1.946	217.702	124.201	0.002	1.061	0.687
Oman	0.000	0.271	0.115	-9.397	-1.138	-2.614	-1.000	-0.573	-0.801	-9.033	-1.581	-4.850	-0.177	-0.093	-0.120
Pakistan	0.000	0.090	0.020	-0.723	6.121	2.267	-1.000	-0.834	-0.962	-4.295	-1.509	-3.165	-0.215	-0.095	-0.134
Saudi Arabia	0.000	0.181	0.042	-6.009	-2.761	-4.294	-1.000	-0.694	-0.923	-65.909	-11.230	-37.211	-0.192	-0.096	-0.130
Singapore	0.021	0.189	0.053	-2.149	-0.836	-1.617	-0.960	-0.681	-0.902	-69.477	-19.561	-49.775	-0.197	-0.094	-0.129
Sri Lanka	0.000	1.250	0.454	1.990	5.376	3.914	-1.000	0.111	-0.468	-1.979	-0.254	-1.082	-0.203	0.035	-0.076
Thailand	0.006	0.045	0.015	-1.864	5.706	0.642	-0.989	-0.913	-0.970	-43.150	-11.016	-28.609	-0.213	-0.096	-0.135
Turkey	7.575	23.571	15.003	4.855	9.720	5.998	0.767	0.919	0.863	80.922	202.141	126.495	1.165	2.616	1.815
United Arab Emirates	0.000	0.975	0.203	-2.427	-0.416	-1.627	-1.000	-0.012	-0.730	-64.036	-5.695	-32.507	-0.173	-0.005	-0.104
<b>Europe</b>															
Austria	0.124	1.055	0.500	-2.441	-0.691	-1.336	-0.780	0.027	-0.373	-25.785	-7.989	-17.566	-0.125	0.007	-0.069
Belarus	0.000	0.729	0.109	-6.079	-1.201	-3.079	-1.000	-0.157	-0.839	-7.852	-1.013	-3.952	-0.193	-0.046	-0.121
Belgium	0.090	0.865	0.416	-1.840	-0.266	-0.782	-0.835	-0.073	-0.441	-74.973	-2.923	-49.256	-0.164	-0.015	-0.084

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Bulgaria	0.000	2.797	0.734	-4.486	-0.240	-2.045	-1.000	0.473	-0.362	-4.015	3.150	-1.494	-0.120	0.335	-0.015
Croatia	0.002	0.838	0.120	-7.587	-1.606	-4.758	-0.996	-0.088	-0.836	-2.727	-0.757	-1.773	-0.179	-0.024	-0.117
Cyprus	0.589	65.754	17.351	-0.436	9.293	2.434	-0.259	0.970	0.677	-0.583	7.804	2.085	-0.077	7.683	1.918
Czech Republic	0.039	0.402	0.232	-3.568	-1.509	-2.100	-0.925	-0.426	-0.640	-31.526	-4.722	-18.295	-0.159	-0.069	-0.105
Denmark	0.006	0.387	0.128	-5.221	-1.341	-2.745	-0.989	-0.442	-0.788	-19.412	-8.705	-14.561	-0.151	-0.094	-0.117
Estonia	0.000	0.068	0.013	-7.537	-2.762	-4.860	-1.000	-0.873	-0.974	-2.890	-0.648	-1.904	-0.212	-0.098	-0.135
Finland	0.000	0.016	0.002	-8.560	-3.973	-6.368	-1.000	-0.968	-0.996	-16.503	-7.383	-11.508	-0.212	-0.098	-0.137
France	0.171	0.397	0.256	-2.289	-1.537	-1.935	-0.707	-0.432	-0.596	-95.260	-41.638	-72.579	-0.163	-0.073	-0.102
Georgia	0.000	2.733	0.576	-3.823	0.862	-1.208	-1.000	0.464	-0.466	-0.424	0.238	-0.159	-0.131	0.295	-0.045
Germany	0.048	0.192	0.119	-3.297	-1.855	-2.453	-0.908	-0.678	-0.791	-248.871	-88.736	-188.077	-0.186	-0.089	-0.120
Greece	0.533	9.055	2.506	-1.816	2.115	-0.527	-0.305	0.801	0.237	-4.694	16.802	1.367	-0.052	0.905	0.185
Hungary	0.000	0.513	0.163	0.000	0.000	#DIV/0!	-1.000	-0.322	-0.746	-20.693	-4.813	-13.253	-0.190	-0.061	-0.115
Italy	0.518	1.434	0.766	-1.090	-0.096	-0.747	-0.317	0.178	-0.143	-64.495	-13.125	-41.057	-0.056	0.057	-0.031
Latvia	0.012	1.009	0.601	-5.981	-0.642	-1.766	-0.976	0.004	-0.316	-1.610	-0.226	-0.978	-0.110	0.002	-0.049
Lithuania	0.389	5.306	1.716	-1.853	-0.005	-0.783	-0.440	0.683	0.064	-4.437	5.888	-0.159	-0.111	0.569	0.089
Luxembourg	0.017	0.345	0.083	-3.273	-0.933	-2.251	-0.966	-0.487	-0.855	-4.339	-1.386	-2.840	-0.159	-0.096	-0.123
Netherlands	0.000	2.287	0.838	6.135	9.967	8.062	-1.000	0.392	-0.201	-0.285	0.007	-0.116	-0.141	0.144	-0.021
North Macedonia	0.000	0.483	0.076	-6.663	-2.701	-4.449	-1.000	-0.349	-0.872	-1.230	-0.183	-0.590	-0.196	-0.061	-0.127
Norway	0.000	0.008	0.001	-9.171	-5.003	-7.274	-1.000	-0.984	-0.998	-29.391	-10.121	-19.252	-0.214	-0.098	-0.137
Poland	0.044	0.612	0.241	-4.300	-1.811	-3.075	-0.916	-0.241	-0.636	-44.079	-2.190	-22.927	-0.195	-0.044	-0.107
Portugal	0.023	2.007	0.670	-3.486	0.138	-1.222	-0.956	0.335	-0.383	-8.386	5.040	-4.567	-0.124	0.208	-0.025
Romania	0.000	0.314	0.068	-7.119	-2.106	-4.357	-1.000	-0.522	-0.885	-12.961	-1.777	-7.615	-0.211	-0.080	-0.128
Russian Federation	0.002	0.166	0.054	-8.039	-3.762	-5.786	-0.996	-0.715	-0.902	-90.487	-16.298	-55.203	-0.210	-0.089	-0.130
Serbia	0.000	0.123	0.057	-5.347	-3.445	-4.463	-1.000	-0.781	-0.926	-3.287	0.000	-1.498	#DIV/0!	#DIV/0!	#DIV/0!
Slovak Republic	0.000	0.392	0.160	-4.945	-1.392	-2.432	-1.000	-0.437	-0.739	-15.188	-1.791	-9.112	-0.196	-0.068	-0.116
Slovenia	0.009	1.987	1.091	-5.630	-0.131	-1.418	-0.983	0.331	-0.098	-4.239	0.316	-1.679	-0.117	0.129	0.015
Spain	11.137	18.629	14.661	1.868	3.181	2.521	0.835	0.898	0.870	177.720	457.977	311.213	1.275	2.611	1.850
Sweden	0.001	0.055	0.024	-6.872	-3.160	-4.074	-0.998	-0.895	-0.953	-31.848	-12.587	-23.953	-0.212	-0.094	-0.134
Switzerland	0.000	0.008	0.002	-8.298	-5.023	-6.724	-1.000	-0.984	-0.997	-61.229	-13.769	-36.203	-0.215	-0.098	-0.137
Ukraine	0.000	0.047	0.006	-7.870	-4.194	-6.836	-1.000	-0.910	-0.989	-11.709	-2.494	-7.291	-0.215	-0.098	-0.136
United Kingdom	0.026	0.295	0.067	-4.033	-1.379	-3.073	-0.949	-0.544	-0.878	-91.151	-44.381	-68.865	-0.206	-0.069	-0.128
<b>Oceania</b>															
Australia	0.013	0.452	0.133	-3.128	0.213	-1.265	-0.975	-0.378	-0.784	-46.128	-6.195	-27.402	-0.182	-0.060	-0.119
French Polynesia	0.000	0.698	0.100	0.843	1.455	1.169	-1.000	-0.178	-0.869	-0.040	-0.013	-0.028	-0.170	-0.065	-0.118
New Zealand	0.381	1.460	0.725	-0.470	0.448	0.016	-0.448	0.187	-0.185	-5.735	1.065	-2.893	-0.084	0.050	-0.038

Source: Authors Computed from FAO, 2021

### 5.3.5 Mango

The calculated revealed comparative advantage indexes for mango exports were integrated into the Table 5.6. According to the BRCA index values, Burkina Faso, Cote d'Ivoire, Ethiopia, Ghana, Guinea, Guyana, Kenya, and Mali are the countries that had a comparative advantage in the African region, and the BRCA index values of those countries ranged between 1.24 (Guinea) and 21.49 (Kenya). Moving to the American region, Brazil, Costa Rica, Dominica, Ecuador, Grenada, Guatemala, Jamaica, Mexico, Nicaragua, Peru, St. Lucia, St. Vincent and the Grenadines were recognized as the comparative advantaged countries. The BRCA index values of those countries were within the range of 6.67 and 43.06; the lowest was for Jamaica, while the highest for Peru. The five countries in the Asian region that gained from the mango exports are India, Israel, Pakistan, the Philippines, and Thailand. The highest BRCA index value in the Asian region was earned by Pakistan (23.41), followed by the Philippines (13.60), and India (11.33), the lowest index value was noted for Israel (4.33). Sri Lanka had a comparative disadvantage in mango exports according to the BRCA index value, which was 0.484. Turning to the European region, Lithuania, Luxemburg, Portugal, and Spain have a comparative advantage. There is not much variation in BRCA index values among these countries, which stand between 1.25 and 3.5.

According to the Vollrath RCA index values, Burkina Faso, Cameroon, Cote d'Ivoire, Ethiopia, Ghana, Guinea, Guyana, Kenya, Madagascar, and Mali experienced comparative advantage in the African region. The highest and the lowest Vollrath index values in the African region are viewed in Burkina Faso (8.46) and Guyana (3.28), respectively. With regard to Vollrath RCA index values in the countries of the American region, Brazil, Costa Rica, Ecuador, Guatemala, Jamaica, Mexico, Nicaragua, Peru, St. Lucia, and St. Vincent and the Grenadines had the comparative advantage in mango export to the world market. Among them, the highest Vollrath RCA index value own by Peru (11.51), while the lowest was for Mexico (4.23). India (6.91), Indonesia (1.46), Israel (4.7), Pakistan (9.97), the Philippines (7.89), Sri Lanka (4.69), and Thailand (4.63) were the five Asian countries having a comparative advantage in mango exports according to the Vollrath RCA index. Pakistan stands for the highest Vollrath RCA index value in the Asian region. Sri Lanka's index value was closer to Thailand. None of the European region's countries had the comparative advantage as the Vollrath RCA index values take negative signs for all. Fiji was the only mango exporting country in Oceania and had a comparative advantage according to Vollrath RCA index value (0.593).

The NRCA index values reveal that Burkina Faso, Cote d'Ivoire, Ethiopia, Ghana, Guyana, Kenya, and Mali were the countries in the African region that gained the comparative advantage. Among them, Cote d'Ivoire ( $5.97 \text{ in } 10^{-7}$ ), Ghana ( $6.069 \text{ in } 10^{-7}$ ), and Kenya ( $5.517 \text{ in } 10^{-7}$ ) got higher NRCA index values. Moving to the American region, Brazil, Costa Rica, Ecuador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Peru, St. Lucia, St. Vincent, and Grenadines are viewed as comparative advantaged countries. Higher NRCA index values among them realized for Mexico, Peru and Brazil. In the Asian region, India, Pakistan, Philippines, and Thailand are recognized as having NRCA index values. Cambodia and Israel were the rest of the two countries with

comparative advantage. Sri Lanka had a comparative disadvantage in mango export to the world market (NRCA=  $-0.425 \text{ in } 10^{-7}$ ). Meanwhile, according to the NRCA index values, Lithuania, the Netherlands, Portugal, and Spain in the European region gained a comparative advantage.

The Last column of Table 5.6 reports the AI index values. Accordingly, in the African region, Burkina Faso, Kenya, Mali, Cote d'Ivoire, Ethiopia, Ghana, Guinea, and Guyana had a comparative advantage, and the first three countries got higher index values. In the American region, Brazil, Costa Rica, Dominica, Ecuador, Grenada, Guatemala, Jamaica, Mexico, Nicaragua, Peru, St. Lucia, St. Vincent and Grenadines are viewed as comparative advantage. The highest index value ( $3.418 \text{ in } 10^{-3}$ ) appears in Peru. Regarding the Asian region, Colombia, India, Israel, Pakistan, Philippines, and Thailand are viewed as comparative advantaged countries, and among them, Pakistan received the highest AI index value ( $1.857 \text{ in } 10^{-3}$ ). According to the AI index values, Sri Lanka has a comparative disadvantage for mango exports (AI=  $-0.033 \text{ in } 10^{-3}$ ). Lithuania, Luxemburg, Netherland, Portugal, and Spain are the five European region countries reached the comparative advantage, and their AI index values ranged from 0.025 to 0.220 ( $\text{in } 10^{-3}$ ).

According to the previous empirical results Idris et al., (2016) examine the trade competitiveness and the impact of the food safety regulations on market access of horticultural trade in India. The study reviewed the comparative advantage of fresh mango as one of the main horticultural exports in India. The study concluded that India had a comparative advantage in mango exports over China in the Asian region. Similarly, an analysis by Baliyan (2018) emphasized that India as the largest producer of "choicest" mango varieties, was not a major player in the export market. But the country had the possibility and the opportunity in being the leader in the market the country had the comparative advantage over the mango. However, Kumaresh and Sekar (2013) stated that India, with the higher rate of production, was able to export to the world market, but there was no quality and the demand in the international market was also low.

Moving further, Ayyaz et al. (2019) performed an analysis on the competitiveness of the mango trade utilizing a comparative analysis among Pakistan and other mango exporting nations. The study stated that the comparative advantage over Pakistan mango export is stable. Further, Mexico, Thailand, and the Philippines had increased the advantage of being competitors in the world market. However, the study revealed that Pakistan needs much managerial effort to address the market issues. Riaz et al. (no date) confirmed the above results with the comparative advantage analysis of Pakistan's agricultural exports stating that Pakistan had high potential in gaining comparative advantage over mango as the country can compete with fresh products from the nearby markets. Hence, the previous studies are proven by the present study results.

Table 5.6: Mean, Maximum and Minimum Comparative Advantage Scores of Mango, 2000-2019 (NRCA values in  $10^{-7}$ , AI values in  $10^{-3}$ )

Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
<b>Africa</b>															
Burkina Faso	0.000	58.079	14.488	7.993	9.014	8.459	-1.000	0.966	-0.318	-0.210	11.965	2.512	-0.086	7.278	1.667
Cameroon	0.000	1.727	0.422	0.129	1.045	0.587	-1.000	0.267	-0.546	-0.459	0.093	-0.212	-0.086	0.093	-0.040
Congo	0.000	0.009	0.001	0.000	0.000	-	-1.000	-0.982	-0.998	-0.943	-0.071	-0.398	-0.149	-0.057	-0.084
Cote d'Ivoire	0.000	17.484	11.679	5.285	9.880	7.964	-1.000	0.892	0.751	-1.105	12.458	5.970	-0.072	2.102	0.928
Eswatini	0.000	0.638	0.161	-3.146	1.450	-0.551	-1.000	-0.221	-0.755	-0.173	-0.029	-0.128	-0.113	-0.021	-0.070
Ethiopia	0.000	24.418	3.427	1.641	7.848	4.226	-1.000	0.921	0.148	-0.244	0.990	0.091	-0.149	1.349	0.157
Ghana	0.000	35.766	7.456	-1.666	8.644	3.737	-1.000	0.946	0.035	-1.119	34.341	6.069	-0.072	4.433	0.832
Guinea	0.000	4.351	1.241	4.299	6.527	5.413	-1.000	0.626	-0.279	-0.169	0.171	-0.013	-0.086	0.196	0.021
Guyana	0.000	14.698	4.126	0.891	5.677	3.284	-1.000	0.873	0.379	-0.082	0.370	0.095	-0.076	0.815	0.198
Kenya	0.000	32.788	21.491	3.486	9.851	7.078	-1.000	0.941	0.725	-0.536	12.698	5.517	-0.076	3.614	1.767
Madagascar	0.000	1.679	0.272	4.987	6.463	5.852	-1.000	0.254	-0.750	-0.192	0.074	-0.084	-0.114	0.087	-0.049
Mali	0.000	38.896	17.158	0.277	8.429	5.197	-1.000	0.950	0.242	-0.228	8.274	2.272	-0.086	4.743	1.501
Morocco	0.000	0.163	0.023	-4.689	-1.008	-3.110	-1.000	-0.719	-0.957	-2.531	-0.623	-1.499	-0.148	-0.057	-0.081
Namibia	0.000	0.138	0.027	-3.873	-1.518	-2.238	-1.000	-0.757	-0.950	-0.467	-0.094	-0.282	-0.147	-0.057	-0.081
Nigeria	0.000	0.007	0.000	-3.986	1.901	-1.163	-1.000	-0.986	-0.999	-10.149	-1.573	-5.238	-0.149	-0.057	-0.084
Tanzania	0.000	0.168	0.028	-1.616	1.574	-0.280	-1.000	-0.713	-0.949	-0.429	-0.064	-0.267	-0.146	-0.057	-0.081
<b>America</b>															
Brazil	5.825	14.609	9.400	7.984	11.391	8.905	0.707	0.872	0.797	49.741	96.464	68.993	0.480	0.963	0.655
Colombia	0.072	1.718	0.527	-1.294	3.121	0.820	-0.866	0.264	-0.394	-5.085	1.091	-1.999	-0.086	0.046	-0.039
Costa Rica	2.886	15.778	8.517	3.577	6.571	4.992	0.485	0.881	0.745	1.129	6.939	3.348	0.240	0.879	0.533
Cuba	0.000	0.160	0.019	0.000	0.000		-1.000	-0.724	-0.966	-0.563	-0.124	-0.282	-0.139	-0.057	-0.081
Dominica	0.000	57.759	16.048	0.000	0.000		-1.000	0.966	0.421	-0.003	0.166	0.037	-0.086	6.453	1.165
Ecuador	12.785	41.096	23.545	5.027	10.127	7.209	0.855	0.952	0.907	8.051	26.519	17.076	0.780	2.565	1.736
Grenada	0.000	25.054	7.501	0.000	0.000		-1.000	0.923	-0.074	-0.004	0.054	0.013	-0.086	2.735	0.651
Guatemala	3.028	31.971	10.968	1.744	6.849	4.704	0.504	0.939	0.788	0.873	7.346	3.872	0.145	1.760	0.767
Honduras	0.000	1.144	0.239	-4.657	2.334	-0.701	-1.000	0.067	-0.690	-0.759	0.073	-0.477	-0.148	0.010	-0.068
Jamaica	0.000	16.604	6.675	-1.300	8.900	6.259	-1.000	0.886	0.248	-0.171	1.566	0.437	-0.126	1.118	0.453
Mexico	6.419	12.119	8.446	3.772	4.875	4.230	0.730	0.848	0.783	42.850	218.973	124.780	0.323	0.978	0.608
Nicaragua	1.692	79.310	22.051	2.982	7.189	4.910	0.257	0.975	0.830	0.234	7.203	2.545	0.103	5.010	1.445
Panama	0.000	0.134	0.010	-4.412	-1.261	-3.221	-1.000	-0.764	-0.982	-1.395	-0.074	-0.757	-0.148	-0.057	-0.083
Peru	31.863	74.875	43.062	10.414	12.438	11.512	0.939	0.974	0.952	34.773	133.153	66.612	2.009	5.528	3.418

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
St. Lucia	0.000	67.499	12.008	3.078	6.252	5.394	-1.000	0.971	0.343	-0.019	0.301	0.050	-0.086	4.254	0.785
St. Vincent and the Grenadines	0.000	114.520	37.509	6.522	7.489	6.906	-1.000	0.983	0.455	-0.004	0.404	0.095	-0.086	8.113	2.639
Uruguay	0.000	0.005	0.001	-4.541	-3.406	-3.912	-1.000	-0.991	-0.998	-0.798	-0.163	-0.498	-0.149	-0.057	-0.084
Venezuela, RB	0.000	1.012	0.233	6.136	6.136	6.136	-1.000	0.006	-0.694	-8.477	0.035	-4.015	-0.127	0.001	-0.068
<b>Asia</b>															
Bahrain	0.000	0.363	0.081	-6.855	-2.192	-4.243	-1.000	-0.468	-0.863	-1.919	-0.322	-1.144	-0.149	-0.037	-0.078
Cambodia	0.000	10.266	0.945	-7.690	4.033	-2.717	-1.000	0.822	-0.713	-0.691	7.340	0.277	-0.103	1.182	0.040
Cyprus	0.000	0.056	0.011	-6.255	-1.787	-3.898	-1.000	-0.895	-0.979	-0.442	-0.074	-0.173	-0.149	-0.054	-0.083
Hong Kong SAR, China	0.020	0.433	0.107	-3.146	-1.186	-2.367	-0.960	-0.395	-0.817	-47.576	-9.965	-31.888	-0.146	-0.033	-0.075
India	3.132	21.791	11.332	4.806	10.086	6.913	0.516	0.912	0.783	21.726	152.063	83.601	0.318	1.375	0.738
Indonesia	0.035	0.784	0.164	-0.103	6.942	1.458	-0.932	-0.121	-0.745	-16.706	-1.094	-10.370	-0.139	-0.012	-0.072
Iran, Islamic Rep.	0.000	0.002	0.000	-9.818	-5.645	-7.683	-1.000	-0.996	-0.999	-11.539	-2.247	-6.583	-0.149	-0.057	-0.084
Israel	2.066	6.506	4.332	3.544	7.108	4.700	0.348	0.734	0.605	2.146	17.644	8.819	0.061	0.486	0.277
Jordan	0.021	1.725	0.267	-4.003	-0.154	-2.510	-0.958	0.266	-0.672	-0.702	0.003	-0.461	-0.127	0.043	-0.066
Korea	0.000	0.000	0.000	-7.503	-4.138	-6.480	-1.000	-1.000	-1.000	-52.916	-13.161	-35.628	-0.149	-0.057	-0.084
Kuwait	0.000	0.009	0.001	-10.636	-6.718	-8.712	-1.000	-0.981	-0.998	-10.403	-1.345	-5.268	-0.149	-0.057	-0.084
Lebanon	0.000	0.837	0.164	-4.829	-1.220	-2.671	-1.000	-0.089	-0.787	-0.496	-0.010	-0.288	-0.141	-0.009	-0.072
Malaysia	0.059	0.547	<b>0.245</b>	-2.185	-0.495	-1.233	-0.889	-0.293	-0.623	-19.746	-3.787	-12.908	-0.140	-0.036	-0.063
Oman	0.000	0.335	0.068	-5.215	-2.142	-3.712	-1.000	-0.498	-0.889	-4.539	-0.969	-2.490	-0.149	-0.057	-0.076
Pakistan	16.209	32.072	23.409	8.219	12.193	9.970	0.884	0.940	0.915	12.625	50.921	24.192	0.934	4.193	1.857
Philippines	5.766	27.493	13.604	5.342	10.773	7.896	0.704	0.930	0.845	12.248	60.884	35.603	0.490	1.944	0.987
Saudi Arabia	0.000	0.117	0.033	-7.630	-3.877	-5.201	-1.000	-0.790	-0.938	-33.396	-5.852	-19.098	-0.149	-0.054	-0.081
Singapore	0.009	0.066	0.026	-4.678	-2.819	-3.728	-0.982	-0.875	-0.950	-36.069	-10.198	-25.840	-0.147	-0.053	-0.082
Sri Lanka	0.000	2.216	0.484	-0.100	7.332	4.690	-1.000	0.378	-0.461	-0.757	0.668	-0.425	-0.086	0.155	-0.033
Thailand	0.723	17.019	5.395	1.996	7.366	4.635	-0.161	0.889	0.493	-5.419	304.981	54.128	-0.016	2.388	0.467
Turkey	0.000	0.021	0.002	-4.960	0.698	-2.337	-1.000	-0.959	-0.995	-15.687	-2.430	-9.855	-0.148	-0.057	-0.083
United Arab Emirates	0.000	1.714	0.295	-7.480	-1.009	-2.684	-1.000	0.263	-0.693	-32.739	3.306	-16.523	-0.120	0.041	-0.062
<b>Europe</b>															
Austria	0.000	0.000	0.000	0.000	0.000		-1.000	-1.000	-1.000	-23.773	-5.546	-15.026	-0.149	-0.057	-0.084
Belarus	0.000	0.081	0.008	-5.570	-1.756	-3.414	-1.000	-0.849	-0.986	-4.030	-0.641	-2.141	-0.148	-0.057	-0.083
Belgium	0.000	0.000	0.000	-7.503	-4.138	-6.480	-1.000	-1.000	-1.000	-52.916	-13.161	-35.628	-0.055	0.044	-0.017

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Bulgaria	0.000	0.026	0.004	-5.041	-1.802	-3.390	-1.000	-0.949	-0.993	-2.884	-0.424	-1.751	-0.147	-0.057	-0.083
Croatia	0.000	0.035	0.004	-6.272	-2.512	-3.891	-1.000	-0.932	-0.992	-1.498	-0.388	-0.982	-0.144	-0.057	-0.083
Czech Republic	0.009	0.132	0.057	-3.295	-1.169	-1.933	-0.982	-0.766	-0.894	-16.562	-2.522	-10.327	-0.141	-0.049	-0.079
Denmark	0.003	0.147	0.051	-4.895	-1.541	-3.036	-0.994	-0.744	-0.906	-10.113	-4.446	-7.745	-0.134	-0.056	-0.078
Estonia	0.000	0.006	0.002	-5.943	-4.266	-4.911	-1.000	-0.988	-0.997	-1.484	-0.335	-0.979	-0.148	-0.057	-0.084
Finland	0.000	0.007	0.001	-7.558	-4.145	-5.711	-1.000	-0.986	-0.997	-8.439	-3.779	-5.884	-0.148	-0.057	-0.084
France	0.288	1.395	0.587	-1.523	-0.433	-1.032	-0.553	0.165	-0.289	-44.532	-1.692	-26.353	-0.088	0.024	-0.038
Georgia	0.000	0.131	0.022	-2.350	-0.213	-1.006	-1.000	-0.769	-0.960	-0.294	-0.028	-0.144	-0.130	-0.057	-0.081
Germany	0.074	0.252	0.158	-2.152	-1.590	-1.897	-0.863	-0.598	-0.730	-118.693	-44.511	-91.781	-0.129	-0.048	-0.070
Greece	0.010	0.172	0.066	-3.174	-0.617	-1.941	-0.980	-0.706	-0.880	-3.365	-0.851	-2.185	-0.144	-0.047	-0.079
Hungary	0.000	0.115	0.015	-3.760	-0.552	-2.069	-1.000	-0.793	-0.972	-10.681	-2.466	-7.365	-0.132	-0.056	-0.082
Italy	0.011	0.259	0.060	-2.751	-0.605	-1.928	-0.977	-0.588	-0.892	-46.718	-20.745	-36.408	-0.138	-0.052	-0.079
Lithuania	0.034	4.806	1.553	-2.679	1.465	-0.454	-0.933	0.656	-0.145	-2.247	4.222	0.117	-0.102	0.328	0.040
Luxembourg	0.013	6.724	1.246	-3.428	0.893	-1.199	-0.975	0.741	-0.271	-1.988	3.502	-0.377	-0.071	0.434	0.025
Netherlands	2.315	4.406	3.496	-0.562	0.130	-0.201	0.397	0.630	0.547	28.371	155.627	66.130	0.076	0.439	0.220
Norway	0.000	0.008	0.001	-8.359	-4.735	-7.124	-1.000	-0.984	-0.997	-15.015	-5.178	-9.840	-0.149	-0.056	-0.084
Poland	0.000	0.066	0.029	-2.900	-1.448	-2.428	-1.000	-0.876	-0.945	-22.103	-2.777	-12.830	-0.140	-0.056	-0.081
Portugal	0.029	3.628	1.308	-5.012	-0.368	-2.233	-0.943	0.568	-0.207	-4.204	10.680	0.722	-0.066	0.331	0.063
Romania	0.000	0.032	0.006	-7.290	-2.016	-4.005	-1.000	-0.938	-0.989	-6.962	-0.911	-4.032	-0.149	-0.056	-0.083
Russian Federation	0.000	0.004	0.001	-8.959	-5.173	-7.058	-1.000	-0.991	-0.999	-46.300	-8.914	-28.946	-0.149	-0.056	-0.084
Slovak Republic	0.000	0.079	0.012	-6.087	-1.513	-3.367	-1.000	-0.854	-0.977	-8.037	-1.035	-5.058	-0.145	-0.052	-0.083
Slovenia	0.000	1.033	0.416	-3.785	-0.113	-0.839	-1.000	0.016	-0.487	-2.425	-0.767	-1.578	-0.071	0.002	-0.043
Spain	0.435	2.537	1.322	-0.481	0.450	-0.028	-0.394	0.435	0.068	-16.598	26.683	0.440	-0.036	0.196	0.043
Sweden	0.000	0.061	0.017	-6.674	-2.257	-3.945	-0.999	-0.885	-0.967	-16.252	-6.615	-12.280	-0.144	-0.053	-0.082
Switzerland	0.005	0.054	0.019	-5.501	-3.424	-4.447	-0.991	-0.897	-0.964	-31.124	-6.975	-18.318	-0.148	-0.055	-0.082
United Kingdom	0.012	0.172	0.097	-4.353	-2.071	-2.931	-0.976	-0.707	-0.825	-45.319	-21.590	-34.211	-0.133	-0.048	-0.076
<b>Oceania</b>															
Fiji	0.236	2.786	0.853	-1.623	2.321	0.593	-0.618	0.472	-0.170	-0.083	0.012	-0.035	-0.095	0.104	-0.018

Source: Authors Computed from FAO (2021)

### 5.3.6 Orange

Table 5.7 contains comparative advantage index values of orange. According to the BRCA index values, Egypt, Morocco, South Africa, Eswatini, Ethiopia, Tanzania, Tunisia, and Zimbabwe in the African region gained the comparative advantage. Egypt had the highest average BRCA index (43.835), was nearly two times greater than Morocco (25.32) and South Africa (23.53), and 20 times greater than Ethiopia (2.125) and Tanzania (2.49). In the American region, Argentina, Belize, Chile, Cuba, Dominica, Jamaica, Nicaragua, United States and Uruguay specialized in orange exports. The higher average BRCA index values were revealed for Dominica (22.86) and the United States (21.85) and were approximately three times greater than the rest of the countries with specialization in the region. In the Asian region, Cyprus, Israel, Jordan, Lebanon, and Turkey had the average BRCA index values greater than 1, implying these countries gained the comparative advantage. Lebanon (13.084) and Cyprus (11.488) realized higher average BRCA index values, and they were nearly six times larger than the other countries having comparative advantage in the same region. Georgia, Greece, Lithuania, Netherlands, Portugal and Spain were identified as advantage countries in the European region. Among them, higher average BRCA index values were visualized for Greece (22.56) and Spain (17.91). The average BRCA index values for the other countries that experienced comparative advantage in the same region were ten times below Greece and eight times that of Spain. Further, the Average BRCA index value for Australia showed the comparative advantage of orange exports (3.076).

The average Vollrath RCA index values got positive signs for most of the orange exporters in the African region. The higher average index values are visualized for Egypt (9.69) and Morocco (10.33), and these index values are five times higher than in Eswatini, Ghana, and Guyana while two times greater than in Ethiopia, South Africa, Tanzania, Tunisia, and Zimbabwe. In the American region, Argentina, Belize, Brazil, Chile, Colombia, Cuba, Dominica, Honduras, Jamaica, Mexico, Nicaragua, Peru, United States and Uruguay showed positive signs for average Vollrath RCA index, which indicated the comparative advantage. Their average index values were not much varied and turned around 0.45 (Colombia) and 6.14 (Uruguay). The average Vollrath RCA index values ranged between 1.15 and 8.42 in five Asian countries, namely Cyprus, India, Israel, Lebanon, Turkey, and Pakistan. In the European region, Italy (0.097), Greece (4.4), and Spain were included as the countries having a comparative advantage. Australia, representing the Oceania, also had the advantage in orange exports according to the average Vollrath index values.

According to the average RSCA index values, South Africa (0.915) and Morocco (0.805) in the African region were placed in the top position in the region and their index values are two to four times higher than that of Egypt, Eswatini, Ethiopia, Tunisia, and Zimbabwe. In the American region, Argentina, Chile, Dominica, Nicaragua, United States and Uruguay had positive average RSCA index values, implying the specialization in orange export. Except for Uruguay (0.896), the average RSCA index values were not considerably varied among countries. In the Asian region, only four

countries appear to have a comparative advantage, namely Cyprus (0.717), Lebanon (0.800), Turkey (0.599), and Israel (0.139). In the European region, Greece, Lithuania, Netherlands, Portugal, and Spain specialized in orange exports according to the RSCA index values. The higher RSCA index values were noted for Germany (0.909) and Spain (0.893), while the lowest index values were for Portugal (0.107). Furthermore, Australia representing Oceania, had a comparative advantage in orange exports according to the RSCA index values (0.484).

The average NRCA index values revealed that Egypt, Eswatini, Morocco, South Africa, Tanzania, Tunisia, and Zimbabwe in the African region had a comparative advantage as their index values take positive signs. According to the NRCA index values, South Africa (278.441 in  $10^{-7}$ ), Egypt (158.717 in  $10^{-7}$ ), and Morocco (71.477 in  $10^{-7}$ ) were the leading competitors in the region, and average NRCA index values of the rest of the countries having the specialization in the same region were many times lower than South Africa, Egypt and Morocco. In the Asian region, three countries are having specialization, according to the NRCA index values they were Cyprus (3.029 in  $10^{-7}$ ), Lebanon (6.041 in  $10^{-7}$ ), and Turkey (39.857 in  $10^{-7}$ ). Three European region countries were visualized as having specialized in orange export, and they were Spain (750.092 in  $10^{-7}$ ), Greece (99.221 in  $10^{-7}$ ), and Portugal (4.452 in  $10^{-7}$ ). NRCA index values showed that Australia also had specialized in orange exports (24.332 in  $10^{-7}$ ).

According to the AI values, Egypt had the highest index value (11.556 in  $10^{-3}$ ), which was two times higher than that of Morocco (6.458 in  $10^{-3}$ ) and South Africa (5.914 in  $10^{-3}$ ). Eswatini, Ethiopia, Tanzania, Tunisia, and Zimbabwe were the rest of the countries that specialized in orange exports and their AI values ranged between 0.315 – 1.09 (in  $10^{-3}$ ). Most countries exporting orange in the American region got positive values for AI. They were Argentina, Belize, Chile, Cuba, Dominica, Honduras, Jamaica, Nicaragua, United States and Uruguay. According to AI values, Nicaragua (0.846) is the highest competitor in the American region. Cyprus, Israel, Jordan, Lebanon, and Turkey were the five countries in the Asian region having a specialization in orange exports. Except in Turkey (0.868 in  $10^{-3}$ ), the index values of the rest of the countries do not show much variation among countries and turn around 0.108 – 3.260 (in  $10^{-3}$ ). Sri Lanka had experienced a comparative disadvantage in exporting orange to the world market (-0.261 in  $10^{-3}$ ). In the European region, Greece (5.804 (in  $10^{-3}$ ) and Spain (4.477 (in  $10^{-3}$ ) realized the higher index values while it was ranged between 0.105 – 0.442 (in  $10^{-3}$ ) for the remaining countries, namely Georgia, Lithuania, Netherlands, and Portugal having specialized in the same region. Representing Oceania, Australia too has a comparative advantage in orange exports according to the AI values (0.55 in  $10^{-3}$ )

The present study revealed the countries that gained the comparative advantage, the demand relationship in exporting orange to Russia was reviewed by Hatab (2016) utilizing a differential demand system approach focused on Egypt. The study revealed that Egypt is experiencing a strong comparative advantage in exporting oranges to Russia. The comparative advantage over the oranges farming in west Sumatera was examined by Romdhon et al. (2013), the analysis emphasized that there is high comparative advantage, and it could be sustained if the domestic resources are

utilized efficiently. However, the analysis performed in Myanmar by Naing and Darwanto (2021) regarding the comparative advantage of fruits, concluded that there is a comparative disadvantage over exporting oranges to the world market.

Table 5.7: Mean, Maximum and Minimum Comparative Advantage Scores of Orange, 2000-2019 (NRCA values in  $10^{-7}$ , AI values in  $10^{-3}$ )

Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
<b>Africa</b>															
Algeria	0.000	0.002	0.000	-9.670	-4.589	-5.988	-1.000	-0.996	-0.999	-31.474	-7.460	-17.950	-0.322	-0.217	-0.265
Egypt, Arab Rep.	0.000	91.470	43.835	7.903	11.525	9.688	-1.000	0.978	0.649	-11.673	382.043	158.717	-0.265	24.346	11.556
Eswatini	0.000	12.006	5.105	1.183	2.373	1.765	-1.000	0.846	0.221	-0.764	4.204	1.172	-0.322	2.838	1.096
Ethiopia	0.000	4.559	2.125	3.074	8.476	5.859	-1.000	0.640	0.222	-1.107	0.740	-0.117	-0.252	1.125	0.315
Ghana	0.000	0.515	0.143	0.441	6.026	2.321	-1.000	-0.320	-0.771	-6.052	-0.462	-2.990	-0.314	-0.105	-0.228
Guyana	0.000	0.375	0.125	-2.443	4.528	1.323	-1.000	-0.454	-0.798	-0.622	-0.129	-0.354	-0.322	-0.139	-0.232
Kenya	0.000	0.163	0.042	-6.784	-1.419	-3.193	-1.000	-0.719	-0.922	-2.432	-0.642	-1.744	-0.314	-0.211	-0.254
Morocco	0.000	52.609	25.320	7.142	12.008	10.327	-1.000	0.963	0.805	-8.595	152.237	71.477	-0.252	13.307	6.458
Namibia	0.000	0.308	0.054	-5.669	-0.800	-3.005	-1.000	-0.529	-0.907	-2.140	-0.335	-1.279	-0.322	-0.197	-0.250
South Africa	14.065	31.462	23.527	5.646	7.867	6.642	0.867	0.938	0.915	188.841	386.026	278.441	4.079	8.361	5.914
Tanzania	0.000	21.796	2.494	2.562	7.502	4.274	-1.000	0.912	-0.229	-1.987	11.763	0.411	-0.255	4.687	0.360
Tunisia	0.000	4.762	3.008	5.585	8.730	6.976	-1.000	0.653	0.420	-4.641	11.596	2.677	-0.222	1.044	0.540
Uganda	0.000	2.402	0.392	-2.260	1.604	-0.047	-1.000	0.412	-0.676	-1.378	-0.130	-0.513	-0.316	0.385	-0.159
Zimbabwe	0.000	38.379	6.813	0.339	8.934	4.388	-1.000	0.949	0.344	-0.953	15.555	2.594	-0.316	9.072	1.492
<b>America</b>															
Argentina	1.373	6.536	2.998	0.938	9.214	4.319	0.157	0.735	0.428	-16.391	54.747	9.353	0.094	1.240	0.516
Belize	0.000	17.247	3.557	1.288	1.288	1.288	-1.000	0.890	-0.256	-2.556	10.808	1.112	-0.322	11.390	1.248
Brazil	0.027	1.606	0.418	-2.731	4.689	1.517	-0.947	0.233	-0.479	-92.758	21.026	-54.318	-0.248	0.178	-0.152
Canada	0.000	0.002	0.000	-11.698	-6.317	-9.523	-1.000	-0.996	-1.000	-189.034	-100.176	-152.141	-0.322	-0.217	-0.265
Chile	0.000	4.181	2.348	1.654	5.077	3.658	-1.000	0.614	0.237	-15.563	16.817	2.337	-0.314	0.859	0.349
Colombia	0.021	0.613	0.215	-1.589	2.369	0.454	-0.959	-0.240	-0.674	-23.565	-4.459	-12.016	-0.299	-0.098	-0.210
Costa Rica	0.011	0.511	0.073	-5.418	2.205	-2.895	-0.977	-0.324	-0.877	-4.580	-0.799	-3.401	-0.293	-0.154	-0.245
Cuba	0.000	17.247	3.557	1.288	1.288	1.288	-1.000	0.890	-0.256	-2.556	10.808	1.112	-0.322	4.189	0.734
Dominica	0.000	66.123	22.857	2.003	8.233	4.19(3	-1.000	0.970	0.459	-0.015	0.884	0.250	-0.322	14.480	5.657
El Salvador	0.000	0.038	0.016	-5.546	-1.983	-3.549	-1.000	-0.927	-0.969	-2.344	-1.126	-1.761	-0.316	-0.210	-0.261
Guatemala	0.000	0.048	0.009	-7.732	-3.141	-5.129	-1.000	-0.908	-0.982	-4.419	-0.961	-3.080	-0.321	-0.213	-0.263
Honduras	0.000	2.437	1.048	2.057	6.176	4.003	-1.000	0.418	-0.130	-3.166	2.576	-1.145	-0.265	0.423	0.023
Jamaica	0.000	23.606	2.984	3.446	3.446	3.446	-1.000	0.919	0.041	-0.773	4.870	0.235	-0.316	5.995	0.542
Mexico	0.031	0.258	0.124	-1.505	1.563	0.304	-0.940	-0.590	-0.785	-171.046	-54.872	-111.259	-0.306	-0.183	-0.233
Nicaragua	0.000	10.228	4.225	-2.551	4.529	2.424	-1.000	0.822	0.224	-1.903	5.521	1.305	-0.314	2.533	0.846
Paraguay	0.000	0.336	0.111	-3.975	1.082	-1.863	-1.000	-0.497	-0.813	-3.753	-0.828	-2.225	-0.304	-0.165	-0.236

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Peru	0.012	1.070	0.330	-0.958	5.494	1.440	-0.977	0.034	-0.560	-17.128	-2.569	-9.984	-0.312	0.015	-0.182
United States	1.061	1.895	1.506	1.447	2.625	2.091	0.030	0.309	0.197	-377.650	221.732	-127.128	0.014	0.202	0.133
<b>Asia</b>															
Afghanistan	0.000	0.215	0.030	-4.385	-0.938	-2.535	-1.000	-0.646	-0.948	-0.340	-0.027	-0.173	-0.322	-0.217	-0.257
Bahrain	0.000	0.322	0.134	-4.847	-1.982	-2.966	-1.000	-0.512	-0.776	-8.446	-1.701	-5.106	-0.294	-0.167	-0.230
Bangladesh	0.000	0.050	0.004	-9.428	-4.764	-6.371	-1.000	-0.904	-0.991	-15.431	-2.413	-8.071	-0.322	-0.217	-0.264
China	0.006	0.218	0.129	-3.955	0.467	-0.987	-0.988	-0.642	-0.778	-946.546	-98.280	-542.623	-0.306	-0.177	-0.232
Cyprus	1.540	28.777	11.488	2.452	10.427	4.647	0.213	0.933	0.717	-0.919	10.626	3.029	0.148	8.783	2.863
Hong Kong SAR, China	0.220	1.089	0.535	-1.698	-0.549	-1.141	-0.640	0.043	-0.332	-189.884	-17.139	-114.462	-0.215	0.024	-0.122
India	0.050	0.602	0.231	-1.792	4.973	1.154	-0.906	-0.248	-0.652	-126.662	-5.827	-71.890	-0.290	-0.114	-0.202
Indonesia	0.000	0.024	0.004	-9.740	-3.971	-6.818	-1.000	-0.952	-0.993	-80.765	-22.467	-51.636	-0.322	-0.217	-0.264
Israel	0.145	4.080	1.860	5.911	10.778	8.482	-0.746	0.606	0.139	-23.334	35.632	-1.458	-0.235	0.718	0.220
Iran, Islamic Rep.	0.000	0.696	0.224	-4.990	-0.653	-2.306	-1.000	-0.179	-0.689	-51.559	-7.552	-26.994	-0.322	-0.068	-0.207
Japan	0.000	0.002	0.000	-10.392	-5.817	-7.644	-1.000	-0.997	-0.999	-326.688	-160.122	-255.239	-0.322	-0.217	-0.265
Jordan	0.178	5.362	1.445	-3.053	0.190	-1.482	-0.697	0.686	-0.068	-3.106	2.232	-0.864	-0.219	1.032	0.108
Kazakhstan	0.000	0.006	0.001	-9.546	-3.888	-6.269	-1.000	-0.988	-0.998	-34.298	-3.429	-18.496	-0.322	-0.217	-0.265
Korea, Dem. People's Rep.	0.000	0.052	0.005	-16.050	-7.164	-13.167	-1.000	-0.901	-0.990	-240.061	-56.012	-161.287	-0.322	-0.217	-0.264
Kuwait	0.000	0.502	0.107	-7.051	-2.403	-4.051	-1.000	-0.331	-0.844	-47.197	-6.100	-22.846	-0.316	-0.134	-0.236
Lebanon	3.735	52.681	13.084	3.343	8.925	6.120	0.578	0.963	0.800	0.458	15.775	6.041	0.689	13.325	3.260
Malaysia	0.003	0.058	0.019	-5.616	-3.155	-4.227	-0.995	-0.890	-0.963	-97.181	-34.801	-69.970	-0.319	-0.213	-0.261
Oman	0.000	0.352	0.106	-5.423	-2.376	-3.742	-1.000	-0.479	-0.821	-21.645	-4.194	-11.431	-0.305	-0.164	-0.236
Pakistan	0.000	0.487	0.159	-0.588	8.349	3.252	-0.999	-0.345	-0.758	-9.672	-2.907	-6.877	-0.322	-0.129	-0.223
Saudi Arabia	0.000	0.133	0.060	-5.224	-3.317	-4.398	-1.000	-0.765	-0.890	-151.883	-25.740	-86.152	-0.322	-0.202	-0.250
Singapore	0.045	0.104	0.068	-2.461	-1.581	-1.963	-0.915	-0.811	-0.874	-161.085	-44.186	-115.457	-0.305	-0.204	-0.248
Sri Lanka	0.000	0.117	0.018	-7.254	-2.088	-4.683	-1.000	-0.791	-0.967	-4.739	-1.865	-3.317	-0.320	-0.199	-0.261
Thailand	0.002	0.129	0.038	-2.147	3.634	-0.383	-0.997	-0.771	-0.928	-100.044	-25.218	-65.776	-0.316	-0.197	-0.256
Turkey	2.020	7.744	4.283	2.426	10.136	3.745	0.338	0.771	0.599	-23.681	93.169	39.857	0.257	1.697	0.868
United Arab Emirates	0.000	0.500	0.153	-2.479	-0.935	-1.924	-1.000	-0.333	-0.767	-148.527	-12.674	-82.365	-0.322	-0.126	-0.225
<b>Europe</b>															
Austria	0.073	0.207	0.143	-2.799	-1.619	-1.991	-0.864	-0.657	-0.751	-69.736	-21.175	-52.839	-0.281	-0.181	-0.228
Belarus	0.000	0.372	0.110	-4.557	-2.049	-3.187	-1.000	-0.458	-0.823	-17.969	-1.753	-9.306	-0.322	-0.173	-0.234
Belgium	0.075	0.848	0.334	-2.383	-0.710	-1.530	-0.860	-0.082	-0.544	-181.884	-3.960	-122.534	-0.253	-0.039	-0.174
Bulgaria	0.000	0.296	0.123	-5.403	-1.310	-2.698	-1.000	-0.543	-0.795	-12.690	-1.926	-7.500	-0.310	-0.159	-0.233

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Croatia	0.000	0.297	0.051	-8.646	-2.409	-4.995	-1.000	-0.542	-0.912	-6.855	-1.754	-4.372	-0.316	-0.166	-0.252
Czech Republic	0.023	0.269	0.138	-4.360	-1.472	-2.344	-0.955	-0.577	-0.766	-78.533	-11.281	-45.973	-0.308	-0.159	-0.230
Denmark	0.013	0.194	0.075	-4.408	-2.000	-3.025	-0.975	-0.675	-0.865	-45.867	-19.440	-35.405	-0.310	-0.198	-0.246
Estonia	0.000	0.062	0.015	-7.172	-2.798	-4.521	-1.000	-0.884	-0.971	-6.731	-1.489	-4.417	-0.313	-0.212	-0.261
Finland	0.000	0.015	0.004	-7.848	-4.224	-6.129	-0.999	-0.970	-0.992	-38.259	-17.111	-26.678	-0.322	-0.217	-0.264
France	0.173	0.330	0.245	-2.447	-1.887	-2.172	-0.705	-0.504	-0.609	-227.799	-86.569	-174.079	-0.262	-0.151	-0.201
Georgia	0.000	14.321	1.292	-5.154	2.244	-1.380	-1.000	0.869	-0.321	-1.147	2.241	-0.367	-0.319	4.183	0.107
Germany	0.041	0.120	0.076	-3.632	-2.403	-2.854	-0.920	-0.786	-0.860	-603.976	-208.087	-451.611	-0.302	-0.192	-0.246
Greece	13.054	40.536	22.562	2.640	5.816	4.395	0.858	0.952	0.909	50.119	198.472	99.221	3.037	12.415	5.804
Hungary	0.000	0.071	0.019	-5.880	-2.183	-4.110	-1.000	-0.868	-0.964	-49.440	-11.134	-33.614	-0.315	-0.217	-0.261
Ireland	0.010	0.075	0.031	-4.530	-2.748	-3.627	-0.980	-0.860	-0.941	-66.632	-30.265	-45.968	-0.313	-0.201	-0.258
Italy	0.543	1.126	0.811	-0.528	0.741	0.097	-0.296	0.059	-0.111	-155.194	1.074	-103.937	-0.144	0.033	-0.052
Latvia	0.026	0.849	0.480	-5.283	-0.758	-1.942	-0.948	-0.082	-0.404	-4.915	-0.620	-2.850	-0.306	-0.041	-0.142
Lithuania	0.764	3.521	1.771	-0.940	-0.009	-0.426	-0.133	0.558	0.215	-8.869	2.816	-1.783	-0.071	0.568	0.197
Luxembourg	0.016	0.242	0.055	-3.673	-1.564	-2.982	-0.968	-0.610	-0.902	-10.105	-3.256	-6.761	-0.314	-0.191	-0.251
Netherlands	1.102	2.145	1.405	-0.707	-0.297	-0.515	0.048	0.364	0.159	-168.565	57.306	-68.704	0.026	0.255	0.105
Norway	0.001	0.023	0.007	-8.105	-4.349	-6.043	-0.999	-0.956	-0.987	-68.096	-23.477	-44.539	-0.321	-0.216	-0.264
Poland	0.038	0.266	0.117	-4.255	-1.874	-2.921	-0.926	-0.580	-0.796	-103.042	-11.788	-56.668	-0.304	-0.165	-0.236
Portugal	0.051	6.434	2.718	-2.475	0.902	-0.284	-0.902	0.731	0.107	-12.721	35.364	4.452	-0.299	1.462	0.442
Romania	0.001	0.081	0.022	-8.066	-3.037	-5.352	-0.998	-0.850	-0.958	-31.588	-4.128	-18.177	-0.317	-0.208	-0.260
Russian Federation	0.004	0.128	0.042	-7.391	-3.711	-5.267	-0.992	-0.774	-0.921	-209.497	-38.767	-128.967	-0.311	-0.194	-0.254
Serbia	0.000	0.166	0.042	-	-	-	-1.000	-0.716	-0.946	-7.769	0.000	-3.535	#DIV/0!	#DIV/0!	#DIV/0!
Slovak Republic	0.014	0.621	0.125	-4.744	-0.837	-2.620	-0.972	-0.234	-0.806	-36.301	-4.628	-21.958	-0.308	-0.084	-0.235
Slovenia	0.003	1.335	0.659	-6.518	-0.330	-1.772	-0.994	0.143	-0.300	-11.371	-3.413	-7.501	-0.313	0.073	-0.098
Spain	13.893	21.571	17.915	2.362	3.678	2.860	0.866	0.911	0.893	534.550	1205.925	750.092	3.539	6.201	4.477
Sweden	0.005	0.163	0.040	-5.746	-1.948	-4.064	-0.990	-0.719	-0.926	-73.822	-28.861	-55.248	-0.318	-0.206	-0.255
Switzerland	0.000	0.002	0.001	-9.312	-6.118	-7.439	-1.000	-0.996	-0.998	-142.023	-31.951	-84.013	-0.322	-0.217	-0.265
Ukraine	0.000	0.055	0.004	-10.382	-4.728	-7.645	-1.000	-0.895	-0.992	-27.188	-5.784	-16.933	-0.322	-0.214	-0.264
United Kingdom	0.059	0.375	0.148	-3.014	-1.220	-2.168	-0.889	-0.454	-0.748	-204.774	-97.119	-153.989	-0.296	-0.139	-0.227
<b>Oceania</b>															
Australia	1.482	4.898	3.076	1.159	2.603	2.126	0.194	0.661	0.484	-52.965	112.512	24.332	0.121	1.060	0.555
Fiji	0.000	0.050	0.016	-5.738	-3.309	-4.171	-1.000	-0.905	-0.968	-0.542	-0.204	-0.338	-0.322	-0.210	-0.261
New Zealand	0.034	0.182	0.104	-3.909	-1.664	-2.638	-0.934	-0.692	-0.815	0.000	0.000	0.000	0.000	0.000	0.000

Source: Authors Computed from FAO (2021)

### 5.3.7 Papaw

Table 5.8 presents the index value calculated for papaw. Thus, the average BRCA index values calculated for the selected countries denoted that in the African region, the countries that gained comparative advantage are Ghana, Ethiopia, Cote d'Ivoire, Guyana, and Senegal. Ghana remarks the highest index value (8.218) which is nearly eight times greater than Senegal (1.622), the country that recorded the lowest average within the region. Moving into the American region, the highest value recorded is for Jamaica (115.76), while the lowest is for the United States (1.082). Hence, the highest value recorded is nearly 115 times greater than the lowest in the region. Moreover, the rest of the countries that gained the advantage in the American region are Guatemala, Dominica, Brazil, Mexico, Costa Rica, and Ecuador. In the Asian region, Sri Lanka, Malaysia, the Philippines, and India respectively remark the countries that benefited from exporting papaw to the world market. Sri Lanka remarked the higher average (9.01) for the region among comparative advantage gain countries, which was greater than nearly nine times the lowest in India (1.557). In addition, Malaysia (5.903) and the Philippines (5.425) were the other countries that gained the comparative advantage. Luxembourg (2.652), Lithuania (1.177), and Portugal (1.146) were the countries in the European region that gained a comparative advantage throughout the period, while the rest of the selected countries have recorded an average below 0, implying a comparative disadvantage. The average index value for Fiji (55.575) implied the comparative advantage for the country selected for Oceania, while Australia experienced a disadvantage for the referenced period.

Permitting to the Vollrath RCA index, Ethiopia, Cote d'Ivoire, Ghana, Kenya, Morocco, Senegal, South Africa, and Tanzania gained a comparative advantage in the African region. The highest and lowest Vollrath index values in the African region are for Ghana (5.858) and Kenya (0.816), respectively. Vollrath RCA index values for the American region were recorded for Brazil, Colombia, Costa Rica, Ecuador, Guatemala, Jamaica, Mexico, and Trinidad and Tobago, which have the comparative advantage for papaw exports. Among them, the highest Vollrath RCA index value was for Brazil (8.695), while the lowest was for Trinidad and Tobago (0.792). Bangladesh (3.734), Cambodia (2.052), India (6.541), Indonesia (0.323), Israel (4.345), Malaysia (6.939), Sri Lanka (3.239) and Thailand (4.479) were the Asian countries that benefitted with comparative advantage in papaw exports according to the Vollrath RCA index. Malaysia represented the highest Vollrath RCA index value for the Asian region. The highest value was nearly two times greater than that of Sri Lanka. In the European region, only the Netherland could gain the advantage where the Vollrath RCA index values take negative signs implying comparative disadvantage for all other countries. Fiji is the only papaw exporting country in Oceania with 5.814 Vollrath RCA index value.

As per the results from the RSCA index, Cote d'Ivoire (0.0085), Ethiopia (0.325), Ghana (0.170) and Guyana (0.018) were the countries that gained comparative advantage in the African region. Seven countries in the American region, Brazil, Costa Rica, Dominica, Ecuador, Guatemala, Jamaica, and Mexico, were the countries that gained

comparative advantage in the region. India (0.157), the Philippines (0.634) and Sri Lanka (0.287) were able to gain the advantage in the Asian region for the reference period. Moving into the European region Netherland (0.383) and Luxemburg (0.157) were able to attain the advantage over exporting Papaw for the World Market. In Oceania, Fiji (0.659) represented the country that gained the comparative advantage.

The NRCA index values discovered that Cote d'Ivoire, Ethiopia, and Ghana, were the countries that gained an advantage in the African region. Where Cote d'Ivoire (0.281 in  $10^{-7}$ ), Ghana (0.3 in  $10^{-7}$ ), and Ethiopia (0.006 in  $10^{-7}$ ) were the recorded NRCA index values. Considering the American region, Brazil, Costa Rica, Dominica, Ecuador, Guatemala, Jamaica, and Mexico represented the countries that gained a comparative advantage in the study period, while Mexico (39.57 in  $10^{-7}$ ) and Brazil (21.81 in  $10^{-7}$ ) recorded the higher values compared to the other countries in the region. In the Asian region, Malaysia, the Philippines, and Sri Lanka were the countries that gained the advantage in the period where Sri Lanka recorded (0.563 in  $10^{-7}$ ). However, the countries in the European region weren't able to attain a comparative advantage for the study period. In Oceania, Fiji (0.429 in  $10^{-7}$ ) was able to be benefitted from exporting papaw to the world market.

The AI index proves the previously reviewed indexes, where Ethiopia, Ghana, Guyana, and Senegal in the African region were able to attain comparative advantage throughout the period recording positive values. The countries exporting orange in the American region were Brazil, Costa Rica, Dominica, Ecuador, Guatemala, Jamaica, Mexico, and United States recorded positive values implying a comparative advantage over papaw exports. Jamaica (1.646 in  $10^{-3}$ ) and Guatemala (0.859 in  $10^{-3}$ ) denote the highest values in the region. Moving into the Asian region, India, Malaysia, the Philippines, and Sri Lanka were the countries that were able to be gained a comparative advantage as the AI index remarking positive values. At the same time, Sri Lanka (0.113 in  $10^{-3}$ ) represents the highest value in the region. However, countries in the Oceania region could not gain the comparative advantage for the reference period according to the AI index.

Studies by Mizik (2021) and Rozana, (2017) proved that Malaysia was a country that gained a high comparative advantage in exporting papaw to the world market. The country could gain a high advantage in exporting papaw to Indonesia and Thailand compared to the remaining. The RCA and RSCA indexes revealed the comparative advantage, and prior to 2006, the country was at the top in the papaya exports among Asian region players. In addition, according to Cai et al. (2007) and Yu et al. (2008), comparative advantage for papaw of Hawaii in the USA mainland market declined between 1995 and 2005. But the comparative advantage for papaw has remained above the average level among other selected fruits. Similarly, it is revealed that in Jamaica Inter-American Development Banak (2003), exporting papaw had a comparative advantage for the country as non-traditional export, which was a critical success factor for the Jamaican papaw industry. As the present study identified that Sri Lanka had a comparative advantage over papaw exports Sachithra et al. (2014) and Weerahewa et al. (2011) study on the agro forestry crop sector in Sri Lanka revealed

that among one non-traditional export, papaw has a comparative advantage over the country and compete in the world market.

Table 5.8: Mean, Maximum and Minimum Comparative Advantage Scores of Papaw, 2000-2019 (NRCA values in  $10^{-7}$ , AI values in  $10^{-3}$ )

Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
<b>Africa</b>															
Botswana	0.000	0.319	0.020	-5.001	-1.942	-4.260	-1.000	-0.516	-0.967	-0.215	-0.046	-0.126	-0.020	-0.010	-0.015
Cameroon	0.000	1.484	0.433	0.000	0.000	-	-1.000	0.195	-0.523	-0.126	-0.044	-0.074	-0.019	0.007	-0.009
Cote d'Ivoire	0.157	35.669	5.641	1.136	4.590	3.284	-0.728	0.945	0.085	-0.307	2.281	0.281	-0.013	0.387	0.063
Eswatini	0.000	3.546	0.571	-3.804	0.843	-1.471	-1.000	0.560	-0.639	-0.049	0.015	-0.033	-0.019	0.040	-0.007
Ethiopia	0.000	7.971	3.033	2.614	6.348	4.481	-1.000	0.777	0.325	-0.070	0.061	0.006	-0.017	0.090	0.030
Ghana	0.000	44.424	8.218	5.590	6.125	5.858	-1.000	0.956	0.170	-0.323	1.831	0.300	-0.019	0.712	0.119
Guyana	0.000	6.298	1.813	-0.217	-0.217	-0.217	-1.000	0.726	0.018	-0.040	0.061	-0.007	-0.015	0.081	0.011
Kenya	0.000	0.361	0.080	-0.254	4.102	0.816	-1.000	-0.469	-0.873	-0.155	-0.044	-0.109	-0.020	-0.008	-0.014
Madagascar	0.000	0.777	0.094	0.000	0.000	#DIV/0!	-1.000	-0.126	-0.870	-0.070	-0.012	-0.037	-0.020	-0.003	-0.013
Morocco	0.000	0.155	0.011	-0.285	4.963	1.881	-1.000	-0.732	-0.981	-0.719	-0.180	-0.439	-0.020	-0.010	-0.015
Senegal	0.000	7.726	1.622	1.515	4.274	2.902	-1.000	0.771	-0.083	-0.064	0.059	-0.020	-0.017	0.079	0.008
South Africa	0.046	0.982	0.463	-0.319	4.095	1.750	-0.911	-0.009	-0.439	-2.482	-0.448	-1.460	-0.019	0.000	-0.008
Tanzania	0.000	0.643	0.151	1.711	4.131	2.816	-1.000	-0.218	-0.780	-0.126	-0.019	-0.074	-0.020	-0.005	-0.013
Uganda	0.000	2.955	0.809	-1.631	-1.631	-1.631	-1.000	0.494	-0.324	-0.082	0.004	-0.028	-0.020	0.029	-0.003
<b>America</b>															
Brazil	12.618	20.112	15.661	8.695	8.695	8.695	0.853	0.905	0.878	13.392	36.383	21.816	0.139	0.379	0.220
Canada	0.000	0.006	0.001	-9.775	-6.068	-8.358	-1.000	-0.989	-0.998	-12.019	-6.370	-9.672	-0.020	-0.010	-0.015
Colombia	0.004	2.218	0.773	-2.708	6.410	2.159	-0.992	0.379	-0.276	-1.476	0.418	-0.602	-0.015	0.022	-0.003
Costa Rica	3.070	27.158	11.863	3.055	7.531	5.599	0.509	0.929	0.793	0.338	1.783	0.828	0.042	0.338	0.150
Dominica	0.000	50.830	18.561	0.000	0.000	-	-1.000	0.961	0.504	-0.001	0.068	0.012	-0.014	0.817	0.284
Ecuador	0.331	22.121	10.759	-0.319	5.168	2.783	-0.502	0.913	0.678	-0.504	2.297	1.213	-0.010	0.246	0.137
Guatemala	3.807	180.278	60.879	0.953	6.779	3.003	0.584	0.989	0.900	0.274	15.804	4.849	0.054	2.739	0.859
Jamaica	0.000	235.603	115.766	5.920	9.708	7.814	-1.000	0.992	0.489	-0.049	6.125	1.690	-0.020	3.676	1.646
Mexico	8.686	23.212	15.064	5.660	9.301	7.285	0.794	0.917	0.870	16.239	73.587	39.570	0.122	0.367	0.207
Peru	0.000	0.079	0.017	-5.204	1.058	-2.075	-1.000	-0.854	-0.968	-1.227	-0.164	-0.748	-0.020	-0.010	-0.015
Trinidad and Tobago	0.000	4.438	0.753	-0.569	4.275	0.792	-1.000	0.632		-0.473	0.371	-0.180	-0.012	0.056	-0.003
United States	0.647	1.470	1.082	-1.354	-0.526	-0.890	-0.214	0.190	0.031	-30.737	9.251	-16.450	-0.005	0.005	0.001
Uruguay	0.000	0.025	0.006	-5.225	-3.622	-4.400	-1.000	-0.950	-0.988	-0.229	-0.047	-0.143	-0.020	-0.010	-0.015
<b>Asia</b>															
Bahrain	0.000	0.655	0.049	-7.335	-2.548	-4.821	-1.000	-0.208	-0.934	-0.553	-0.141	-0.340	-0.020	-0.005	-0.014
Bangladesh	0.000	0.891	0.145	2.205	5.340	3.734	-1.000	-0.057	-0.828	-0.965	-0.153	-0.472	-0.020	-0.002	-0.013

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Cambodia	0.000	1.302	0.200	0.336	3.768	2.052	-1.000	0.131	-0.774	-0.362	-0.035	-0.135	-0.020	0.005	-0.012
China	0.004	0.511	0.152	-6.654	1.063	-2.067	-0.991	-0.324	-0.770	-55.947	-6.260	-34.058	-0.019	-0.007	-0.013
Hong Kong SAR, China	0.000	0.831	0.133	-7.193	-1.310	-4.286	-0.999	-0.092	-0.834	-14.338	-0.534	-9.177	-0.018	-0.003	-0.013
India	0.752	5.192	1.557	6.541	6.541	6.541	-0.142	0.677	0.157	-5.823	4.483	-2.236	-0.005	0.069	0.008
Indonesia	0.000	0.948	0.089	-1.223	1.456	0.323	-1.000	-0.027	-0.878	-4.857	-0.385	-3.163	-0.019	-0.001	-0.013
Israel	0.000	0.164	0.032	4.345	4.345	4.345	-1.000	-0.719	-0.942	-1.704	-0.733	-1.300	-0.020	-0.010	-0.014
Malaysia	2.042	15.687	5.903	4.165	10.207	6.939	0.343	0.880	0.621	-2.349	37.742	8.499	0.016	0.261	0.081
Oman	0.000	0.730	0.100	-5.331	1.091	-1.566	-1.000	-0.156	-0.847	-1.349	-0.257	-0.736	-0.020	-0.003	-0.014
Philippines	1.423	9.228	5.425	0.000	0.000	-	0.175	0.804	0.634	-0.695	7.227	1.849	0.007	0.133	0.064
Singapore	0.000	0.039	0.005	-9.034	-3.654	-6.893	-1.000	-0.925	-0.990	-10.482	-2.988	-7.562	-0.020	-0.010	-0.015
Sri Lanka	0.000	36.754	9.015	-2.481	6.547	3.239	-1.000	0.947	0.287	-0.195	3.112	0.563	-0.016	0.532	0.113
Thailand	0.172	1.173	0.408	2.290	6.632	4.479	-0.707	0.080	-0.453	-5.503	-0.294	-3.537	-0.014	0.003	-0.009
United Arab Emirates	0.000	0.072	0.017	-5.880	-2.654	-4.156	-1.000	-0.866	-0.967	-9.641	-1.222	-5.584	-0.020	-0.010	-0.015
<b>Europe</b>															
Austria	0.004	0.069	0.027	-4.557	-2.286	-3.310	-0.993	-0.871	-0.949	-4.589	-1.703	-3.575	-0.020	-0.010	-0.014
Belgium	0.135	0.651	0.305	-0.508	0.940	-0.026	-0.762	-0.211	-0.546	-11.294	-3.096	-8.213	-0.017	-0.005	-0.010
Czech Republic	0.000	0.050	0.025	-3.849	-1.303	-2.291	-1.000	-0.906	-0.952	-5.060	-0.734	-3.084	-0.020	-0.010	-0.015
Denmark	0.001	0.108	0.018	-5.833	-1.001	-3.419	-0.998	-0.806	-0.965	-2.941	-1.271	-2.307	-0.020	-0.010	-0.015
Finland	0.000	0.014	0.002	-7.238	-3.679	-5.360	-1.000	-0.973	-0.996	-2.434	-1.091	-1.698	-0.020	-0.010	-0.015
France	0.081	0.541	0.252	-1.901	-0.083	-0.982	-0.850	-0.298	-0.622	-14.365	-5.072	-11.146	-0.017	-0.005	-0.011
Germany	0.044	0.270	0.103	-3.222	-1.584	-2.493	-0.916	-0.575	-0.819	-36.646	-12.871	-28.483	-0.019	-0.009	-0.013
Greece	0.000	0.436	0.074	-3.098	1.698	-0.441	-1.000	-0.393	-0.882	-0.982	-0.263	-0.640	-0.020	-0.006	-0.014
Hungary	0.000	0.078	0.004	-3.961	-0.294	-2.758	-1.000	-0.855	-0.992	-3.147	-0.711	-2.152	-0.020	-0.010	-0.015
Italy	0.002	0.123	0.035	-4.978	-1.697	-3.079	-0.996	-0.781	-0.934	-13.735	-6.039	-10.789	-0.020	-0.009	-0.014
Latvia	0.000	0.507	0.123	-1.464	0.180	-0.382	-1.000	-0.327	-0.814	-0.353	-0.047	-0.222	-0.020	-0.007	-0.013
Lithuania	0.000	5.272	1.177	-1.813	2.709	-0.014	-1.000	0.681	-0.372	-0.823	0.183	-0.301	-0.020	0.047	-0.001
Luxembourg	0.010	5.840	2.652	-5.137	1.569	-0.669	-0.981	0.708	0.157	-0.573	0.690	-0.023	-0.019	0.063	0.022
Netherlands	1.579	2.896	2.283	-0.339	0.534	0.176	0.225	0.487	0.383	-7.617	14.991	-0.633	0.010	0.038	0.019
Poland	0.000	0.046	0.011	-4.935	-1.252	-2.953	-1.000	-0.911	-0.978	-6.667	-0.801	-3.779	-0.020	-0.010	-0.015
Portugal	0.022	4.153	1.146	-5.437	-1.116	-2.945	-0.957	0.612	-0.242	-1.344	0.961	-0.652	-0.018	0.052	0.002
Slovenia	0.000	0.215	0.085	-2.692	0.252	-1.017	-1.000	-0.646	-0.851	-1.124	-0.221	-0.670	-0.020	-0.009	-0.014
Spain	0.126	1.447	0.697	-1.857	-0.330	-1.034	-0.776	0.183	-0.255	-6.429	-1.857	-4.523	-0.017	0.007	-0.005
Sweden	0.000	0.027	0.006	-6.746	-2.908	-4.473	-1.000	-0.948	-0.988	-4.715	-1.909	-3.576	-0.020	-0.010	-0.015

(Continued)

(Continue)

Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
United Kingdom	0.006	0.156	0.044	-5.266	-2.163	-3.762	-0.989	-0.730	-0.918	-13.695	-6.844	-10.353	-0.020	-0.009	-0.014
<b>Oceania</b>															
Australia	0.000	0.063	0.010	-7.300	1.190	-2.474	-1.000	-0.881	-0.982	-6.857	-1.587	-4.317	-0.020	-0.010	-0.015
Fiji	0.000	207.540	55.575	4.124	7.432	5.814	-1.000	0.990	0.659	-0.015	1.190	0.429	-0.019	2.092	0.735
New Zealand	0.000	0.063	0.016	-7.062	-3.576	-5.231	-1.000	-0.882	-0.969	-1.043	-0.334	-0.725	-0.020	-0.010	-0.015

Source: Authors Computed from FAO (2021)

### 5.3.8 Pineapple

According to the BRCA index, Benin, Cameroon, Cote d'Ivoire, Ghana, Guyana, Kenya, Mauritius, Togo and Uganda in Africa retained the comparative advantage in pineapple exports as the index values were greater than 1. Among these countries, Cote d'Ivoire (47.496) and Ghana (24.707), had a strong comparative advantage. The BRCA index values for the remaining countries in the same region ranged between 1.196 and 8.168. In the American region, Costa Rica remained at the top place (617.450), followed by Dominica (93.620), Honduras (32.008), Ecuador (20.170), and Guatemala. Only two countries in the Asian region had a specialization in pineapple exports. They were the Philippines (17.492), and Sri Lanka (3.039). The Netherlands (2.786) and Portugal (3.898) had a comparative advantage in the European region according to the BRCA index values. Therefore, Costa Rica had the strongest comparative advantage in the world for exporting pineapple to the world market. It can be seen that how Costa Rica was stronger by comparing its BRCA index values with the lowest comparative advantaged (1.196) country (Kenya). Sri Lanka's index value was 203 times lower than that of Costa Rica.

It is obvious that according to Vollrath index, many countries in the African region have a comparative advantage. Except for Botswana, Egypt, Ethiopia, and Morocco, the index values of all other countries take positive signs. Cote d'Ivoire (9.103) remained at the top position, followed by Ghana (7.082), Mauritius (7.10), Cameroon (6.224), and Tanzania (5.895). Bolivia, Guinea, Guyana, Kenya, Madagascar, Rwanda, South Africa and Togo were the rest of the countries in the same region that specialized in pineapple exports to the world. In the American region, Costa Rica occupied the top position, also having the strongest comparative advantage (9.192) in the world, followed by Ecuador (7.351), Guatemala (5.342), and Honduras (5.643). Vallarta index values ranged between 1.604 to 4.26 for the rest, namely Cuba, Dominica, Jamaica, Mexico, Nicaragua, Paraguay, Peru, and Trinidad and Tobago. In the Asian region, the Philippines had the strongest comparative advantage (9.31), followed by Sri Lanka (6.570), India (5.758), and Thailand (5.479). According to Vollrath index, Sri Lanka's comparative advantage was better than BRCA. Indonesia (2.166) and Malaysia (2.456) also have a comparative advantage. Further, Belgium (0.219), Georgia (0.059), and Netherland (0.236) in the European region and Fiji in Oceania had a comparative advantage.

According to the RSCA index, in the American region, Cote d'Ivoire (0.903) was viewed as the country having the strongest comparative advantage, followed by Mauritius (0.677). Cameroon, Ghana, Guyana, Toga and Uganda were the rest of the countries in that specialized in pineapple exports in the same region, and their RSCA index values ranged between 0.125 - 0.395. The RSCA index value of Cote d'Ivoire was six times higher than that of the lowest (0.125) reported in Uganda. RSCA index values among four American region countries, Costa Rica (0.996) had the strongest comparative advantage. Dominica (0.512), Ecuador (0.894), Guatemala (0.764), and Honduras (0.653) got positive signs indicating the comparative advantage. This country group shows a common feature of having a strong comparative advantage. Only two

countries in the Asian region, the Philippines (0.868) and Sri Lanka (0.304), had a comparative advantage. The Philippines's and Cote d'Ivoire index values were approximately three times larger than that of Sri Lanka. Belgium (0.584), the Netherlands (0.435), and Portugal (0.460) are the three countries in the European region that specialize in pineapple exports in the world market.

Cote d'Ivoire (28.624 in  $10^{-7}$ ) retained the highest comparative advantage in the African region according to the NRCA index value, and this result is supported by BRCA, Vollrath RCA, and RSCA indexes. Followed by Cote d'Ivoire, Ghana received the second-highest index value (7.659 in  $10^{-7}$ ) in the same region. Cameroon, Guyana, Mauritius, Togo and Uganda were the remaining countries in the region, and their index values were relatively low (0.056 – 0.399 in  $10^{-7}$ ). Costa Rica remains at the highest (394.095 in  $10^{-7}$ ) in the American and other regions. Further, Ecuador (19.653 in  $10^{-7}$ ) and Honduras (14.269 in  $10^{-7}$ ) had a strong comparative advantage in pineapple exports. Guatemala and Dominica in the American region also had comparative advantage. According to the NRCA index, only two Asian countries, the Philippines (59.750 in  $10^{-7}$ ) and Sri Lanka (1.056 in  $10^{-7}$ ), had the comparative advantage in pineapple exports to the world. It is obvious that Sri Lanka's NRCA index value was very low compared to the world's highest, Costa Rica and the neighboring country Philippines. Belgium (87.960 in  $10^{-7}$ ), Netherland (55.515 in  $10^{-7}$ ), and Portugal (9.483 in  $10^{-7}$ ) also had a comparative advantage in pineapple exports.

The calculated AI values revealed a stronger comparative advantage for Cote d'Ivoire (4.173 in  $10^{-3}$ ) followed by Ghana (2.173 in  $10^{-3}$ ) Benin, Cameroon, Guyana, Kenya, Mauritius, Togo, and Uganda. Costa Rica (62.189 in  $10^{-3}$ ) stands as the strongest comparative advantaged country in the American region and among all the regions, even according to the AI values. Followed by Costa Rica, Dominica (10.168), Ecuador (1.956), Guatemala (1.031), and Honduras (3.108) the rest of the countries in the American region have specialized in pineapple exports. Surprisingly, none of the Asian countries got a positive sign for AI values, which implies all the countries in the Asian region had a comparative disadvantage according to the AI values. Further, In the European region, Belgium (0.330), Netherland (0.184) and Portugal (0.292) were the countries that have specialization in pineapple exports.

Previous empirical studies also support the findings of the present study. Henry and Chato (2019) assessed the pineapple supply chain in the Philippines, focusing on economic and social upgrading. Thus, the analysis revealed that the Philippines has high demand from North America, East Asia, the Pacific region, and Europe. The study by Untoro et al. (2021) and Wiranthi and Mubarok (2017) highlighted a comparative advantage over Indonesian processed pineapple exports. Similarly, the analysis by Ferreira et al. (2018) focused on the success and shortcomings of the pineapple exports of Costa Rica and has identified that as one of the emerging export industries, the country was able to gain the comparative advantage in pineapple. Further, CBI Market Information Database (2014) revealed that as a dominant exporter to the EU market, Costa Rica became a model for neighbouring economies. To assess the Sri Lankan pineapple supply chain, an analysis was performed by International

Development Center( n.d.), and the findings revealed that the Sri Lankan pineapple industry cater to main four markets and the country has the potential to expand further.

Table 5.9: Mean, Maximum and Minimum Comparative Advantage Scores of Pineapple, 2000-2019 (NRCA values in  $10^{-7}$ , AI values in  $10^{-3}$ )

Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
<b>Africa</b>															
Benin	0.000	2.975	1.358	0.000	0.000		-1.000	0.497	-0.059	-0.200	0.145	-0.024	-0.103	0.197	0.033
Bolivia	0.000	1.666	0.803	4.944	4.944	4.944	-1.000	0.250	-0.168	-0.836	0.215	-0.286	-0.115	0.073	-0.020
Botswana	0.000	0.003	0.001	-5.614	-4.579	-5.142	-1.000	-0.993	-0.999	-0.812	-0.232	-0.481	-0.120	-0.062	-0.100
Cameroon	0.000	7.874	2.838	5.333	7.754	6.224	-1.000	0.775	0.193	-0.431	1.816	0.399	-0.092	0.731	0.188
Cote d'Ivoire	7.018	195.250	47.496	7.315	10.846	9.103	0.751	0.990	0.903	4.649	72.105	28.624	0.724	12.047	4.173
Egypt, Arab Rep.	0.000	0.119	0.018	-2.832	0.469	-1.391	-1.000	-0.787	-0.966	-2.885	-0.461	-1.894	-0.118	-0.061	-0.098
Ethiopia	0.000	1.001	0.094	-2.735	6.277	1.670	-1.000	0.001	-0.874	-0.320	0.012	-0.174	-0.117	0.000	-0.090
Ghana	0.000	136.428	24.707	5.147	9.007	7.082	-1.000	0.985	0.395	-1.221	43.491	7.659	-0.105	14.267	2.173
Guinea	0.000	2.970	0.240	1.663	1.663	1.663	-1.000	0.496	-0.810	-0.429	0.208	-0.142	-0.119	0.157	-0.079
Guyana	0.000	6.141	2.320	1.700	1.700	1.700	-1.000	0.720	0.228	-0.087	0.375	0.056	-0.119	0.489	0.120
Kenya	0.000	10.790	1.196	-0.290	8.592	2.939	-1.000	0.830	-0.313	-0.585	3.240	-0.050	-0.107	1.129	0.024
Madagascar	0.000	0.539	0.138	3.142	5.133	4.278	-1.000	-0.299	-0.802	-0.273	-0.046	-0.130	-0.117	-0.042	-0.085
Mauritius	0.328	16.397	8.168	4.612	8.294	7.100	-0.506	0.885	0.677	-0.170	1.914	1.071	-0.064	1.398	0.716
Morocco	0.000	0.026	0.002	-7.244	-3.274	-5.466	-1.000	-0.949	-0.997	-2.780	-0.680	-1.666	-0.120	-0.062	-0.099
Rwanda	0.000	2.223	0.337	0.540	4.161	1.838	-1.000	0.379	-0.725	-0.069	0.028	-0.021	-0.119	0.130	-0.062
South Africa	0.349	1.754	0.598	2.779	4.977	3.564	-0.482	0.274	-0.292	-8.553	2.157	-3.994	-0.076	0.047	-0.043
Togo	0.000	23.403	6.144	2.528	5.690	3.508	-1.000	0.918	0.255	-0.072	1.263	0.299	-0.105	2.383	0.531
Uganda	0.232	29.047	2.871	0.000	0.000	#DIV/0!	-0.623	0.933	0.125	-0.138	1.079	0.084	-0.081	1.739	0.140
Tanzania	0.015	2.299	0.350	5.308	6.375	5.895	-0.971	0.394	-0.579	-0.412	0.116	-0.220	-0.105	0.138	-0.064
<b>America</b>															
Brazil	0.027	1.199	0.362	0.747	8.572	4.286	-0.947	0.091	-0.565	-23.685	1.048	-12.240	-0.112	0.012	-0.066
Canada	0.000	0.028	0.007	-8.466	-3.914	-6.135	-1.000	-0.945	-0.986	-45.197	-24.096	-36.415	-0.119	-0.062	-0.099
Chile	0.000	0.210	0.032	-8.231	-2.107	-4.855	-1.000	-0.653	-0.943	-7.695	-1.709	-5.208	-0.119	-0.062	-0.096
Colombia	0.065	2.516	0.633	0.174	9.082	4.093	-0.879	0.431	-0.406	-5.007	2.921	-1.740	-0.112	0.182	-0.031
Costa Rica	309.395	862.215	617.450	4.200	11.968	9.192	0.994	0.998	0.996	186.542	584.201	394.095	20.715	96.901	62.189
Cuba	0.000	5.428	0.728	2.081	4.828	3.455	-1.000	0.689	-0.615	-0.615	0.716	-0.188	-0.119	0.533	-0.018
Dominica	0.000	892.703	93.620	1.686	7.927	3.428	-1.000	0.998	0.512	-0.004	0.967	0.112	-0.119	102.829	10.168
Ecuador	8.538	32.402	20.170	4.818	9.328	7.351	0.790	0.940	0.894	3.546	33.615	19.653	0.468	3.308	1.956
El Salvador	0.000	0.016	0.004	-6.788	-4.639	-5.684	-1.000	-0.968	-0.992	-0.566	-0.273	-0.425	-0.120	-0.062	-0.099
Guatemala	1.850	35.086	10.839	2.038	7.647	5.342	0.298	0.945	0.764	0.220	22.565	5.463	0.053	3.931	1.031
Honduras	0.000	64.371	32.008	4.010	8.212	5.643	-1.000	0.969	0.653	-0.762	27.831	14.269	-0.096	5.400	3.108

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Jamaica	0.000	0.055	0.012	1.036	2.765	1.789	-1.000	-0.897	-0.977	-0.233	-0.106	-0.145	-0.119	-0.062	-0.098
Mexico	0.452	0.946	0.671	3.137	4.763	3.859	-0.377	-0.028	-0.209	-28.524	2.716	-14.133	-0.058	-0.006	-0.033
Nicaragua	0.000	1.336	0.294	-3.060	4.345	0.425	-1.000	0.144	-0.638	-0.486	0.033	-0.258	-0.114	0.021	-0.073
Paraguay	0.000	1.532	0.606	-2.155	3.370	1.604	-1.000	0.210	-0.320	-0.903	-0.122	-0.302	-0.092	0.047	-0.038
Peru	0.000	0.148	0.037	-1.825	5.911	1.965	-1.000	-0.742	-0.931	-4.436	-0.599	-2.763	-0.116	-0.059	-0.096
Trinidad and Tobago	0.000	0.269	0.078	-2.832	5.101	1.645	-1.000	-0.576	-0.865	-1.790	-0.337	-0.924	-0.117	-0.052	-0.092
United States	0.156	0.838	0.664	-2.380	-0.391	-0.988	-0.730	-0.088	-0.216	-113.007	1.566	-58.841	-0.087	-0.016	-0.034
Uruguay	0.000	0.012	0.002	-5.995	-4.293	-5.202	-1.000	-0.977	-0.996	-0.870	-0.178	-0.543	-0.119	-0.062	-0.099
<b>Asia</b>															
Bahrain	0.000	0.166	0.029	-4.493	-1.072	-3.086	-1.000	-0.715	-0.946	-2.072	-0.532	-1.280	-0.115	-0.062	-0.097
China	0.008	0.033	0.018	-3.812	-0.100	-2.177	-0.985	-0.935	-0.965	-235.099	-23.063	-137.544	-0.118	-0.060	-0.098
Hong Kong SAR, China	0.000	0.110	0.028	-7.470	-0.536	-2.859	-1.000	-0.802	-0.948	-54.122	-18.178	-36.702	-0.119	-0.061	-0.097
India	0.041	0.138	0.078	3.940	7.651	5.758	-0.922	-0.758	-0.856	-29.311	-3.570	-17.801	-0.114	-0.055	-0.092
Indonesia	0.000	0.663	0.150	-3.038	7.446	2.166	-1.000	-0.202	-0.782	-19.427	-1.394	-11.075	-0.119	-0.039	-0.084
Japan	0.000	0.001	0.000	-10.437	-6.843	-8.262	-1.000	-0.998	-1.000	-78.542	-38.522	-61.397	-0.120	-0.062	-0.100
Kazakhstan	0.000	0.029	0.002	-7.776	-2.894	-5.539	-1.000	-0.943	-0.996	-8.253	-0.825	-4.444	-0.120	-0.062	-0.099
Kuwait	0.000	0.041	0.010	-6.284	-3.534	-4.349	-1.000	-0.922	-0.980	-11.353	-1.467	-5.710	-0.115	-0.062	-0.099
Malaysia	0.178	0.414	0.284	1.313	3.531	2.456	-0.698	-0.414	-0.562	-20.120	-4.207	-13.410	-0.090	-0.036	-0.072
Oman	0.000	0.047	0.013	-4.391	-2.402	-3.556	-1.000	-0.910	-0.975	-5.283	-1.038	-2.867	-0.118	-0.062	-0.098
Korea, Dem. People's Rep.	0.000	0.001	0.000	-15.459	-10.564	-13.479	-1.000	-0.997	-1.000	-57.742	-14.362	-38.876	-0.120	-0.062	-0.136
Philippines	8.545	40.078	17.492	7.076	12.384	9.310	0.790	0.951	0.868	22.462	164.565	59.750	0.589	4.506	-0.133
Saudi Arabia	0.000	0.098	0.033	-7.768	-0.886	-3.275	-1.000	-0.821	-0.938	-36.902	-6.135	-20.802	-0.119	-0.062	-0.045
Singapore	0.000	0.007	0.002	-5.942	-3.081	-4.792	-0.999	-0.985	-0.996	-39.637	-11.566	-28.629	-0.120	-0.062	-0.137
Sri Lanka	0.000	5.131	3.039	3.789	8.685	6.570	-1.000	0.674	0.304	-1.140	2.500	1.056	-0.115	0.439	-0.136
Thailand	0.062	0.395	0.195	3.166	9.394	5.479	-0.884	-0.433	-0.686	-20.815	-3.796	-13.869	-0.113	-0.037	-0.134
Turkey	0.000	0.051	0.005	-7.322	-0.210	-3.434	-1.000	-0.903	-0.990	-16.894	-2.621	-10.734	-0.120	-0.061	-0.099
United Arab Emirates	0.000	0.395	0.105	-2.557	-0.798	-1.598	-1.000	-0.434	-0.831	-35.726	-4.404	-19.371	-0.119	-0.062	-0.088
<b>Europe</b>															
Austria	0.082	0.275	0.154	-2.151	-1.062	-1.632	-0.849	-0.569	-0.737	-16.740	-5.438	-12.092	-0.106	-0.053	-0.085
Belarus	0.000	0.115	0.019	-6.954	-1.898	-3.996	-1.000	-0.794	-0.965	-4.376	-0.695	-2.322	-0.120	-0.062	-0.098
Belgium	1.833	6.996	4.340	-0.088	0.507	0.219	0.294	0.750	0.584	6.699	208.949	87.960	0.096	0.653	0.330

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Country	RCA			Vollrath RCA			RSCA			NRCA			AI		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Bulgaria	0.000	0.028	0.004	-6.053	-2.306	-4.266	-1.000	-0.946	-0.993	-3.202	-0.463	-1.913	-0.120	-0.062	-0.099
Croatia	0.000	0.426	0.091	-6.169	-0.816	-3.474	-1.000	-0.402	-0.865	-1.368	-0.422	-0.991	-0.119	-0.058	-0.090
Czech Republic	0.010	0.227	0.080	-3.499	-0.942	-2.125	-0.980	-0.631	-0.856	-18.596	-2.642	-11.097	-0.116	-0.059	-0.092
Denmark	0.010	0.100	0.047	-4.165	-2.301	-3.078	-0.980	-0.818	-0.912	-10.474	-4.699	-8.501	-0.113	-0.060	-0.095
Estonia	0.000	0.045	0.008	-6.198	-1.940	-4.219	-1.000	-0.914	-0.984	-1.617	-0.366	-1.063	-0.119	-0.062	-0.099
Finland	0.000	0.053	0.004	-7.899	-2.442	-6.009	-1.000	-0.900	-0.993	-9.206	-4.121	-6.413	-0.119	-0.062	-0.099
France	0.099	2.771	0.794	-2.549	0.239	-1.111	-0.820	0.470	-0.325	-52.470	97.956	-14.318	-0.103	0.163	-0.027
Georgia	0.000	2.876	0.584	-1.479	0.593	0.059	-1.000	0.484	-0.594	-0.244	0.174	-0.064	-0.119	0.190	-0.036
Germany	0.102	0.365	0.218	-2.125	-1.199	-1.584	-0.815	-0.465	-0.648	-137.282	-43.209	-94.089	-0.107	-0.051	-0.078
Greece	0.049	0.432	0.236	-1.622	-0.052	-0.889	-0.907	-0.397	-0.632	-3.139	-0.829	-2.048	-0.100	-0.047	-0.076
Hungary	0.000	0.128	0.019	-6.687	-0.627	-2.917	-1.000	-0.774	-0.963	-11.736	-2.691	-8.033	-0.119	-0.062	-0.098
Ireland	0.003	0.036	0.018	-4.215	-2.664	-3.458	-0.993	-0.931	-0.965	-15.875	-7.366	-11.070	-0.118	-0.062	-0.098
Italy	0.226	0.500	0.351	-2.210	-1.307	-1.728	-0.632	-0.334	-0.485	-43.600	-6.358	-30.011	-0.088	-0.043	-0.065
Latvia	0.012	0.765	0.276	-4.353	-0.393	-1.902	-0.976	-0.133	-0.619	-1.226	-0.151	-0.699	-0.115	-0.021	-0.073
Netherlands	1.097	3.980	2.786	-0.137	0.531	0.236	0.046	0.598	0.435	2.199	114.750	55.515	0.006	0.358	0.184
Norway	0.000	0.007	0.002	-7.996	-4.522	-5.852	-1.000	-0.987	-0.996	-16.372	-5.619	-10.733	-0.120	-0.062	-0.099
Poland	0.000	0.274	0.125	-4.167	-0.645	-1.378	-1.000	-0.570	-0.787	-23.661	-3.031	-13.024	-0.109	-0.062	-0.087
Portugal	0.820	9.976	3.898	-1.114	0.446	-0.279	-0.099	0.818	0.460	-3.240	40.648	9.483	-0.018	0.946	0.292
Romania	0.000	0.182	0.030	-5.695	-0.545	-2.922	-1.000	-0.692	-0.945	-7.596	-0.994	-4.322	-0.120	-0.062	-0.097
Russian Federation	0.002	0.010	0.006	-6.836	-4.628	-5.419	-0.997	-0.980	-0.989	-50.487	-9.684	-31.474	-0.119	-0.062	-0.099
Serbia	0.000	0.059	0.019	-5.279	-1.835	-3.073	-1.000	-0.888	-0.975	-1.869	0.000	-0.852	-0.119	-0.087	-0.101
Slovak Republic	0.001	0.233	0.084	-5.804	-0.794	-2.228	-0.997	-0.622	-0.852	-7.923	-1.128	-5.177	-0.114	-0.062	-0.091
Slovenia	0.000	0.709	0.356	-6.459	-0.246	-1.442	-1.000	-0.171	-0.528	-3.112	-0.836	-1.896	-0.104	-0.028	-0.064
Spain	0.547	1.479	0.835	-1.212	-0.386	-0.967	-0.293	0.193	-0.107	-18.332	11.679	-8.911	-0.050	0.038	-0.017
Sweden	0.002	0.073	0.017	-5.504	-1.753	-3.528	-0.997	-0.863	-0.967	-17.833	-7.206	-13.377	-0.119	-0.061	-0.098
Switzerland	0.001	0.021	0.007	-7.175	-3.895	-5.103	-0.998	-0.958	-0.985	-34.125	-7.676	-20.114	-0.120	-0.062	-0.099
United Kingdom	0.007	0.489	0.214	-4.486	-1.147	-2.193	-0.986	-0.343	-0.671	-48.953	-20.371	-33.565	-0.105	-0.045	-0.077
<b>Oceania</b>															
Australia	0.000	0.007	0.002	-4.650	-1.389	-2.720	-1.000	-0.987	-0.996	-25.918	-6.037	-16.371	-0.120	-0.062	-0.099
Fiji	0.000	0.131	0.025	0.998	4.071	2.021	-1.000	-0.768	-0.953	-0.122	-0.049	-0.080	-0.119	-0.059	-0.097
New Zealand	0.000	0.038	0.014	-6.192	-3.402	-4.795	-1.000	-0.928	-0.972	-3.922	-1.269	-2.728	-0.119	-0.062	-0.098

Source: Authors Computed from FAO (2021)

## 5.4 Ranking of Countries

### 5.4.1 Avocado

Based on the strength of the comparative advantage on the average values for NRCA, determine the countries that experience the highest benefits and those that unable in gaining the advantage from 2000 to 2019. Respectively, Mexico, Netherlands, Chile, Peru, Spain, Israel, New Zealand, South Africa, Kenya, and Morocco were remarked as the highest advantageous countries. Thus, as identified above, the most advantageous region was the American region. Despite the Netherlands, the leading countries were in the American and African regions. The countries that experience the less advantage can be identified as Germany, the United States of America, Korea, Canada, Italy, the United Kingdom, the Russian Federation, Singapore, and Saudi Arabia. Thus, moving into the position of Sri Lanka on world rank among selected 83 countries, Sri Lanka ranked 38<sup>th</sup> place where the most of other selected 15 Asian countries were ranked below 50<sup>th</sup>. Israel as 6<sup>th</sup>, Lebanon as 25<sup>th</sup>, the Syria Arab Republic as 34<sup>th</sup>, Brunei as 36<sup>th</sup> and Bahrain as 46<sup>th</sup>, denoting that Sri Lanka can be specialized to some extent compared with other Asian countries. Considering the less advantage countries, most Asian countries were experiencing a disadvantage in exporting avocado in the respective period.

### 5.4.2 Banana

Identifying the most advantageous and less advantageous countries in exporting bananas to the world market ranking as per the NRCA averages, the most advantageous top ten countries were Ecuador, Costa Rica, Colombia, Belgium, the Philippines, Guatemala, Honduras, Panama, Cote d'Ivoire, and Cameroon Respectively. Thus, most of the top rankers were in the American region. Countries that experience disadvantage from 2000 to 2019 are China, the United States, Germany, Republic of Korea, United Kingdom, Hong Kong, Canada, the Netherlands, France, and Italy. Commonly countries in the European region were mostly disadvantageous among the above-identified countries. The stance of Sri Lanka as 37<sup>th</sup> among selected countries and moving in Sri Lanka's position in Asia, Philippines, Lebanon, Cambodia, and Jordan are the countries ranked above the position of Sri Lanka. And most of the countries in Asia are ranked below 50<sup>th</sup> position among selected countries in exporting bananas, implying the disadvantage as a region too.

### 5.4.3 Cashew

Observing the world ranking on cashew exports based on the NRCA average values rankings, India, Cote d'Ivoire, Tanzania, Brazil, Ghana, Benin, Nigeria, Indonesia, Guinea, and Cambodia can be identified as the leading countries that gained comparative advantage between 2000 and 2019. As mentioned previously, the African region countries could gain an advantage in cashew exports. However, India was able to be the top leader in specializing in Cashew exports. While Indonesia, Cambodia,

Lebanon, and Sri Lanka were other leading countries in the Asian region. In the world rankings among selected countries, Sri Lanka's ranking is 27<sup>th</sup>, and the country gains many benefits compared with the other countries in the region too as most the Asian countries were ranked below 50<sup>th</sup> in world rankings. Moving into the most disadvantage, China, United States, Germany, France, Republic of Korea, Hong Kong, United Kingdom, Canada, and Russian Federation can be identified, mentioning that mostly European region countries weren't able to be leading exporters in cashews.

#### **5.4.4 Lime and Lemon**

The world rankings on lime and lemon as per the strength of comparative advantage based on the NRCA values indicated that Sri Lanka's stance is 39<sup>th</sup> among the selected countries in the present study. The Maldives as 4<sup>th</sup>, Lebanon as 12<sup>th</sup>, Jordan as 15<sup>th</sup>, and Afghanistan as 21<sup>st</sup> is ranked above Sri Lanka's competitors in the Asian region. Considering the South Asian countries reviewed it's notable that Maldives and Afghanistan comparative advantage was much strengthened than that of Sri Lanka and Pakistan. Bangladesh, and India were ranked below the 50<sup>th</sup>. Further, recognizing the world-leading countries that are gaining comparative advantage respectively, Spain, Turkey, Argentina, Maldives, South Africa, Morocco, Chile, Uruguay, Brazil, and Egypt could be mentioned. Further, as identified above, countries in the American region were able to be ranked among the top leading countries according to the NRCA. On the other hand, considering the most disadvantaged countries according to the NRCA indexes, China, Germany, United States, France, United Kingdom, Canada, Hong Kong, Russian Federation, Singapore, and Belgium can be identified.

#### **5.4.5 Mango**

Considering the strength of the comparative advantage of the average values for the NRCA index, define the countries that encounter the highest benefits and the countries that not able in gaining the advantage throughout the study period. Mexico, India, Brazil, Peru, Netherlands, Thailand, Philippines, Pakistan, Ecuador, and Israel were remarked as the highest advantageous countries. Thus, as found above, the most advantageous region is the American region, the leading countries were in the American region other than India. The countries that experience the most disadvantage can be identified as Germany, Italy, Republic of Korea, the United Kingdom, Hong Kong, Russian Federation, France, Singapore, Saudi Arabia, and Switzerland. Thus, moving into the rank of Sri Lanka in the world ranking among selected 86 countries, Sri Lanka ranked 43<sup>rd</sup> place where the most of other selected 10 Asian countries were ranked below 50<sup>th</sup>. India was 2<sup>nd</sup>, Thailand was 6<sup>th</sup>, Pakistan was 8<sup>th</sup>, Cambodia was 22<sup>nd</sup>, and Lebanon was 40<sup>th</sup>, which signifies that Sri Lanka was able to specialize to some extent compared with other Asian countries. Considering most disadvantage countries, most of the European countries were experiencing a disadvantage in exporting mango in the respective period.

#### 5.4.6 Orange

Observing the countries' positions on orange exports based on the NRCA average rankings, Spain, South Africa, Egypt, Greece, Morocco, Turkey, Australia, Uruguay, Argentina, and Lebanon correspondingly can be identified as the prominent countries that achieved comparative advantage between 2000 and 2019. Considering the Asian region countries, Turkey as 6<sup>th</sup>, Lebanon as 10<sup>th</sup>, Afghanistan as 24<sup>th</sup>, Jordan as 29<sup>th</sup>, Israel as 32<sup>nd</sup>, and Sri Lanka as 40<sup>th</sup> ranked as the leading Asian countries. It can be identified that most Asian countries were ranked below 50<sup>th</sup>. Moving into the most disadvantage biggest losers over exporting oranges, China, Germany, Japan, France, Republic of Korea, United Kingdom, Canada, Russian Federation, United States of America, and Belgium can be identified, revealing that mainly in European region, countries weren't able to be gain advantage in exporting oranges.

#### 5.4.7 Papaw

The world ranks on papaw according to the strength of comparative advantage based on the strengths of the NRCA values, indicate that Sri Lanka's stance as 9<sup>th</sup> among the selected countries in the present study. Malaysia as 3<sup>rd</sup> and the Philippines as 5<sup>th</sup>, are ranked above Sri Lanka's position being competitors in the Asian region. Considering the South Asian countries reviewed, Sri Lanka is the leading among the considered countries. Further, recognizing the world top countries that achieved comparative advantage are respectively Mexico, Brazil, Malaysia, Guatemala, Philippines, Jamaica, Ecuador, Costa Rica, Sri Lanka, and Fiji. Further, as found above, countries in the American region were able to be ranked among the top leading countries according to the strength of NRCA. Moreover, considering the most disadvantage countries in the reference period according to the NRCA indexes, China, Germany, United States, France, Italy, United Kingdom, Canada, Hong Kong, Belgium, and Singapore can be identified.

#### 5.4.8 Pineapple

Distinguishing the most advantage and disadvantage countries in exporting pineapples to the world market ranking as per the NRCA averages, the most beneficial top ten countries are Costa Rica, Belgium, Philippines, Netherland, Cote d'Ivoire, Ecuador, Honduras, Portugal, Ghana and Guatemala, respectively. Thus, most of the top rankers are scattered around the world. Countries experiencing disadvantage are China, Germany, Republic of Korea, Japan, United States, Hong Kong, Canada, United Kingdom, Russian Federation, and Italy. The stance of Sri Lanka as 12<sup>th</sup> among selected countries and moving in Sri Lanka's position in Asia, the Philippines as ranking 3<sup>rd</sup> being the leading in the region while Sri Lanka ranked the second in the region and despite Bahrain, other selected countries are ranked below 50<sup>th</sup> rank in exporting Pineapple.

Concluding the above analysis, on the comparative advantaged countries and the level of the comparative advantage according to the present analysis, utilizing the BRCA, Vollrath RCA, RSCA, NRCA and the AI index, Sri Lanka was able to gain the comparative advantage only over papaw and pineapple exporting. In addition, some of the other countries can enhance their comparative advantage over the referenced period.

## CHAPTER SIX

### Patterns of Comparative Advantage

#### 6.1 Introduction

This chapter analyses the trends and patterns of comparative advantage of the selected eight fruit crops. The trend analysis was performed for not only Sri Lanka but also for all the countries that export the selected fruit crops to make a comprehensive analysis. Therefore, trends of comparative advantage were analysed for individual countries over the period, classifying the countries into regions as in FAO, i.e., America, Europe, Asia, Africa, and Oceania. The Signs of coefficients reported in the Table 6-2 showed whether the comparative advantage significantly increased or decreased from 2000 to 2019.

#### 6.2 Trend Analysis

##### 6.2.1 Avocado

The study summarized the overall trends of the comparative advantage of selected countries according to the respective region. In the Asian region, Brunei, Hong Kong, Lebanon, Malaysia, Singapore, and the Republic of Korea illustrated positive trends in comparative advantage significant at a 1% level, while Sri Lanka and the Syrian Arab Republic gained the same results significant at 5% level.

Compared with the Asian region, most American countries recorded positive trends. Brazil, Colombia, Peru, and Uruguay increased the trend at a 1% level while the United States increased at a 5% level, followed by Saint Vincent at 10% level. The trend of comparative advantage of Dominica was decreased at 5% level. Canada, Cuba, Ecuador, Honduras, Mexico, Saint Lucia, Trinidad, and Tobago were the same trend at 5% from 2000 to 2019.

Furthermore, African region countries mostly recorded a positive trend. Burundi, Ivory Coast, Kenya, Rwanda, and Tanzania were significant at a 1% level, whereas Ethiopia gained the same results significant at 5%. However, the trend of comparative advantage of South Africa decreased, which was significant at the 5% level, while the trend of all other selected countries was insignificant.

Moving into the European region, it recorded mixed results in trend analysis than other regions (Asia, America, and Africa). Austria, Belarus, Bulgaria, Czech Republic, Denmark, Estonia, Finland, Georgia, Hungary, Latvia, Luxembourg, Netherland, Poland, and Portugal showed a positive trend in comparative advantage, which was significant at a 1% level. Russian Federation, Slovakia, Slovenia, and Switzerland stated a positive and significant trend at a 5% level, and the United Kingdom was the same positive and significant trend at 10% level. By contrast, Estimates from France and Greece showed

a declining comparative advantage at 1% and 5% significant levels, respectively, for the selected period. Finally, Oceania region countries such as Australia and New Zealand registered a negative trend, however, only New Zealand was significant at a 10% level.

### **6.2.2 Banana**

According to banana trend analysis, Pakistan and the Philippines gained a positive and significant trend at a 1% level, while it was significant at a 5% level for Sri Lanka, Cambodia, Indonesia, and Kazakhstan. The trend of Thailand also widened significantly during the study period (2000-2019) at the 10% level. By contrast, China and Malaysia experienced a significant and declined trend at a 1% level while Hong Kong diminished the trend, significant at 10% level.

Moving to the American region, the positive and significant trends for Bolivia, Guatemala, Mexico, Peru, and Paraguay were observed at 1% level, while it was significant at 5% level for Belize, Canada, and Jamaica. However, significant declining trends were recorded in Brazil, Colombia, Guatemala, Mexico, Panama, Paraguay, St. Lucia, and St. Vincent at 1% level. Nicaragua has shown a downtrend among the countries, which was significant at 5% level.

Considering the African region, Burundi, Cote d'Ivoire, Eswatini, and South Africa gained a positive and significant trend at a 1% level, whereas Ethiopia, Madagascar, Nigeria, and Tanzania gained the positive trend, which was significant at 5% level. Uganda showed a negative and significant trend at the 5% level. By contrast, Ghana, Kenya, and Zimbabwe had a negative trend, but they were insignificant.

When compared with other regions, most European countries indicated an insignificant negative trend in the analysis from 2000 to 2019. Nevertheless, Greece, Latvia, Netherlands, Russia, and Slovenia have shown significant growth in comparative advantage at 1% level, while it was significant at 5% level for Belarus Croatia and the Kyrgyz Republic. By contrast, Belgium, Lithuania, Poland and Italy indicated a negative and significant trend at 5% level. Only New Zealand showed a positive and significant trend at 10% level in the Oceania region. The trends of Australia (positive) and Fiji (negative) were insignificant.

### **6.2.3 Cashew**

As illustrated in Table 6.1, positive trends for cashew for Bangladesh, India, Hong Kong, Jordan, Korea, Kuwait, Oman, Singapore, and Thailand were visualized, at 1% significance level. In the same way, Cambodia, and Kazakhstan have positive trends, significant at 5% level. Turkey also has built up a positive trend, significant at the 10% level. Hong Kong, India, and the Republic of Korea have revealed a decreased trend in comparative advantage at 1% significance level. Indonesia and UAE showed a negative trend, significant at 5% level. By contrast, Sri Lanka has shown a negative and

insignificant trend in comparative advantage during the entire period from 2000 to 2019. The same results showed in Lebanon, Malaysia, the Philippines, and China.

The analyses of the American region, Brazil, Canada, El Salvador, Guatemala, and Jamaica show a positive and significant trend at 1% level. Differently, Guatemala, Guinea, and Brazil had declined trend, significant at a 1% level, while that of at 5% significance level for Trinidad and Tobago.

According to the Africa region analyses, results showed that Cameroon, Ivory Coast, Mali, Nigeria, South Africa, and Togo recorded a significant growth trend at 1% level, while Bosnia and Ghana gained a positive trend on the comparative advantage significant at 5% level. The trend in the comparative advantage of Kenya has significantly decreased 1 % level while it was significant at 5% level for Benin and Tanzania. Madagascar, Senegal and Uganda noted negative insignificant trends.

Turning to the European region, the trends of most of the countries were statistically insignificant compared to other regions. However, Belarus, Croatia, Denmark, France, Germany, Hungary, Lithuania, Norway, Slovakia, Slovenia, and Sweden showed positive and significant trends at 1% level. The trends for Austria, Belgium, Czech Republic, Spain, Switzerland, and United Kingdom were positive and significant at 5% level. Differently, only Estonia showed a significant downward trend at 1% level. All other selected counties showed insignificant trends (Honduras, Italy, Netherlands, North Macedonia, Moldova, Poland, Romania, Russian Federation, Serbia, Greece, Ireland, Luxembourg, Portugal). Lastly, Australia gained negative trend in the Oceania region, which was significant at 5% level while New Zealand showed a positive insignificant trend.

#### **6.2.4 Lime and Lemon**

Most of the countries in the Asian region witnessed weakening comparativeness from 2000 to 2019. A negative and significant trend were recorded for Jordan, Lebanon, Thailand, and Turkey at 1% level. Nevertheless, Sri Lanka recorded a negative and insignificant trend in the comparative advantage of the selected period. The same results showed for Bahrain, Indonesia, Malaysia, Thailand, and Turkey. However, Bangladesh, China, and Kuwait recorded positive and significant trends at 1% level, followed by UAE and Saudi Arabia, significant at 5% level and Afghanistan, Hong Kong and Kazakhstan significant at 10% level.

Moving into the American region, countries also exhibited mixed results with the trend for comparative advantage. The countries that showed a positive trend in comparative advantage were Brazil, Peru and Colombia at 1% level, followed by Bolivia and Chile, significant at a 5% level. By contrast, Argentina, Dominica, Ecuador, Uruguay and Venezuela recorded a negative and significant trend at 1% level, followed by Guatemala and USA at 5% level, and Mexico and Cuba at 10% level.

The result from the African region showed Kenya, Madagascar, South Africa and Morocco experienced a positive and significant trend at 1% , followed by Cote d' Ivoire and Algeria at 5% level and 10% level, respectively. By contrast, a significant downward trend in comparative advantage at 1% level has been visualized for Ethiopia, followed by Ghana and Guyana at 5% level and Zimbabwe at 10% level.

The countries in the European region recorded mixed results. The trends of Bulgaria, Denmark, Georgia, Germany, Latvia, Luxembourg, and Portugal were positive and significant at 1% level followed by Croatia and Czech at 5% level. Meanwhile, Belgium, Greece, and Russia showed downward trends, significant at 1% level, followed by Poland and Spain at 5% level. Finally, in the Oceania region, French Polynesia showed a positive and significant trend at 1% level, while Australia recorded a negative and significant trend at 5% level.

### **6.2.5 Mango**

Corresponding to the data uncovered by the trend analysis of mango for the data in the study period, considerable trends in exporting mango for the world market can be found. In the Asian region, Sri Lanka, Oman, and Thailand signified positive trends at 1% level, while Cambodia, Jordan, and Kuwait are the countries that demonstrated a positive trend at 5% level of significance. Korea, Iran, and the Philippines have recorded positive trends at 10% significant level. As the countries in the American region, trends of comparative advantage of Cuba and Uruguay were positive and significant at 1% level, while it was significant at 5% level for Colombia. Moreover, the countries that noted positive trends in the African region are Burkina Faso, Cameroon, Ghana, Namibia, and Madagascar, which were significant at 1% level, while the trend of Nigeria was significant at 5% level, and the trends of Congo, Morocco and Tanzania significant at 10% level. Moving into the European region Bulgaria, Croatia, Denmark, Estonia, Finland, Georgia, Germany, Hungary, the Netherlands, Poland, Portugal, Slovenia, Spain, and Sweden gained a positive trend at a 1% level. Similarly, the Czech Republic (5%) and Russian Federation (10%) stated the same trend in exporting mango to the world market. In addition to that, in Oceania, a positive trend from selected countries cannot be identified.

Considering the countries that are experiencing negative trend in exporting mango to the world market in region base, in the Asian region, Lebanon (significant at 1% level), Singapore, India and Indonesia (significant at 5% level), the Philippines and Hong Kong ( significant at 10% level) are the countries that were demonstrated negative trend. The countries in the American region that identified negative trend at 1% significance level are Brazil, Costa Rica, Ecuador, Honduras, Mexico, Nicaragua, Peru, St. Lucia, Venezuela, and at 5% significance St. Vincent and Cuba, respectively. In the African region, the declining trends were demonstrated in Guyana and Ethiopia, significant at 1% level and 10% level respectively. Further, Hungary and France signify negative trends at 1% level and 5% level respectively as the countries in the European region. Finally, in Oceania, there aren't selected countries with a negative and significant trends.

### 6.2.6 Orange

The trend analysis of orange for the referenced study period revealed that as the countries in the Asian region, Afghanistan, Bangladesh, China, Kazakhstan, Kuwait, Hong Kong, Malaysia, and Pakistan experienced positive and significant trends at 1% level. Moving into the American region, Chile, Mexico, and Nicaragua, Peru gained a positive significant at 1% level. As per the trend analysis, the countries in the African region that can be identified positive trends for Algeria, Egypt, and Uganda, at significant 1% level.

Examining the Europe region, the countries with a positive trend are Denmark, France, Latvia, Luxembourg, Portugal, and Slovenia significant at 1% level. The same trend was recorded in Croatia, Finland, and Switzerland, and significant at 5% level, while the Netherlands significant at 10% level. Moreover, in the Oceania region, Fiji and New Zealand (1%) showed positive and significant trends at 1% level.

Furthermore, reviewing the countries that have a negative trend in exporting oranges over the period, India, Indonesia, Lebanon (significant at 1% level), and R Korea (significant at 5% level) are the countries in the Asian region. Likewise, Brazil, Dominica, Cuba, and Uruguay in the American region is significant at 1% level while Argentina is significant at 5% level. Ethiopia, Guyana, Morocco, South Africa, Tunisia, and Uganda showed a negative trend, significant at 1% level (1%) which are the countries in the African region. In the European region, the countries that have negative trends are signified from Belgium, Cyprus, Greece, Latvia, and Spain, which is significant at a 1% level. Among the selected countries in Oceania, Australia denoted a negative trend at a 5% level of significance.

### 6.2.7 Papaw

The trend analysis performed for the selected countries in the present study for the referenced period denoted that despite the fact of experiencing comparative advantage or disadvantage, countries were denoting positive and negative trends throughout the period. According to the trend analysis, the countries with positive trends in the Asian region are Bangladesh, China, Cambodia, Israel, Sri Lanka, and the United Arab Emirates, significant at 1% level, while Bahrain was significant at 10% level. In the American region, trends of Guatemala, Jamaica, Uruguay are positive significant at 1% level while that of Costa Rica significant at 10% level in exporting papaw to the world market. The African region countries that had a positive trend over the study period are Cameroon, Kenya, Madagascar, and South Africa at 1% of significance, while Morocco and Uganda were significant at 5% level. It can be identified that Tanzania had a positive trend which was significant at 10% level. Further, in the European region, countries with positive and significant trends at 1% level are the Czech Republic, Finland, Germany, Latvia, Luxemburg, Poland, Portugal, Spain, and Austria, followed by Hungary significant at level (10%). Finally, In Oceania, Australia got a positive trend which is significant at 5% level.

On the other hand, reviewing the countries with negative trends throughout the reference period, Hong Kong, Malaysia, and Singapore recorded negative trends, significant at 1% level while that was significant at 10% for the Philippines as the countries in the Asian region. Moving to the American region, the trend of Brazil declined, significant at 1% level, followed by Dominica significant at 10% level. Moreover, in the African region, Ghana can be identified as the country which had a negative trend, significant at 5% level. Among the selected countries in the European region, France and Denmark signified declining trends throughout the period at 5% and 10% levels of significance respectively. In exporting papaw among the selected countries in Oceania, negative and significant trends for the referenced period cannot be identified.

### **6.2.8 Pineapple**

Considering the trend analysis of individual countries in exporting pineapple from 2000 to 2019, the countries that have positive trend, in the Asian region are, Bahrain, Japan, Kuwait, the Philippines, Singapore, United Arab Emirates significant at 1% level, Oman significant at 5% level and Hong Kong and significant at 10% level. Considering the American region countries, Canada, Colombia, Costa Rica, Cuba, El Salvador, Uruguay, and Paraguay were experienced positive trends significant at 1% level, while Dominica significant at 5% level, Chile, Guatemala, and Peru significant at 10% level also recorded the positive trend throughout the period. Moving into the African region, countries with positive trends are Botswana, Mauritius, Madagascar, Rwanda, and Togo, which were significant at 1% level, while the positive trend of Tanzania was significant at a 5% level. Examining the countries in the European region, positive trends are observed for, Croatia, Georgia, Hungary, Ireland, Netherlands, Latvia, Slovakia, Slovenia, United Kingdom significant at 1% level, , for Russian Federation significant at 5% level, and for Denmark, Greece, Norway, Poland, and Serbia significant at 10% level. Among the selected countries, only New Zealand, in Oceania can be identified as the country with a positive trend which was significant at 5% level.

However, considering countries with a negative trend in exporting pineapple to the world market, in the Asian region Singapore and Kazakhstan recorded a declining trend at 1% and 5% level of significance respectively. Brazil, Nicaragua, and Trinidad signified a negative trend, significant at 1% level which are in the American region. Similarly, the trends of Benin, Ivory Coast, Guyana, and South Africa in the African region were significant at 1% level. Further, Bolivia and Ethiopia & Ghana also denoted a negative trend significant at 5% level and 10% level respectively in exporting pineapple to the world market throughout the period. In addition, Belgium, France, Italy, and Luxembourg in the European have recorded negative trends significant at 1% level region while it cannot identify countries with a negative significant trend in Oceania. Considering the stance of Sri Lanka, even though the country has a comparative advantage in exporting pineapple, the trend analysis revealed that Sri Lanka had a negative and insignificant trend throughout the referenced period.

Moving to the summary of the trend of selected fruit exports of Sri Lanka, despite the fact of having comparative advantage or disadvantage, it has been revealed that there is positive significant trend on exporting avocado, banana, mango and papaw while positive insignificant trend with orange. Further, there is negative insignificant trend with cashew, lime and lemon and pineapple.

**Table 6.1: Summary of Sri Lanka Trend of the Selected Fruits**

<b>Fruit</b>	<b>Trend</b>
Avocado	Positive (significant)
Banana	Positive (significant)
Cashew	Negative (Insignificant)
Lime and Lemon	Negative (Insignificant)
Mango	Positive (significant)
Orange	Positive (insignificant)
Papaw	Positive (significant)
Pineapple	Negative (Insignificant)

Source: Authors Computed from FAO, 20214

**Table 6.2: Trend Analysis 2000-2019**

Countries	Avocado		Banana		Cashew		Lime and Lemon		Mango		Orange		Papaw		Pineapple	
	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P
Afghanistan							0.0014	0.078			55	0.007*				
Algeria							0.00007	0.082			5826	0.001*				
Argentina							-0.92	0.000*			-2.0348	0.011**				
Australia	-0.0016	0.501	0.00003	0.135	-0.002	0.018**	-0.011	0.022			-3.581	0.011**	0.0013	0.02	0.000007	0.305
Austria	0.0041	0.000*	0.0041	0.218	0.0105	0.000**	0.0093	0.386	-	-	20.74	0.579	0.00268	0.000*	-0.00007	0.973
Bahrain	0.0003	0.173			0.0001	0.632	-0.00013	0.969	-0.005	0.184	-1.77	0.905	0.01138	0.056	0.004	0.008
Bangladesh					0.0024	0.002*	0.00238	0.000*			264.38	0.01***	0.030778	0.003		
Barbados	0.0051	0.705														
Belarus	0.0013	0.015**	-0.0051	0.047**	0.0301	0.001*	0.005	0.478	0.0012	0.106	-2.25	0.84			0.0007	0.564
Belgium	-0.004	0.65	-0.1171	0.008*	0.0114	0.032**	-0.0279	0.000*	-0.0127	0.28	-21.017	0.000*	-0.00396	0.433	-0.212	0.000*
Belize			5.806	0.034**			-0.1234	0.13			-2.2671	0.021**				
Benin					-7.949	0.026**									-0.115	0.003
Bolivia			0.2092	0.000*			0.06009	0.013							-0.0353	0.017
Bosnia and Herzegovina					0.006	0.026**										
Botswana													-0.00347	0.216	0.000118	0.000*
Brazil	0.0097	0.000*	-0.2722	0.000*	-1.0444	0.000*	0.0549	0.001	-0.3917	0.000*	-0.048125	0.000*	-0.26935	0.000*	-0.04719	0.000*
Brunei	0.0007	0.01*														
Bulgaria	0.0004	0.006*	0.0133	0.096***			0.11425	0.000*	0.0007	0.002*	35.51	0.005*			0.00024	0.311
Burkina Faso							0.00508	0.137	2.619	0.000*						
Burundi	0.2952	0.000*	0.0567	0.001*												
Cambodia			0.1089	0.016**	1.7068	0.043**			0.2311	0.019**			0.04024	0.004		
Cameroon	-0.0027	0.324	0.0458	0.942	0.0024	0.004*			0.0559	0.002*			0.05036	0.003	0.0902	0.36
Canada	-0.0012	0.031**	0.000001	0.001**	0.0054	0.000*	-0.000031	0.129			-0.000000067	0.724	0.000047	0.394	0.001119	0.000*
Chili	-0.7951	0.192	-0.0001	0.501			0.1768	0.032			0.22908	0.000*			0.00407	0.083
China			-0.0008	0.000*	-0.00018	0.11	0.013	0.000*			0.008532	0.000*	0.0244	0.000*	-0.0003226	0.303
Colombia	0.2447	0.000*	-1.1024	0.000*			0.11474	0.000*	-0.0257	0.137	-34.4	0.004	-0.04171	0.107	0.0872	0.001
Congo									0.0001	0.071***						
Costa Rica	-0.0001	0.972	-0.2502	0.643					-0.5519	0.000*	-0.008251	0.043	0.618	0.01	30.989	0.000*
Côte d'Ivoire	0.0014	0.000*	-0.4946	0.053***	18.203	0.000*	0.00023	0.017	0.1129	0.453			-0.5031	0.189	-7.278	0.000*
Croatia			0.0127	0.033**	0.0041	0.000*	0.0184	0.034	0.0009	0.006*	0.007188	0.023			0.01912	0.000*
Cuba	0.00097	0.046**					-0.0081	0.079	0.0042	0.008*	-0.7321	0.000**			0.15065	0.004
Cyprus			0.0037	0.055***			-2.1296	0.000*	-0.00003	0.961	-1.2392	0.000**				
Czech Republic	0.0028	0.000*	0.0063	0.674	0.0021	0.029**	0.009	0.054	0.0027	0.027**	0.001512	0.656	0.001762	0.002	-0.00139	0.541

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Countries	Avocado		Banana		Cashew		Lime and Lemon		Mango		Orange		Papaw		Pineapple	
	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P
Denmark	0.0083	0.000*	0.002	0.566	0.0076	0.001*	0.0158	0.000*	0.0072	0.000*	0.007753	0.000*	-0.00165	0.095	0.00161	0.088
Dominica	-14.72	0.001*					-2.328	0.000*	-0.8463	0.197	-2.6359	0.000*	-1.0028	0.092	20.555	0.022
Ecuador	-0.0523	0.006**	-1.919	0.159			-0.0694	0.000*	-1.3565	0.000*			0.0024	0.993	-0.3517	0.183
Egypt	0.0019	0.290					0.156	0.109			4.2286	0.000*			0.001108	0.346
El Salvadore					-0.0783	0.000*	-0.04314	0.166			0.0004605	0.38			0.000634	0.001
Estonia	0.0005	0.000*	-0.0013	0.536	-0.0868	0.0065*	-0.00025	0.698	0.0002	0.000*	-0.000275	0.626			-0.0001218	0.793
Eswatini	0.0183	0.452	0.0854	0.02**	0.0001	0.000*	-0.0194	0.646	-0.0062	0.367	-0.026	0.868	0.05672	0.191		
Ethiopia	0.0051	0.003**	0.0172	0.481			-0.0381	0.005	-0.392	0.057	-0.12548	0.005*	0.0422	0.569	-0.014784	0.096
Fiji			-0.0004	0.917					-0.01886	0.47	0.00175	0.001*	0.196	0.926	0.0017	0.2
Finland	0.0007	0.000*	0.0051	0.001*			0.000156	0.319	0.00002	0.000*	0.00033	0.021**	0.000439	0.001	0.0006232	0.173
France	-0.042	0.001*	0.0024	0.668	-0.0004	0.0002*	0.00247	0.274	-0.0211	0.038**	0.0051	0.004*	-0.01087	0.081	-0.1305	0.000*
French Polynesia							0.023668	0.002								
Georgia	0.0062	0.000*	-0.0023	0.946			0.08248	0.001	0.005	0.000*	-0.1262	0.309			0.12044	0.000*
Germany	0.0002	0.828	-0.0039	0.575	0.027	0.000*	0.0053	0.002	0.0063	0.000*	0.0013	0.146	0.007729	0.001	-0.0041	0.17
Ghana			-0.0198	0.896	7.734	0.014**	-0.0252	0.024	1.5031	0.000*	-0.00513	0.338	-0.8671	0.047	-3.384	0.017
Greece	-0.0029	0.03**	0.0727	0.002*	-0.012	0.512	-0.2887	0.001	-0.0005	0.802	-0.8325	0.000*	0.007867	0.101	0.0112	0.011
Greenland																
Greneda									0.5156	0.139						
Guatemala	-0.0242	0.409	1.9801	0.001*	-0.034	0.003*	-0.13889	0.018	-0.3174	0.211	-0.0002537	0.571	9.2893	0.000*	0.5054	0.082
Guinea					5.251	0.004*			-0.0527	0.361					-0.04154	0.121
Guyana							-0.1447	0.051	-0.3792	0.003*	-0.013208	0.004*	-0.07221	0.316	-0.2417	0.000*
Honduras	0.0203	0.022**	-0.4543	0.637	0.0165	0.106	0.0067	0.427	-0.0378	0.000*	-0.01895	0.537			-0.7892	0.246
Hong Kong	0.0096	0.000*	-0.0008	0.074***	-0.0035	0.005*	0.007		-0.007	0.035	0.02418	0.008	-0.0312	0.001	0.002675	0.083
Hungary	0.0029	0.003*	-4.46	0.085	0.0006	0.000*	0.007		0.0029	0.001*	0.00076	0.389	0.00119	0.076	0.00334	0.001
India			0.0135	0.000*	-3.8547	0.000*	-0.005		-0.615	0.014**	-0.02281	0.000*	-0.0277	0.462	0.0012	0.251
Indonesia	-0.0002	0.312	0.0018	0.045**	-0.1178	0.017**	-0.0000		-0.0142	0.03**	-0.00064	0.005	-0.00909	0.28	0.0031	0.695
Iran					0.001	0.185			0.00004	0.061***	-0.0077	0.431				
Ireland	0.0001	0.062***	-0.018	0.061***	-0.277	0.344					0.00006	0.943			0.00133	0.000*
Israel	-0.825	0.003*					0.003305	0.522	0.03855	0.391	-0.07015	0.13	0.006097	0.001		
Italy	0.0008	0.927	-0.03139	0.000*	0.0007	0.731	0.0107	0.15	0.00131	0.583	0.0082	0.119	0.00154	0.155	-0.008997	0.001
Jamaica	-0.0298	0.554	-0.4966	0.04**	0.008	0.007*			0.0165	0.94	0.0463	0.825	8.626	0.005	0.0000685	0.923
Japan											0.000013	0.287			0.00003646	0.007
Jordan			-0.0192	0.145	0.0302	0.009*	-0.5135	0.001	0.0331	0.033**	-0.01552	0.794				
Kazakhstan			0	0.0001**	0.0004	0.025**	0.00034	0.051			0.000185	0.004			-0.9942	0.049
Kenya	3.6089	0.000*	-0.0012	0.99	-0.688	0.000*	0.01472	0.005	0.0722	0.832	0.0026	0.125	0.01552	0.000*	0.06161	0.518
Korea			-0.0003	0.000*	-0.00009	0.005*			0.000003	0.071***	-0.00128	0.017			-0.00001409	0.292
Kuwait			0.0223	0.001**	0.004	0.000*	0.00289	0.008	0.00022	0.018**	0.02	0.001			0.00151	0.01
Kyrgyz Republic			0.0026	0.025**												

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Countries	Avocado		Banana		Cashew		Lime and Lemon		Mango		Orange		Papaw		Pineapple	
	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P
Latvia	0.0497	0.000*	0.1157	0.000*	0.002	0.838	0.047099	0.000*			0.03997	0.000*	0.02354	0.000*	0.02533	0.004
Lebanon	0.0038	0.000*	0.2423	0.006*	-0.0031	0.728	-0.7944	0.000*	-0.0258	0.009*	-1.443	0.000*				
Lithuania	0.0602	0.27	-0.087	0.000*	0.062	0.000*	0.06119	0.315	0.07613	0.282	0.01865	0.588	0.06102	0.376		
Luxembourg	0.029	0.002*	-0.001	0.417	-0.0016	0.944	0.009829	0.001	0.1136	0.104	0.0072	0.001	0.20466	0.002	-0.0848	0.01
Madagascar			0.001	0.034**	-0.0978	0.415	0.00279	0.004	0.059	0.002*			0.02173	0.002	0.01957	0.008
Malaysia	0.0001	0.001*	-0.0036	0.000*	-0.00001	0.669	-0.00094	0.238	0.0016	0.748	0.0022	0.000*	-0.61951	0.000*	-0.000151	0.955
Maldives							0.1055	0.103								
Mali					0.2599	0.003*			0.8626	0.145						
Mauritania					-0.0013	0.000*										
Mauritius	0.0025	0.027**													0.5397	0.001
Mexico	0.5129	0.022**	0.0513	0.000*	0.0002	0.956	0.11403	0.066	-0.678	0.005*	0.0077	0.000*	0.0758	0.585	0.00718	0.3
Morocco	0.2659	0.000*					0.085539	0.000*	0.003	0.057***	-2.238	0.000*	0.002661	0.043	0.00035	0.126
Moldova					0.002	0.086										
Namibia									0.004	0.01*	-0.0025	0.445				
Netherland	0.1711	0.000*	0.0741	0.000*	0.032	0.047	0.04149	0.069	0.0861	0.000*	0.0175	0.099	0.01911	0.178	0.1028	0.000*
New Zealand	-0.03318	0.07***	0.0001	0.053***	0.0003	0.964	-0.0124	0.243			0.005	0.003	0.000862	0.206	0.00106	0.017
Nicaragua	-0.0035	0.686	-0.4419	0.04**	-0.0025	0.622			-2.5539	0.000*	0.3616	0.003			-0.048512	0.000*
Nigeria			0	0.029**	1.2458	0.000*			0.0001	0.042**						
North Macedonia					0.0003	0.814	-0.0052	0.213								
Norway	0.0001	0.054***			0.0007	0.004*	0.000107	0.132	0.000003	0.966	0.0003056	0.202			0.000132	0.069
Oman					0.0018	0.008*	0.002	0.503	0.0124	0.002*	0.002051	0.612	0.003637	0.589	0.00116	0.025
Pakistan			0.1268	0.000*			0.00156	0.125	-0.2317	0.237	0.016869	0.007				
Panama	0.0005	0.622	-10.239	0.001*					0.001219	0.301						
Paraguay			0.09	0.000*							-0.000218	0.957			0.0404	0.005
Peru	2.1035	0.000*	0.3828	0.000*			0.060798	0.000*	-1.2043	0.003*	0.027743	0.005	-0.00031	0.733	0.00302	0.063
Philippines	0.0009	0.203	1.0735	0.001*	-0.0079	0.041			-0.3524	0.082***			-0.15737	0.075	1.3326	0.000*
Poland	0.0051	0.000*	-0.0143	0.379	0.0011	0.002	-0.0123	0.047	0.00323	0.000*	0.003815	0.147	0.0019	0.000*	0.005601	0.084
Portugal	0.014	0.000*	-0.0725	0.001*	-0.0003	0.872	0.10828	0.000*	0.2173	0.000*	0.37797	0.000*	0.19414	0.000*	-0.1309	0.219
R Korea	0.000001	0.000*														
Romania	0.0004	0.407	0.0012	0.281	0.0003	0.822	0.000398	0.29	0.0003	0.323	0.00096	0.328			0.000698	0.697
Russian Federation	0.00003	0.044**	0.008	0.000*	0.0002	0.11	-0.005042	0.003	0.00006	0.079***	-0.003165	0.018			0.00021	0.014
Rwanda	0.0368	0.01*	-0.0215	0.16											0.0794	0.001
Saint Lucia	-0.316	0.02**														
Saint Vincent	-0.891	0.095***														
Saudi Arabia	-0.0001	0.198	0.001	0.107	0.0003	0.01*	0.003565	0.032	-0.0005	0.664	0.001585	0.297			0.0005	0.721
Senegal					0.9317	0.243							0.10118	0.183		

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Countries	Avocado		Banana		Cashew		Lime and Lemon		Mango		Orange		Papaw		Pineapple	
	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P	Coefficient	P
Serbia			-0.0037	0.605	0.0013	0.271	0.0029	0.207			0.0007	0.815			0.0025	0.065
Singapore	0.0004	0.000*	-0.00001	0.342	-0.0036	0.004*	0.001868	0.274	-0.0013	0.038**	0.000098	0.87	-0.00096	0.008	-0.000269	0.001
Slovakia	0.0014	0.045**	0.008	0.286	0.0066	0.000*	0.001229	0.789	-0.0006	0.926	-0.004399	0.503			0.00956	0.000*
Slovenia	0.0343	0.035**	0.0878	0.003*	0.004	0.002*	0.0558	0.028	0.045	0.000*	0.05103	0.000*	0.003175	0.272	0.0269	0.003
South Africa	-0.2195	0.044**	0.0056	0.000*	0.0016	0.000*	0.61396	0.000*			0.75107	0.000*	0.0491	0.000*	-0.04289	0.000*
Spain	-0.1334	0.067***	0.0007	0.91	0.003	0.028**	-0.19002	0.011	0.1036	0.000*	-0.2646	0.001	0.0656	0.000*	0.0025	0.801
Sri Lanka	0.0024	0.016**	0.0213	0.02**	-0.0384	0.201	-0.00377	0.817	0.05809	0.003*	0.0011	0.398	1.58	0.000*	-0.025	0.699
St. Lucia			-36.983	0.000*					-1.7329	0.003*						
St. Vincent and the Grenadines			-25.578	0.01*					-2.783	0.044**						
Sweden	0.0012	0.181	-0.0134	0.051***	0.0054	0.006*	0.000556	0.352	0.0002	0.000*	0.00105	0.335	0.00013	0.674	0.00055	0.445
Switzerland	0.00008	0.049**	-0.00001	0.255	0.0006	0.012**	0.000033	0.667	-0.0003	0.559	0.000051	0.019			-0.00036	0.085
Syrian Arab Republic	0.0704	0.017**			0.1198	0.186										
Tanzania	0.2617	0.1	0.02	0.046**	-15.128	0.048**			0.003	0.081***	0.2266	0.338	0.0127	0.093	0.0405	0.027
Thailand	0	0.545	0.0057	0.069***	0.0026	0.006*	-0.00115	0.007	0.6334	0.000*	0.0002	0.852	0.01159	0.229	-0.0025	0.556
Togo					1.5889	0.001*									0.9381	0.000*
Trinidad and Tobago	-0.0018	0.009**			-0.0055	0.048**							-0.04702	0.197	-0.0085	0.005
Tunisia							0.02101	0.134			-0.12267	0.003				
Turkey	0.0001	0.391	0.0166	0.105	0.0031	0.063***	-0.5262	0.003	0.0002	0.139	-0.0176	0.74			0.00065	0.131
Uganda	0.0533	0.123	-0.10617	0.003**	0.0005	0.232	0.025036	0.011			0.07977	0.002	0.0724	0.025	-0.2996	0.224
Ukraine			0.0001	0.759			-1.24	0.139			0.000332	0.506				
United Arab Emirates	0.001	0.244	-0.0009	0.384	0.0617	0.029**	0.0238	0.024	-0.0198	0.324	0.00921	0.156	0.00237	0.005	0.0141	0.002
United Kingdom	-0.0387	0.800***	0.0032	0.169	0.0077	0.072**	0.000173	0.94	0.0009	0.577	0.000232	0.932	-0.00165	0.281	0.0152	0.005
United State of America	0.0119	0.019**	0.0069	0.226	-0.003	0.005	-0.01385	0.011			-0.0043	0.574	-0.005	0.52	-0.0021	0.742
Uruguay	0.0002	0.001*					-0.5514	0.000*	0.00017	0.003*	-1.3265	0.000*	0.00088	0.003	0.00038	0.001
Vanuatu							0.195	0.918								
Venezuela, RB							-0.0097	0.004	-0.351	0.000*						
Zimbabwe	0.0893	0.000*	-0.1297	0.425			-0.2479	0.065			-0.3405	0.332				

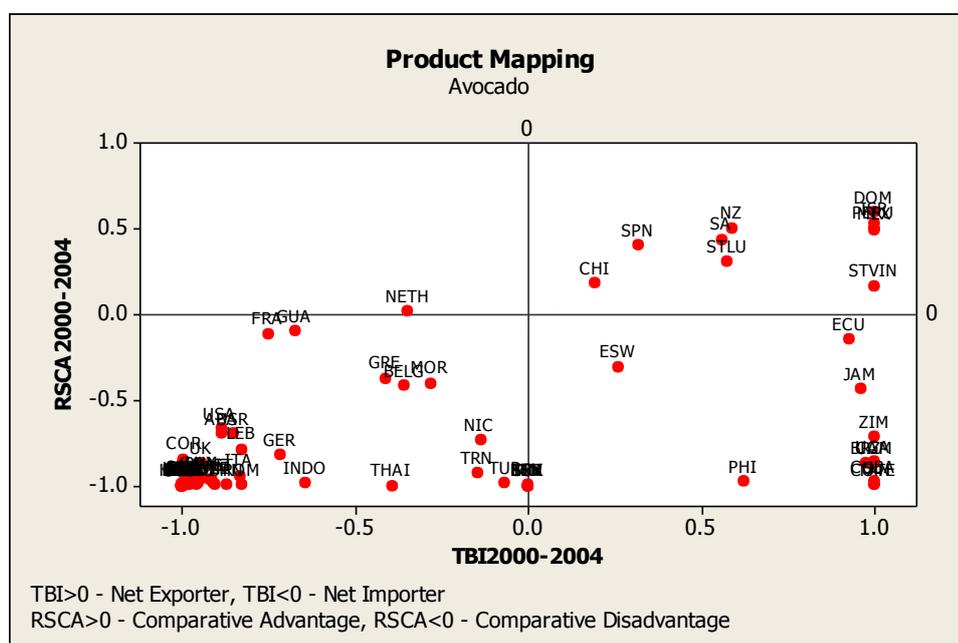
Note: \*, \*\* and \*\*\* indicate significance at 1%, 5% and 10% respectively.

Source: Authors Computed from FAO (2021)

### 6.3 Product Mapping

#### 6.3.1 Avocado

Based on the analysis performed for product mapping on avocado in 83 selected countries, it was found that 72% of the countries were categorized in the first group, which is that there is no comparative advantage while being net importers. The Netherlands is the only country that is classified in the second group, where the country has comparative advantage but a net importer. 12 countries, namely Brazil, Cameroon, Cote d’Ivoire, Cuba, Ecuador, Eswatini, Jamaica, Philippines, Sri Lanka, Uganda, United Republic of Tanzania, and Zimbabwe, were classified in the third group, as identified the countries are net exporters of avocado to the world market but with comparative disadvantage. The countries that occupy the identically positioned are Chili, Dominica, Israel, Mexico, New Zealand, Peru, St. Lucia, St. Vincent, South Africa, and Spain, having both comparative advantage and net exporter position, illustrated in Figure 6.1, which is around 12.04% of the selected countries.

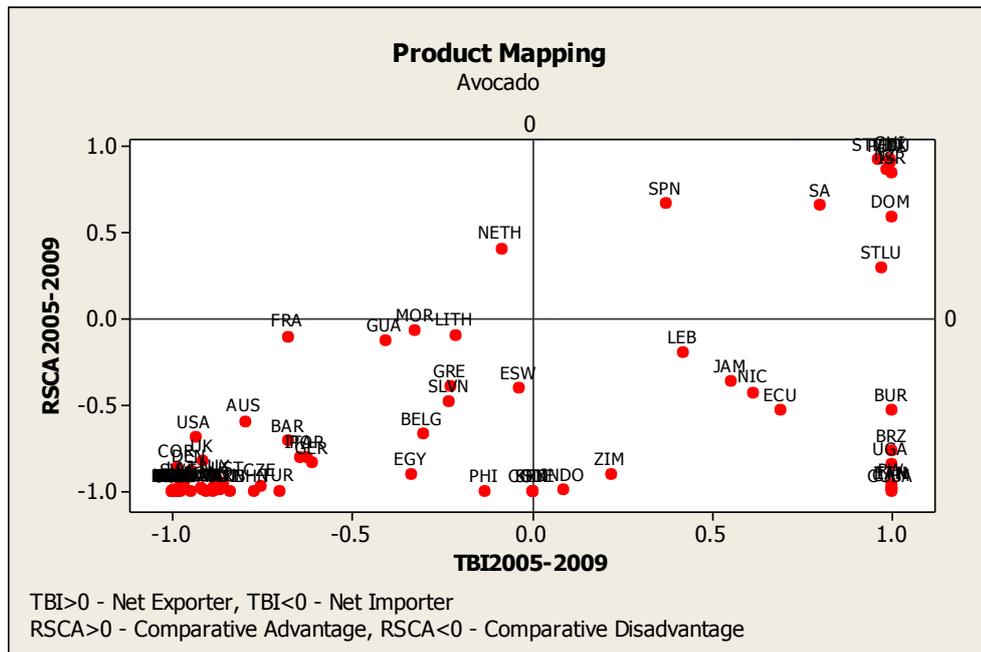


Source: Authors Computed from FAO, 2021

**Figure 6.1 : Product Mapping of Avocado 2000 – 2004**

Moving in the second phase as shown in the Figure 6-2, determining that of the changes that were faced by the countries, from 2005 to 2009 Cote d’Ivoire, Eswatini, the Philippines and Sri Lanka were downgraded as net importers that haven’t advantage which are remain as exporters throughout 2000 to 2004 including 69.87% among selected countries were endured in the group. As plotted in the second group that has the comparative advantage but remains an importer, Netherland remains in the same group as in the period 2000-2004, while increasing exports. Notably, Burundi, Ethiopia, Indonesia, Lebanon, Nicaragua, and Rwanda were able to make their move as exporters without gains, while the rest of the countries remain in the same position.

As previously identified that the countries in the identical position, the exporters with comparative advantage, and the remaining countries from 2004 to 2005 are still able to remain in their position.

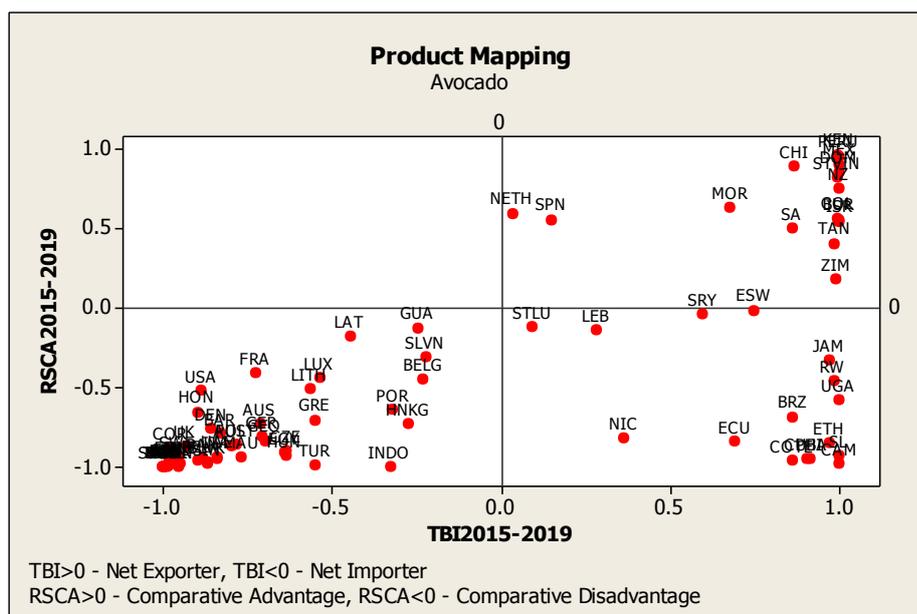


Source: Authors Computed from FAO, 2021

**Figure 6.2: Product Mapping of Avocado 2005 – 2009**

As the results unfolded in the product map in Figure 6-3, it can be identified that the countries in the first phase are reduced than the previous five-year analysis (2005-2009), as 63.85% among selected countries were in the first group of neither advantage nor exporters in the period of 2010 to 2014. Further, Ecuador was downgraded to group one, previously classified into group three. Being able to gain an advantage, Lithuania has a sudden change for group two where the Netherland occupies from group 1. Moving further, 21 countries were positioned in group three, where cote d'Ivoire, Kenya, the Philippines, Sri Lanka, and the Syrian Republic were improved as avocado net exporters without having a comparative advantage. In addition to that, Dominica, St. Lucia, and St. Vincent are the countries that remained as net exporters and comparative advantage, as their strength of comparative advantage got reduced and downgraded from the identical position into the group 3. Moreover, the rest of the countries in group four, namely Chili, Israel, Mexico, New Zealand, Peru, South Africa, and Spain, could manage their position compared with the previously reviewed phases (2000-2004, and 2005-2009).





Source: Authors Computed from FAO, 2021

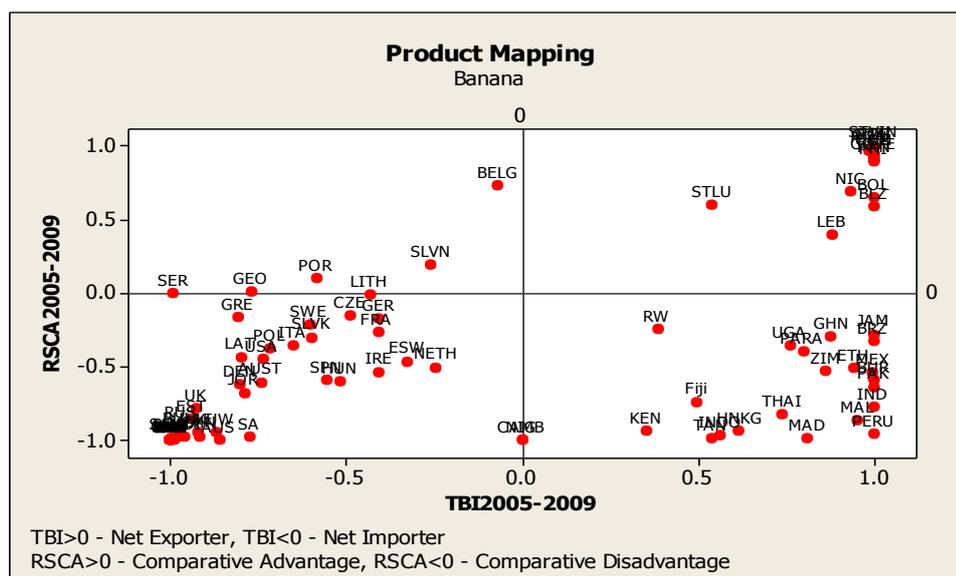
**Figure 6.4: Product Mapping of Avocado 2015 – 2019**

Concluding the above changes, throughout the referenced study period, it can be identified that countries' movements are from importer to exporter and vice-versa. Further, it is notable that countries that can maintain a positive trade balance strengthened their level of comparative advantage over time.

### 6.3.2 Banana

Figures 6-5 depict product mapping of banana exports to the world market from 2000 to 2004. According to Figure 6-5, there are 89 banana exporters, of them, 58% belong to Group 1, where there is no comparative advantage and export specialization. Moving to the left upper cell (Group 2) of the Figure 6-5, only Lithuania (1%) appears in that group, which has a comparative advantage but no export specialization. Countries plotted in the bottom right cell (Group 3) consisted of 22% of the total exporters, and this group of countries have no international competitiveness ( $RSCA < 0$ ) but have export specialization ( $TBI > 0$ ). Sri Lanka includes in Group 3 trade implying that the county has trade surplus, but no comparative advantage in banana exports.

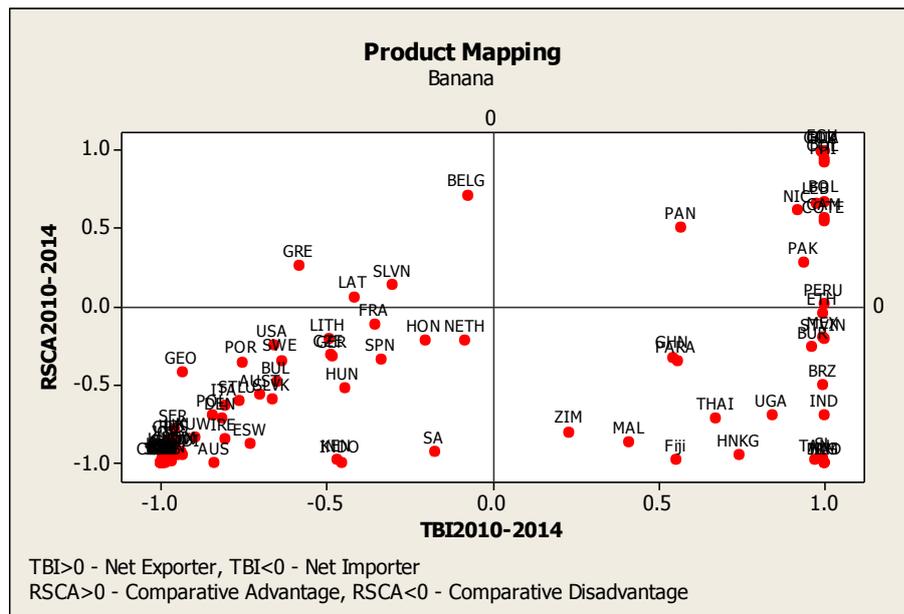




Source: Authors Computed from FAO, 2021

**Figure 6.6: Product Mapping of Banana 2005-2009**

In analyzing the country's movement between 2005-2009 and 2010-2014, Honduras, and St. Lucia previously occupied the identical position having both international competitiveness and trade surplus, have downgraded into Group 1, the lowest position having neither international competitiveness nor specialization. St. Vincent and the Grenadines also previously stood in the identical position and moved downwards into the group three losing the international competitiveness while maintaining the specialization. In a similar vein, Indonesia, Kenya, and Rwanda previously retained the net exporter position but had no international competitiveness and moved left towards Group 1, losing their net exporter position too. Further, Georgia, and Portugal, previously positioned in group 2 with an internationally competitive position but as a net importers, moved downwards losing their international competitiveness too. Greece and Latvia previously retained the comparative disadvantage, and net importer position, have stayed in group 1 but moved upward toward the group 2 where gaining the international competitiveness however as a net importers. Meanwhile, Nigeria and Sri Lanka have progressed to the right from Group 1 to Group 2, achieving the net exporter position but no international competitiveness. Finally, Pakistan and Peru previously were at comparative disadvantage but the net exporter position upgraded into the identical situation achieving international competitiveness while retaining the net exporter position (Figure 6-7).



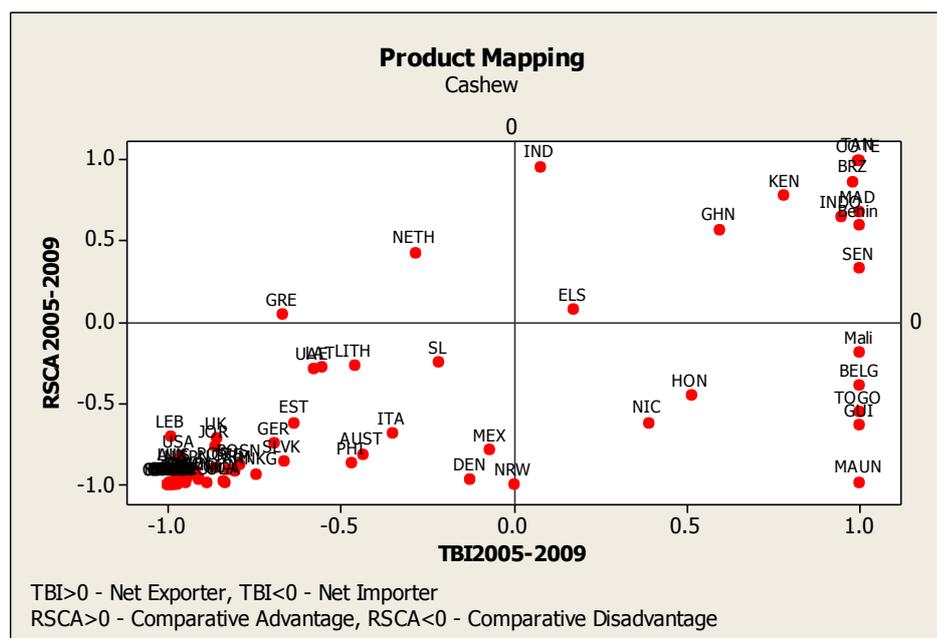
Source: Authors Computed from FAO, 2021

**Figure 6.7: Product Mapping of Banana 2010-2014**

Moving to the final phase, 2016-2019, Malaysia and Nigeria previously had a trade surplus, but no international competitiveness reversed back into Group 1, where there is neither comparative advantage nor specialization. In contrast, Cambodia, Indonesia, and Rwanda were at a comparative disadvantage and the trade deficit position transferred into right attaining the trade surplus but with comparative disadvantage. During the period of 2016-2019, six countries reached an identical position where there is a comparative advantage and net exporter position. Eswatini, Ghana, and St Lucia, previously located where there is no international competitiveness and specialization, directly moved into the 4th group with having comparative advantage and trade surplus. Ghana, Paraguay, and St. Vincent and the Grenadines previously had comparative disadvantages but as the net exporter, moved attaining international competitiveness while maintaining the trade surplus (Figure 6-8).



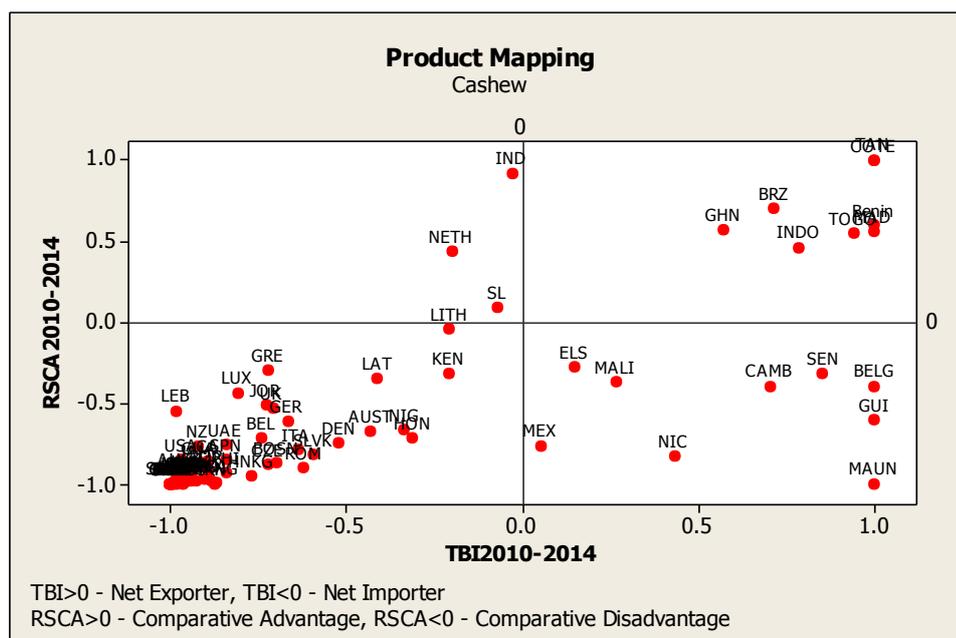




Source: Authors Calculated from FAO, 2021

**Figure 6.10: Product Mapping of Cashew 2005– 2009**

According to the results revealed in Figure 6-11, it can be identified that 75.9% of selected countries in the study were grouped in the first group, where there is no comparative advantage as well with a negative trade balance. Moving further, Greece, which had a comparative advantage with a negative trade balance, lost their gain over cashew exports and downgraded to the group one again. Further, because of reducing trade balance to negative, Honduras shifted into group one again from the group three. Kenya failing its benefits and trade balance, lowered to group one from the group four. Considering the situation of India, it has moved to group two during 2010-2014 as of the negative trade balance over cashew, which was in group four during 2005-2009. Notably, while failing to group one in the second phase, Sri Lanka was able to gain benefits from cashew exports in the third phase (2010-2014) of the study with a negative trade balance on cashew exports. Countries listed in group three are Belgium, Guinea, Mali, Mauritania, Nicaragua, and were positioned at group three in the previously analyzed time phases also in the present study.

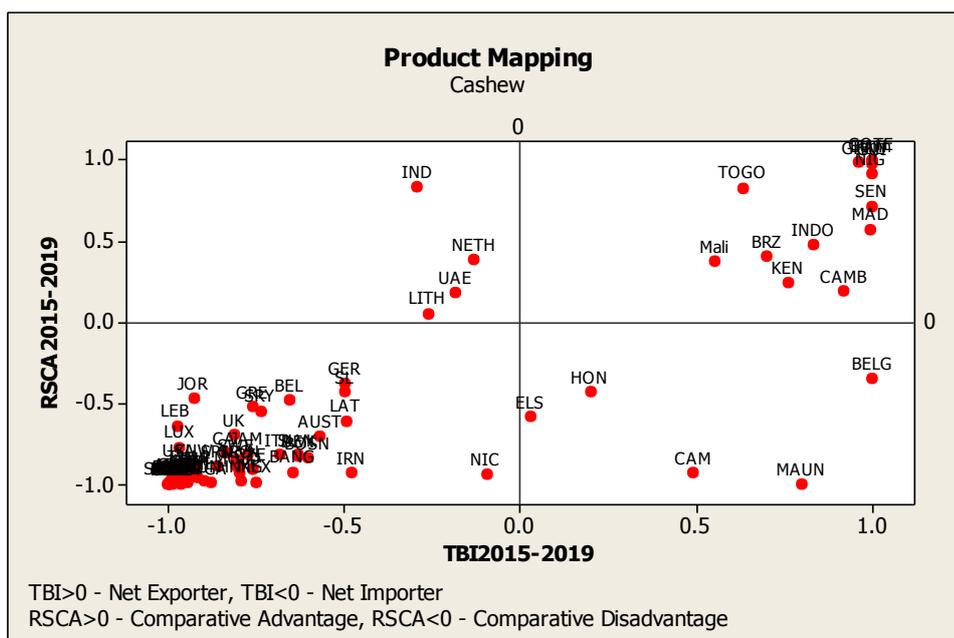


Source: Authors Calculated from FAO, 2021

**Figure 6.11: Product Mapping of Cashew 2010 – 2014**

Further, Cambodia and Mexico were in the group one and shifting to group three while El Salvador and Senegal being in the group four during 2005-2009 were downgraded to group three over time. The stance of Togo implied that they were able to enhance their benefits compared with previously reviewed time periods. In addition, the other countries able to gain the comparative advantage and the positive trade balance are Benin, Brazil, Cote d'Ivoire, Ghana, Indonesia, Madagascar, and Tanzania from 2010 to 2014.

According to the results unfolding by the product mapping approach, as depicted in the Figure 6-12, 60 countries were categorized into the group one with no gains and with negative trade balance, where Mexico and Nicaragua were shifted from group three into group one and Sri Lanka reduced the strength of comparative advantage over cashew and downgraded to group one. However, the strength of the comparative advantage increased in Lithuania and United Arab Emirates during 2015-2019. India and Netherland were able to maintain the benefit compared with sub-period, 2010-2014, but the countries weren't able to be net exporters and played as net importers. Moving further, Belgium, El Salvador, and Mauritania remained in group three as same as during the period, 2010 - 2014 and Cameroon and Honduras were able to upgrade as net exporters during 2015 - 2019 from net importers during 2009 - 2014.



Source: Authors Calculated from FAO, 2021

**Figure 6.12: Product Mapping of Cashew 2015 – 2019**

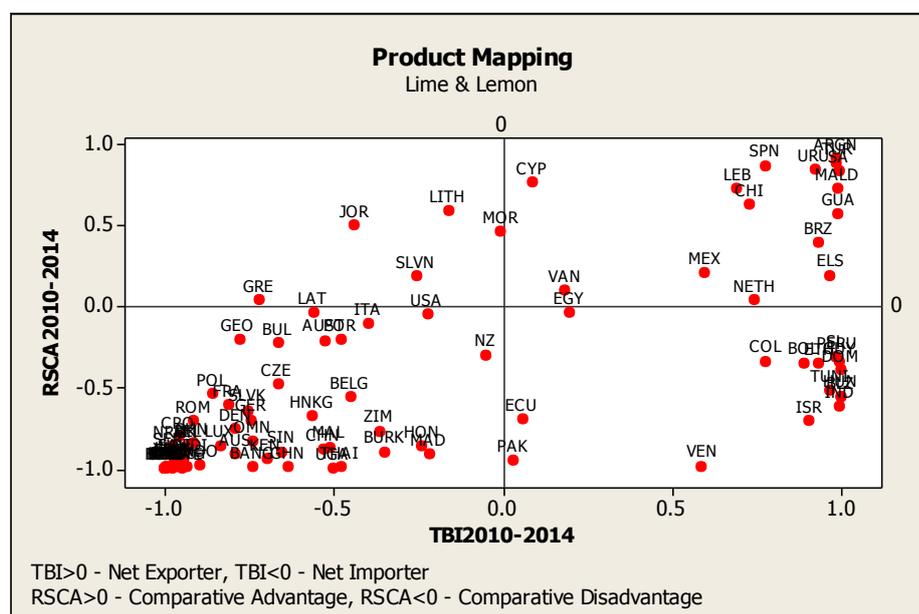
Collectively, going through the above results, it is notable that most of the countries are neither able to enhance their trade balance over cashew exports nor the gains of comparative advantage. Further, some countries were downgraded from group four into group one implying that countries were unable to maintain their strength of comparative advantage and the net exporter position over cashew exports.

#### 6.3.4 Lime and Lemon

According to the product mapping for lime and lemon in 94 selected countries, the study revealed that 55.91% of the countries were grouped in the first group during 2000-2004 (Figure 6-13), indicating there is no opportunity for either comparative advantage or trade balance. As depicted in Figure 6-13, Greece and Morocco can be recognized as the countries that have had a comparative advantage but remained lime and lemon net importers. However, the study revealed that, including Sri Lanka, 21 countries performed as net exporters but did not have a comparative advantage over the lime and lemon exports. As analyzed by the product map, it revealed that among the selected countries, 18 countries were able to gain the benefits of comparative advantage and the positive trade balance during 2000 - 2004.



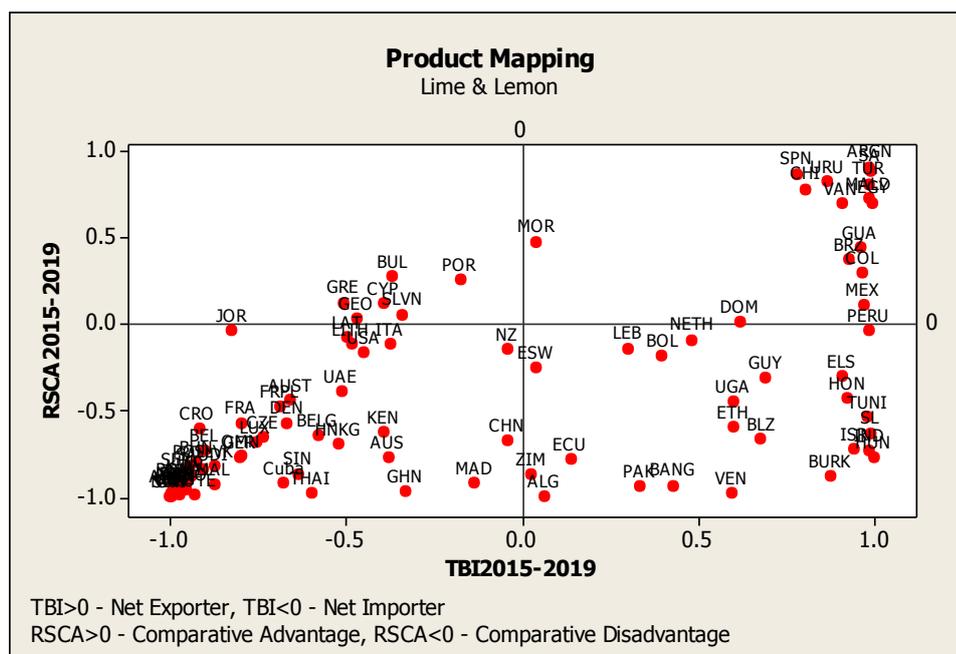
but with negative trade balance, Greece and Morocco remained as the previous analyst time phase (2000-2004). Slovenia and Lithuania have strengthened their advantage as they were moved into group two from group one. Continuing further, regardless of Ecuador and Guyana, the other countries remained net exporters without comparative advantage in group three as same as during the period, 2000-2004. Ecuador and Guyana were downgraded from group four to group three, implying that they could not gain a comparative advantage. Notably, Vanuatu was able to rapidly enhance its position from group one to group four, visualizing a rapid change.



Source: Authors Calculated from FAO, 2021

**Figure 6.15: Product Mapping of Lime and Lemon 2010– 2014**

According to the results revealed in Figure 6-15, it can be identified that 61.29% of countries in the study were categorized in the first group implying that the countries weren't able to gain a comparative advantage as well experienced a negative trade balance. Ghana, Honduras, New Zealand, the Russian Federation, Thailand, and Zimbabwe were not able to maintain a positive trade balance compared with the period 2005-2009. The countries with the comparative advantage but not able to have positive trade balance are Greece, Jordan, Lithuania, Morocco, and Slovenia who remained in the same position at the previous time phase (2005-2009). Sixteen countries with a positive trade balance without comparative advantage can be recognized as per the product map. Further, Bolivia shifted from group one to group three, being enhanced as a net exporter. In Dominica and Egypt, they were downgraded from group four to group three, indicating that they lost the benefits of lime and lemon exports. During the period 2010-2014, there were 15 countries classified into group four. The position of Mexico and the Netherland was upgraded from group three to group four, denoting that the two countries were able to be as net exporters and enhanced their gains over lime and lemon exports.



Source: Authors Calculated from FAO, 2021

**Figure 6.16: Product Mapping of Lime and Lemon 2015 – 2019**

Proceeding with the position of the countries according to the product mapping model in the Figure 6-16, Cuba, Ghana, Madagascar, New Zealand, Russian Federation, and Thailand are the countries that remained in the group one compared with the previous time phase, while Jordan and Lithuania lost their advantage over the lime and lemon exports. Bulgaria, Georgia, and Portugal are the countries that improved their advantage over lime and lemon exports, while Cyprus moved into group two from group four, implying that they were gain negative trade balance over lime and lemon exports. According to the product mapping approach, there are 23 countries in group three that remained net exporters without gaining over the commodity. Algeria, Bangladesh, Burkina Faso, Eswatini, Honduras, Uganda and Zimbabwe are the countries that shifted from group one to group three, signifying that the countries could achieve a positive trade balance over lime and lemon exports. However, El Salvador, Lebanon, and Netherland weakened the comparative advantage indicating a comparative disadvantage. Fifteen countries were able to be classified into group four in the period 2015-2019, including nine countries naming, Argentina, Brazil, Chile, Guatemala, Maldives, South Africa, Spain, Turkey, and Uruguay, were able to gain the comparative advantage and be the net exporters over the four phases constantly. The situation of Colombia, Dominica, and Egypt are that the countries were able to enhance their comparative advantage while remaining in group 3 from 2010 to 2014 and entered the group four from 2015 to 2019. As a country that remained in group two in previously reviewed stages and moved into group four by gaining a positive trade balance (Figure 6.16).

In concluding above movements of the countries with the four-time periods according to the study, it is notable that 41 countries were continuously remained in group one throughout the four phases of the study, as they could not gain either a comparative







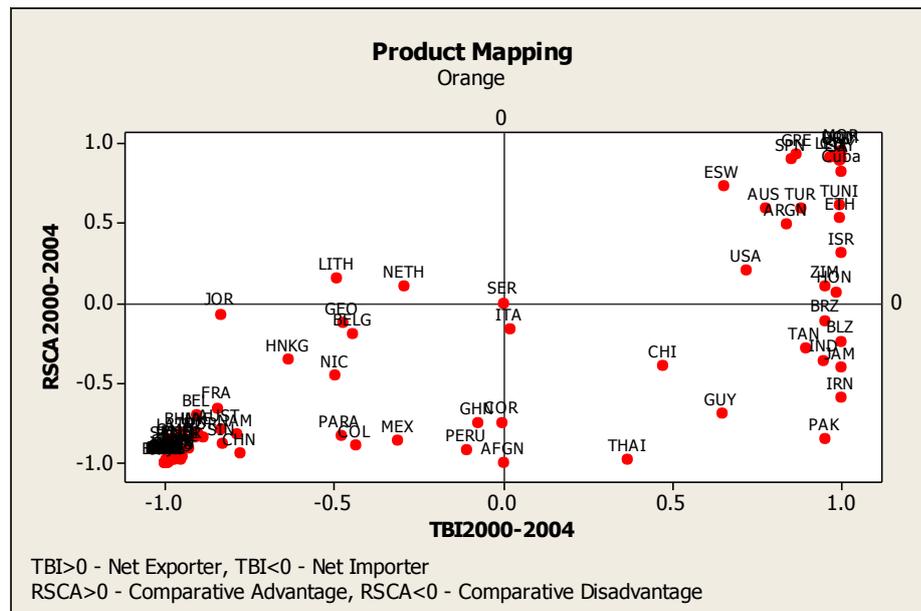
Moving into the end phase of product mapping analysis of mango (2015-2019), 16 countries in total have moved into different groups from the earlier positions that they occupied during 2010-2014. Congo from group 3 has comparative disadvantage and trade surplus, Lithuania from group 2 has international competitiveness but is a net importer, and Ethiopia from the group 4 enjoying both international competitiveness and specialization, have moved into the group 1 where there is neither comparative advantage nor trade surplus. It is worth noting that seven countries from group 3 have upgraded into group 4, the identical position achieving international competitiveness while retaining the specialization. Further, Cambodia and Mali from group 1 showed a sudden upgrade into group 4, where there are both international competitiveness and specialization. Finally, Netherland moved right from group 2 into group 4, achieving a net exporters positing while maintaining the international competitiveness (Figure 6.20).

Summarizing the analysis of all four sub-periods, it was recognized that 43 countries out of the 86 were locked in group 1, where there is no international competitiveness and specialization. These countries have not moved into any group during the studied four sub-periods. However, only 4 countries, Cameroon, Indonesia, Sri Lanka, and Venezuela, were caught in Group 3, showing comparative disadvantage but attain a net exporter position. These countries also have not moved into any other group during the studied four-sub periods. It is substance to note that 15 countries stayed in group 4 during all four sub-time periods, with international competitiveness and specialization, without moving into any other group. They are Brazil, Costa Rica, Cote d'Ivoire, Ecuador, Guatemala, Guyana, India, Israel, Kenya, Mexico, Nicaragua, Pakistan, Peru, Philippines, and Thailand. During the four sub-periods, it can be identified that the movement of countries as six countries from group one to group two, two countries from group two to group 1, seven countries from group 1 to group 3, and five countries from group 3 to group 1. Further, two countries have moved directly from group 1 to group 4, while two countries moved to group 1 from group 4. It was especially noticed that nine countries from group 3 have moved into group 4, which is having both comparative advantage and trade surplus, while 5 countries moved from group 4 into group 3. Two countries have moved from group 2 to group 4. The general observation of the movement of mango exporters in the flying gees path is above as most countries have moved between group 1, group 2, and group 3. Sri Lanka has not moved any group and stayed only in group 3, where there is a comparative disadvantage but as a net exporter.

### **6.3.6 Orange**

The product mapping analysis for 94 selected countries for orange indicates that 61 countries, remarking 64.89%, were categorized into group one that countries do not have either advantage or trade surplus over the orange exports. Netherland and Lithuania are in group two that the countries with comparative advantage but remain net importers. The analysis categorized 11 countries into the group three from 2000 to 2004 as countries performed as net exporters but without having a comparative advantage over orange exports. Moving further, the study revealed that 20 countries

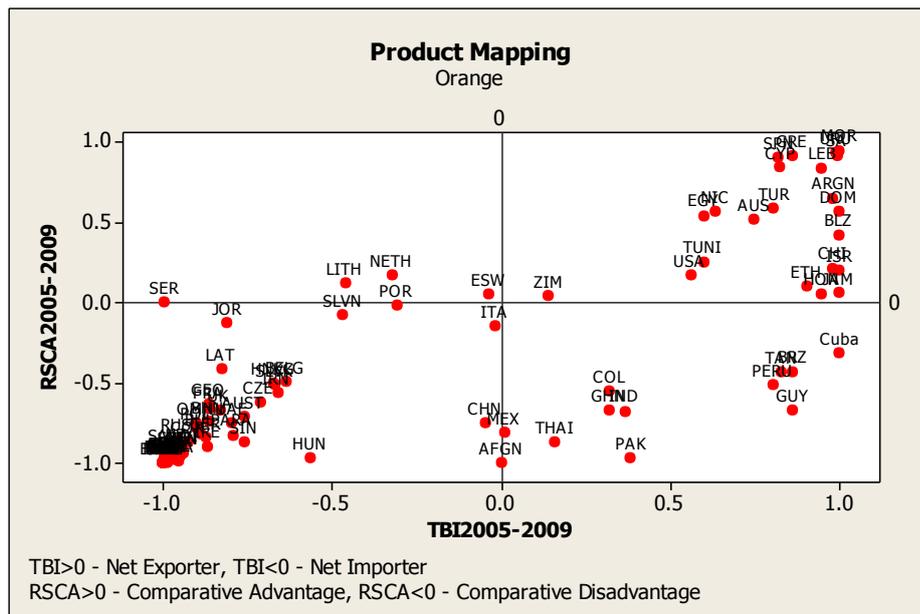
were in the best position, group four. Figure 6.21 visualized the above examined positions of the countries.



Source: Authors Calculated from FAO, 2021

**Figure 6.21: Product Mapping of Orange 2000 – 2004**

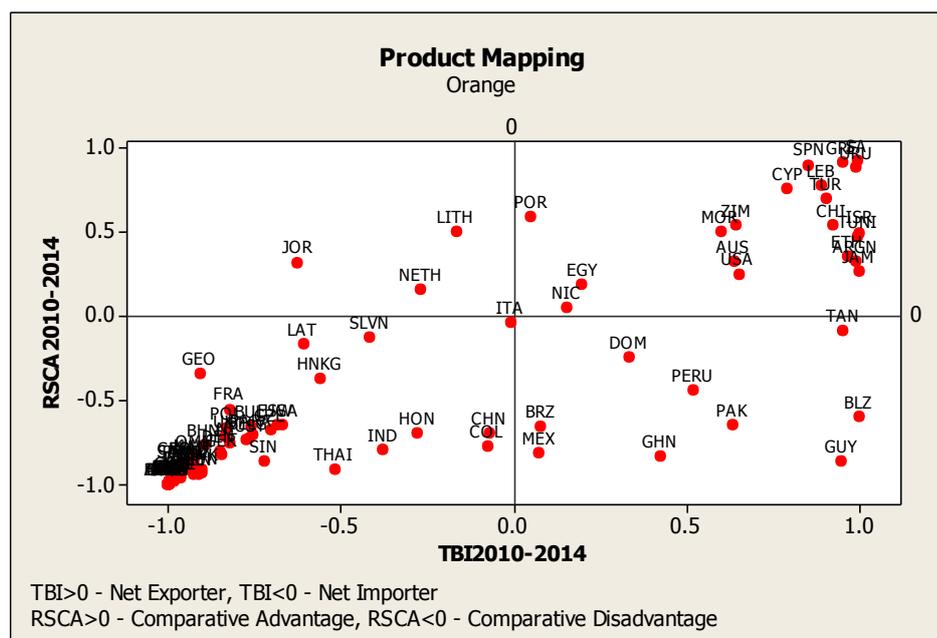
Figure 6.22 embodied the countries' situation in the period from 2005 to 2009, where 58 countries were identified as the net importers and without having gains over oranges. Compared with 2000 - 2004, Iran and Italy were shifted from group three to group one. Moving into the countries that have the comparative advantage but with negative trade balance, Lithuania and Netherland remained as previously reviewed time phase whilst Eswatini was downgraded from group four to group two, indicating that the country lost the net exporter position over time. Continuing further, Colombia, Ghana, Mexico and Peru shifted as net exporters without comparative advantage compared with 2000 - 2004. Cuba was downgraded from group four to group three, implying that they could not gain a comparative advantage but stayed with a positive trade balance in the meantime. Remarkably, Nicaragua was able to speedily boost its position from group one to group four signifying an increase in comparative advantage and attain the positive trade balance.



Source: Authors Calculated from FAO, 2021

**Figure 6-22: Product Mapping of Orange 2005 – 2009**

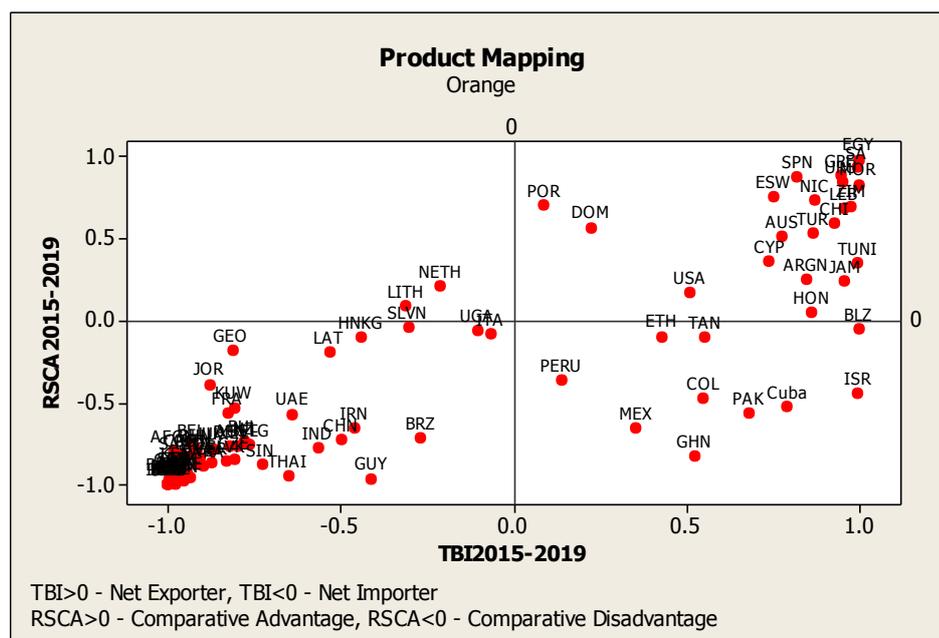
According to the figure in Figure 6.23, it can be identified that 65.95% of countries in the study were categorized in the first group, implying that the countries weren't able to gain a comparative advantage as well experienced a negative trade balance. Colombia, Cuba, India, and Thailand were unable to maintain positive trade balance compared with 2005 - 2009, when the countries were shifted to group one from group three. Eswatini lost its comparative advantage overtime. Moving further, Belize and Dominica can be identified as countries with a positive trade balance without gaining comparative advantage compared to 2005 - 2009. Additionally, Portugal shifted straightly from group one to group four, being enhanced as a net exporter achieving the comparative advantage, while 18 other countries could maintain their positions in group four.



Source: Authors Calculated from FAO, 2021

**Figure 6.23: Product Mapping of Orange 2010 – 2014**

According to the finding integrated with Figure 6.24, it can be identified that 61 countries (64.89%) in the study were categorized in the first group implying that the countries weren't able to gain a comparative advantage as well as were experienced a negative trade balance. Brazil and Guyana were not able to maintain a positive trade balance compared with 2010 - 2015, when the countries were moving to group one from group three, while Jordan shifted from group two to group one, implying a loss of comparative advantage over the time. The countries that have a strong comparative advantage but not were able to have a positive trade balance are Lithuania and Netherland. Compared with the previous period, ten countries with a positive trade balance without gaining comparative advantage can be recognized as per the flying gees approach. Further, Colombia and Cuba were shifted from group one to group three, being enhanced as the net exporters. Ethiopia and Israel can be identified as being downgraded from group four to group three, indicating that they lost the comparative advantage of orange exports. In the period from 2015 to 2019, there are 21 countries classified into group four. The position of Eswatini was upgraded from group one to group four, denoting that the country was able to be a net exporter and enhanced its gains over orange exports. The shift of the Dominica and Honduras from group three to group four signifies that the country attained the comparative advantage while maintaining the net exporter position.



Source: Authors Calculated from FAO, 2021

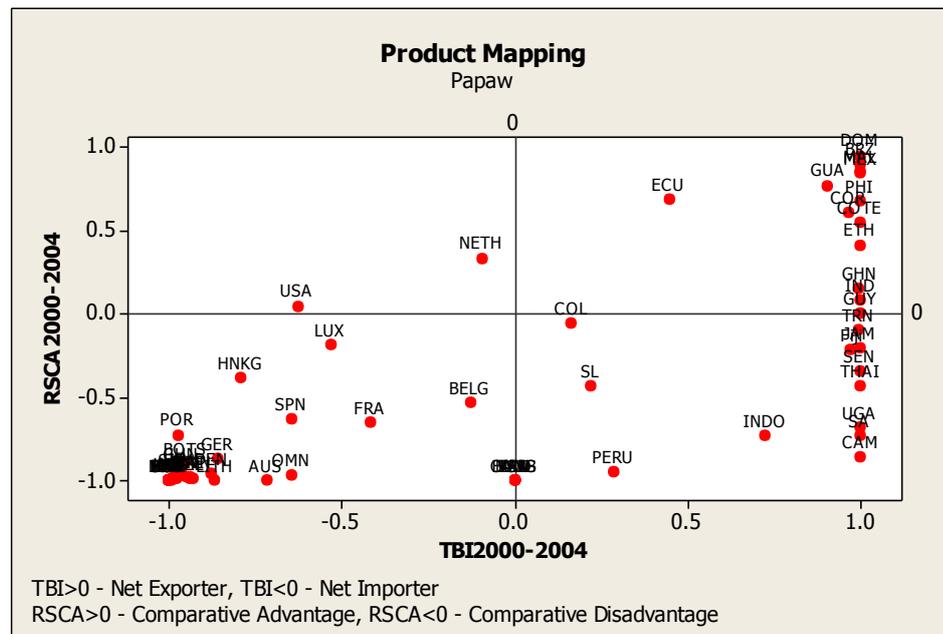
**Figure 6-244: Product Mapping of Orange 2015 – 2019**

Ultimately, above movements of the countries with the four-time periods according to the study, it is notable that 54 countries, including Sri Lanka were, continuously remained in the group one throughout the four phases of the study, as they couldn't gain either a comparative advantage or positive trade balance over exporting oranges. One country was able to be shifted from group one to group two during four periods while vice-versa for two countries. Moreover, it can be identified that six countries were shifted from group one to group three and similar for vice-versa, six countries from group three to group four, and five countries from group four to group three, which implies that the situations are common among the countries. However, there is one country for the movements between group four to one and group four to two, while three countries shifted from group one to four. Sri Lanka stagnated in group one during the four stages, indicating that the country could not enhance the comparative advantage as well as positive trade balance over orange export.

### 6.3.7 Papaw

The product mapping analysis on 65 selected countries for papaw indicated that 38 countries (58.46%) were categorized into group one and these countries do not have either advantage or trade balance over the papaw exports. Netherland and the United States of America are in group two that the countries with a comparative advantage over papaw exports but remain net importers with a negative trade balance. The analysis categorized 13 countries into the group three in the period from 2000 to 2004 as countries performed as net exporters even without having a comparative advantage over papaw exports. Moving further, the study revealed that 12 countries were in the identical position, group four, naming Brazil, Costa Rica, Cote d'Ivoire,

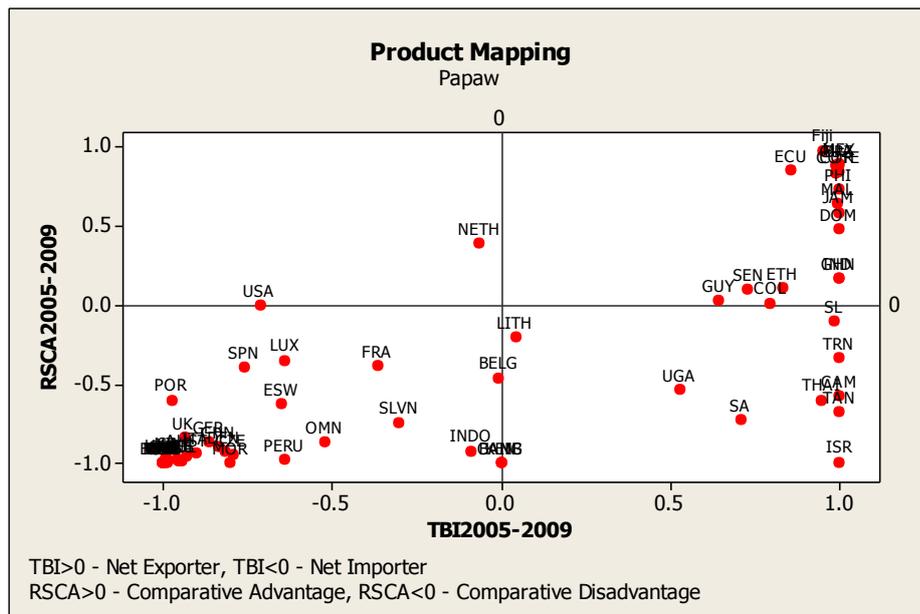
Dominica, Ecuador, Ethiopia, Ghana, Guatemala, India, Malaysia, Mexico, and the Philippines. Figure 6.25 visualize the above-reviewed positions of the countries.



Source: Authors Calculated from FAO, 2021

**Figure 6.25: Product Mapping of Papaw 2000– 2004**

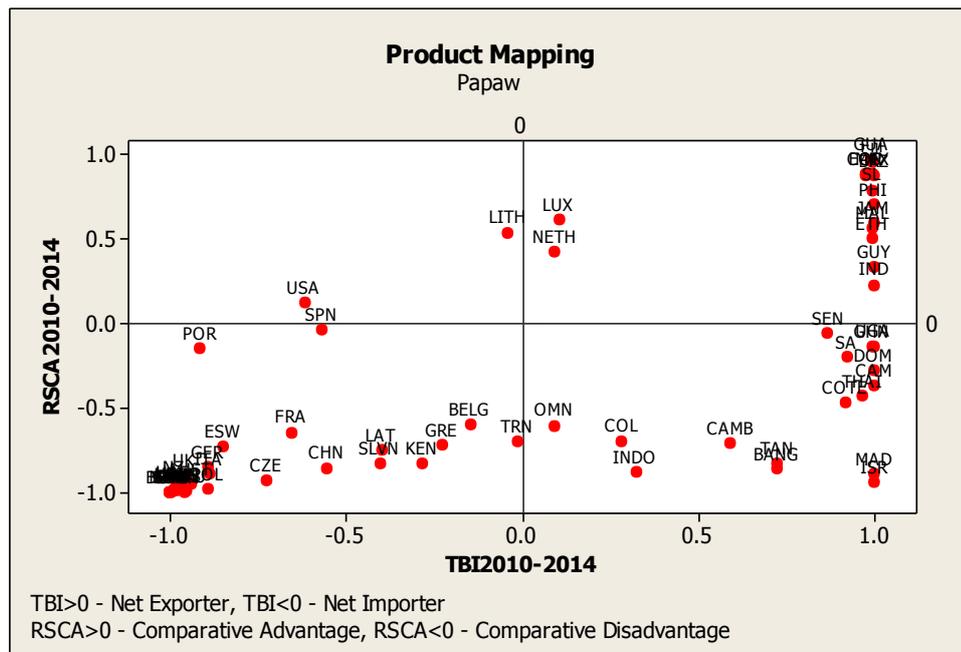
As the results revealed by the product mapping analysis for the second time phase of the study, 38 countries were classed into the group one in the second time phase in the study from 2005 to 2009. It can be identified that Indonesia and Peru were shifted as net importers who were performed as net exporters during 2000 to 2004. The stance of the United States of America denotes that in the first phase of the study, it had a comparative advantage but with a negative trade balance, and when it comes to the second phase of the study, strengthen the comparative advantage for the country is reduced. Being had gained with negative trade balance, Netherland remained in the second group in the period from 2005 to 2009 too. Cameroon, South Africa, Sri Lanka, Thailand, Trinidad and Tobago, and Uganda are the countries that can be identified in the third group who remain in the same group in the first phase too. However, Israel, Lithuania, and Tanzania were able to be shifted from group one to group three, having a positive trade balance on papaw exports. Continuing further, Colombia, Fiji, Guyana, Jamaica, and Senegal were able to strengthen their comparative advantage towards papaw exports and moved from group three to group four. While Brazil, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ethiopia, Ghana, Guatemala, India, Malaysia, Mexico, and the Philippines maintained their position in the fourth group from 2005 to 2009, as shown in Figure 6-26.



Source: Authors Calculated from FAO 2021

**Figure 6.26: Product Mapping of Papaw 2005 – 2009**

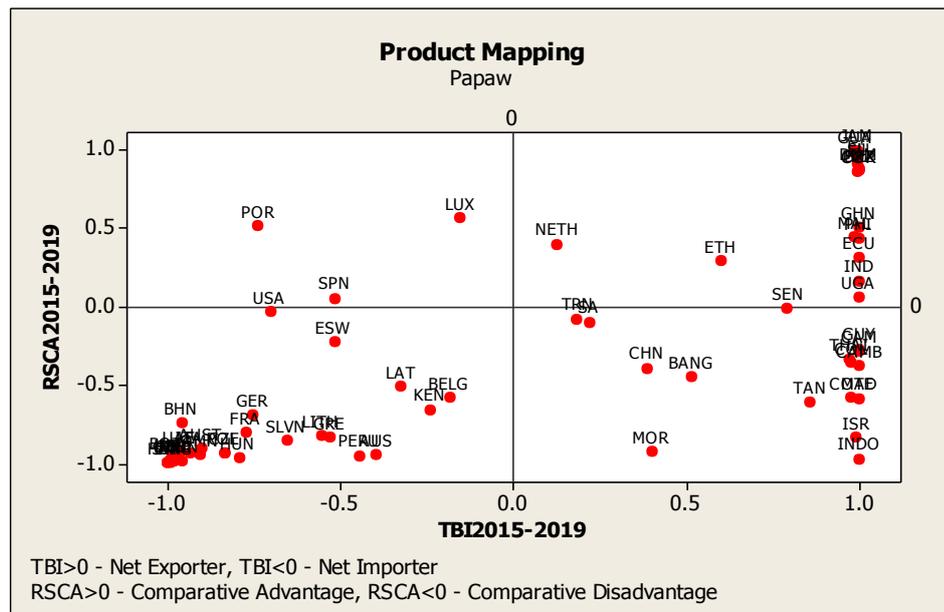
According to the results disclosed in Figure 6 - 27, it can be identified that 49.23% of countries in the study were categorized in the first group implying that the countries weren't able to gain a comparative advantage as well as were able to experience a negative trade balance. Trinidad and Tobago were not able to maintain a positive trade balance compared with 2005 - 2009, and they moved into group one from group three. The countries that have a strength of comparative advantage but not were able to have a positive trade balance are, Lithuania and the USA, compare with the previous period, the USA moved from group one to group three whilst Lithuania moved from group three to group two. Sixteen countries with a positive trade balance without the gain the comparative advantage can be recognized as per the flying gees approach.



Source: Authors Calculated from FAO, 2021

**Figure 6.27 Product Mapping of Papaw 2010– 2014**

Further, Bangladesh, Cambodia, Indonesia, Madagascar, and Oman were shifted from group one to group three, being enhanced as a net exporters. Dominica, Colombia, Cote d'Ivoire, Ghana, and Senegal were downgraded from group four to group three, indicating that they lost the benefits over papaw exports. From 2010 to 2014, there were seven countries classified into group four. The position of Luxemburg was upgraded from group one to group four, denoting that the country was able to be a net exporter and enhanced its gains over papaw exports. The shift of the Netherland from group two to group four signifies that country performed as a net exporter after gaining the advantage. The movement of Sri Lanka from group three to group four implies that the country strengthened its comparative advantage after performing as a net exporter of papaw to the world market.



Source: Authors Calculated from FAO, 2021

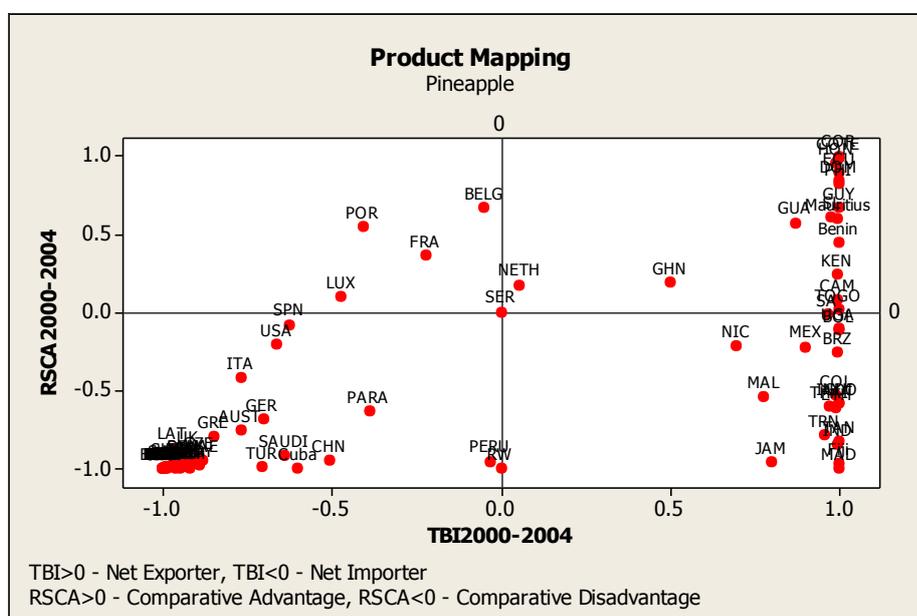
**Figure 6-285: Product Mapping of Papaw 2015 – 2019**

According to the results unfolding from the analysis in Figure 6.28, 30 countries were categorized into group one with no gains and with negative trade balance, where Lithuania and the United States of America were shifted from group two to group one. In contrast, Oman shifted from group three to group one. However, the strengthening of the comparative advantage increased in Portugal and Spain from 2015 to 2019 while Luxembourg shifted from group four to group two compare with 2010 - 2014. Moving further, 12 countries remained in group three as same as from 2010 to 2014, China and Morocco were able to upgrade as net exporters that previously remained as net importers. Dominica, Ghana, and Uganda can be identified as the countries that enhanced their comparative advantage over exporting papaw to the world market. Moreover, including Sri Lanka, 13 countries could maintain the identical position according to the flying gees approach (Figure 6-28).

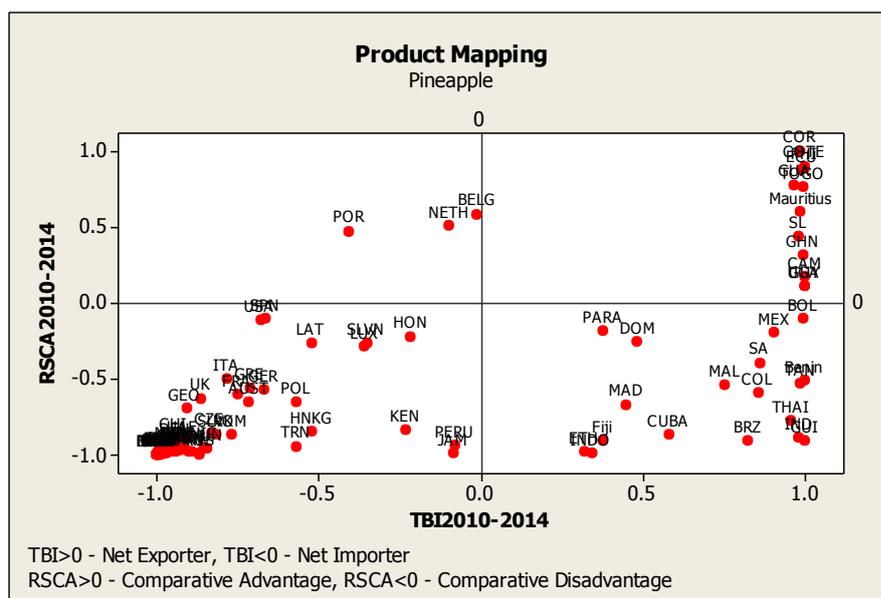
Concise the above movements of the countries with the four-time periods permitting the study. It is noted that 23 countries were continuously remained in the group one throughout the four phases of the study, as they could not achieve either a comparative advantage or positive trade balance. Three countries could be shifted from group one to group two during four periods while vice-versa for three countries too. Moreover, it can be identified that 11 countries were shifted from group one to group three and four countries for vice-versa, nine countries from group three to four, and six countries from four to three, which implies that the situations are common among the countries. However, there is one country for the movements between groups one to four, and groups two to four, four to two, and three to two. There are movements in the position of Sri Lanka from group three to group four, implying that the country was able to be at the identical position after remaining in group three for the first- and second-time phases.

### 6.3.8 Pineapple

The product mapping analysis of pineapple is shown in the Figures 6.29. The analysis found that out of the 90 selected countries for pineapple exports, 58% were categorized in the first group, which is that there is a comparative disadvantage of pineapple exports and trade deficit. Belgium, France, Luxemburg, and Portugal are classified in the second group, where the country has gained international competitiveness but is a net importer. Eighteen countries (20%) of the total, namely Bolivia, Brazil, Colombia, Ethiopia, Fiji, Guinea, India, Indonesia, Jamaica, Madagascar, Malaysia, Mexico, Nicaragua, South Africa, Thailand, Trinidad, Uganda, and Tanzania, classified into the Group 3, and these countries are net exporter but no comparative advantage. The countries that can achieve both international competitiveness and specialization are Benin, Cameroon, Costa Rica, Cote d'Ivoire, Dominica, Ecuador, Ghana, Guatemala, Guyana, Honduras, Kenya, Mauritius, Netherland, Philippines, Sri Lanka, and Togo, which is illustrated in Figure 6.29, accounted for 18% of the total selected countries.



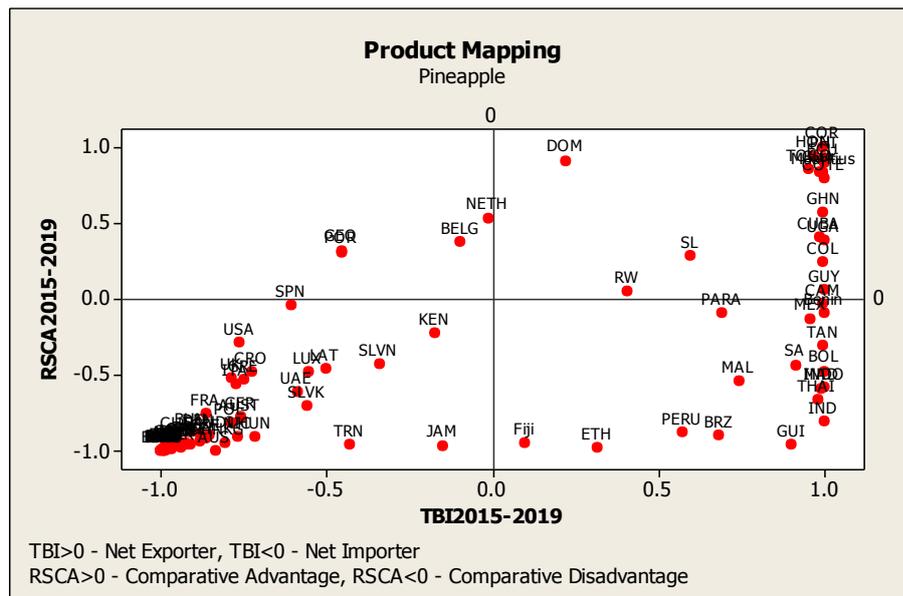




Source: Authors Calculated from FAO, 2021

**Figure 6.31: Product Mapping of Pineapple 2010-2014**

Moving to the final phase, 2015-2019, 58.88% countries are remained in the 1<sup>st</sup> phase, where Georgia, Honduras, Peru, and Rwanda are moving out there comparing with 2010-2014. Further, Belgium, Georgia, Netherlands, and Portugal are in the 2<sup>nd</sup> phase experiencing comparative advantage with trade deficit. In addition to that 17 countries are in phase 3 experiencing comparative disadvantage with trade surplus. Further, it is identified that during the period of 2015-2019, 16 countries including Sri Lanka reached to the identical position where there is a comparative advantage and net exporter position. Honduras and Rwanda the Countries that previously located where there is no international competitiveness and specialization, directly moved into the 4<sup>th</sup> group with having comparative advantage and trade surplus. Colombia, Cuba and Dominica were previously had comparative disadvantages but as the net exporter, moved attaining international competitiveness while maintaining the trade surplus (Figure 6.32).



## CHAPTER SEVEN

### Determinants of Comparative Advantage

#### 7.1 Introduction

This chapter examined the determinants of the comparative advantage for the crops that Sri Lanka has Comparative advantage as found in the chapter five. The determinants of comparative advantage were regressed over two comparative advantage indexes for the two crops. Further, the chapter encloses two models for the respective crop overcoming the problem of multicollinearity. Hence, model one is estimated with the per capita GDP of the exporting country while the second model is with capital-labour ratio.

#### 7.2 Papaw

The study used a balance panel for 16 identified countries that have a comparative advantage over papaw exports. Brazil, Costa Rica, Cote d'Ivoire, Ecuador, Fiji, Ghana, Guatemala, India, Jamaica, Malaysia, Mexico, the Netherlands, the Philippines, Senegal, Sri Lanka, and the United States was selected, and Dominica, Ethiopia, Guyana, and Luxembourg were neglected as data deficiency of determinants in those countries in the period from 2000 to 2019. As the number of countries is less than the number of time periods the FGLS estimator is fixed for the present study.

The study applied RSCA as the index of the comparative advantage for identifying determinants of comparative advantage. Thus, proceeding with the full model with the determinants identified for the present study, as the multicollinearity problem is detected among the independent variables.

**Table 7.1: Statistics of Variance Inflation Factor (VIF)**

Variable	Centered VIF Full model
LOG(TOT)	4.295663
LOG(PCGDP)	2.713140
LOG(KL)	6.694304
LOG(G)	1.163752
LOG(FDI)	1.100658

Source: Authors calculations from FAO

As Table 7.1 denotes there isn't multicollinearity problem, thus, the study performed as the VIF values are less than five.

According to the panel regression run for the countries that have comparative advantage on papaw exports the established model. Thus, in examining the determinants used in analyzing the model are per capita GDP, capital-labour ratio,

government expenditure, foreign direct investment, and terms of trade as indicated in table 7.2 are in log form.

**Table 7.2: FGLS Results of Papaw**

Variables	Model 01 RSCA
LOG(PCGDP)	0.0016 (0.000)
LOG(KL)	0.0016 (0.000)
LOG(G)	0.0028 (0.0738)
LOG(FDI)	0.0043 (0.0000)
LOG(TOT)	-0.0081 (0.0000)
Constant	16.0796 (0.0000)
R-squared	
	0.991524
Adjusted R-squared	
	0.990957
S.E. of regression	
	1.029912
F-statistic	
	1748.814
Prob(F-statistic)	
	0.000000
Mean dependent var	
	1114.599
S.D. dependent var	
	75271.21
Sum squared resid	
	317.1546
Durbin-Watson stat	
	1.902604

Source: Authors computed from FAO, 2021

As presented in the table 7-2, the developed fixed cross section SUR balanced model is able to capture 99% variation of comparative advantage. According to the model established, per capita GDP, government expenditure, capital labour ratio and FDI are positive and statistically significant implying that there is a positive impact of those variables on comparative advantage. The result of the positive impact is similar to the Torok and Jambor (2016). Moreover, there is a negative relationship with TOT and on comparative advantage.

### 7.3 Pineapple

The study used balance panel for 16 identified countries that have comparative advantage over pineapple exports. Belgium, Cameroon, Costa Rica, Cote d'Ivoire, Ecuador, Ghana, Guatemala, Honduras, Kenya, Mauritius, Netherlands, Philippines, Portugal, Sri Lanka, Togo and Uganda were selected, and Dominica, Guyana, and were excluded from the model as data deficiency of determinants in those countries in the period of 2000 to 2019. As the number of countries are less than the number of time periods the FGLS estimator is fixed for the present study.

The study applied RSCA as the index of the comparative advantage for identifying determinants of comparative advantage. Thus, proceeding with the full model with

the determinants identified for the present study, as the multicollinearity problem is detected among the independent variables.

**Table 7.3: Statistics of Variance Inflation Factor (VIF)**

Variable	Centered VIF		
	Full model	Model 01	Model 02
LOG(TOT)	2.626831	1.257985	1.104529
LOG(PCGDP)	19.37417	1.219545	-
LOG(KL)	24.97459	-	1.149287
LOG(G)	1.499241	1.203728	1.254546
LOG(FDI)	1.296138	1.003739	1.014447

Source: Authors calculations from FAO, 2021

As Table 7.3 denotes there is the multicollinearity problem, thus, the study performed with two models by excluding per capita GDP and capital-labour ratio for the two models respectively. Proceeding with the two models, the problem being resolved as VIF values are less than five. According to the panel regression run for the countries that have comparative advantage on pineapple exports, the study proceeds with two models as the multicollinearity problem. Thus, examining the determinants used in analyzing the model are per capita GDP, capital labour ratio, government expenditure, foreign direct investment, and terms of trade as indicated in table 7-4 are in log form.

**Table 7.4: FGLS Results of Pineapple**

Variables	Model 01	Model 02
	RCA	RCA
LOG(PCGDP)	0.1984 (0.000)	- -
LOG(KL)	- -	0.0262 (0.0000)
G	2.1792 (0.0000)	2.1044 (0.0000)
FDI	0.0561 (0.0000)	0.0440 (0.0000)
TOT	-0.3072 (0.0000)	-0.2837 (0.0000)
Constant	-18.7207 (0.0000)	-14.4636 (0.0000)
R-squared	0.997707	0.997879
Adjusted R-squared	0.997561	0.997745
S.E. of regression	1.0001651	1.004472
F-statistic	6869.300	7428.828
Prob(F-statistic)	0.000000	0.000000
Mean dependent var	882.6140	499.1187
S.D. dependent var	1478.495	744.1898
Sum squared resid	300.9915	302.6890
Durbin-Watson stat	1.938386	1.934917

Source: Authors computed from FAO, 2021

As presented in the table 7-4, the developed fixed cross section SUR balanced model both respective models are captured 99% variation of comparative advantage. According to the model 1 established, per capita GDP, government expenditure, and FDI are positive and statistically significant implying that there is a positive impact of these variables on comparative advantage. The result of the positive impact is similar to (Torok and Jambor, 2016).

As the second model performed similarly with above conditions, depicted the same result above as revealed by the model one. Where positive impact for comparative advantage from capital labour-ratio, government expenditure, and foreign direct investment over gaining comparative advantage for the country. In addition to that there is a negative and statistically significant relationship with TOT and comparative advantage.

## CHAPTER EIGHT

### Conclusion and Policy Implications

#### 8.1 Conclusion

International competitiveness is crucial in the economic and management literature, and it has traditionally been at the core of the agenda of academics, policymakers and practitioners in general. Hence, the export industry is considered as one of the key sectors for foreign gains. It is also reported that Sri Lanka has lost traditional international markets for its agricultural products. Hence, investigating reasons for such changes is important to identify the underlying causes. Most of the agricultural exports in Sri Lanka are limited to primary commodities, vulnerability to sudden external shocks is frequent and serious. Therefore, exploring the level of comparative advantage is essential to understand to make a sensible export strategy.

Identifying the level of comparative advantage for commodities is crucial since it directly impacts the decisions related to product specialization and building foreign trade relations. Thus, the present study aims to assess the comparative advantage of the fruits sector in Sri Lanka, identify major competitors and measure the comparative advantage level to position Sri Lanka in the international trade and explore possible potentials. Hence, to achieve the above goal, the present study targets specific objectives to calculate and determine the level of comparative advantage of eight fruit crops, investigate the trends and patterns of comparative advantage of eight fruit crops, determine the major competitors for Sri Lanka's fruit crops, and identify the contributing factors behind comparative advantage/disadvantage of fruit crops.

#### 8.2 Main Findings

This study assesses the state of comparative advantage of selected eight fruit crops among different countries, and analyzes whether Sri Lanka has a comparative advantage in exporting eight fruit crops and compared with other countries individually from 2000 to 2019. As the study calculated five comparative advantage indexes, and when a country passes at least three indexes of five, countries are grouped into two categories, namely comparative advantaged countries and comparative disadvantaged countries.

##### 8.2.1 Avocado

The study revealed that 19 countries gained comparative advantage from 2000-2019. Therefore, 21.68% of countries can gain comparative advantage over exporting avocado to the world market while 78.32% of countries experienced a disadvantage in exporting avocado. Further, most of the countries having comparative advantage belong to African and American regions, while few countries are located in Asian and European regions.

1. The evidence shows that Sri Lanka is a comparative disadvantageous in avocado exports, according to the results obtained from five indexes. Sri Lanka only gained the advantage according to the Vollrath RCA results, however, the other indexes recorded a disadvantage for Sri Lanka which can determine that the country wasn't able to gain in exporting avocado to the world market.
2. Mexico, Netherland, Chile, Peru, Spain, Israel, New Zealand, South Africa, Kenya, and Morocco are the most advantageous countries. Thus, as identified above, the most advantageous region is the American region. Despite the Netherland, the leading countries are in the American and African regions.
3. Countries that identified as earning a positive trend in avocado exporting are Brunei, Hong Kong, Lebanon, Malaysia, Singapore, Republic of Korea, Brazil, Colombia, Peru, Uruguay, Burundi, Ivory Coast, Kenya, Rwanda, Tanzania, Austria, Belarus, Bulgaria, Czech Republic, Denmark, Estonia, Finland, Georgia, Hungary, Latvia, Luxembourg, Netherland, Poland, Portugal, Russian Federation, Slovakia, Slovenia, Switzerland, and United Kingdom. Further, some of the countries can be in top advantages countries too.
4. The product mapping analysis found that the country's movements are between net importer to net exporter and vice-versa.

### **8.2.2 Banana**

In bananas, 23 countries gained an advantage at least from three indexes. Hence, the overall status of the comparative advantage for exporting bananas to the world market is that 25.84% countries among selected 89 countries can be concluded as gaining the advantage over the period. However, most countries (74.15%) were experiencing a comparative disadvantage in exporting bananas.

1. Regarding Sri Lanka's stance, only the Vollrath RCA index passes for Sri Lanka, and according to the BRCA, RSCA, NRCA and AI indexes, Sri Lanka is experiencing a disadvantage in exporting bananas to the world market.
2. The most advantageous top ten countries are Ecuador, Costa Rica, Colombia, Belgium, Philippines, Guatemala, Honduras, Panama, Cote d'Ivoire, and Cameroon. Thus, most of the top rankers are in the American region.
3. Bolivia, Guatemala, Mexico, Peru, Paraguay, Belize, Canada, Jamaica, Burundi, Cote d'Ivoire, Eswatini, South Africa, Ethiopia, Madagascar, Nigeria, Tanzania, Nevertheless, Belgium, Poland, Greece, Italy, Lithuania, Latvia, Netherlands, Russia, Slovenia, Australia and New Zealand were identified that has a positive trend of comparative advantage among the selected countries.
4. The general observation of the movement of banana exporters in the flying gees path is above as most countries have moved between group 1, group 2, and group 3. Sri Lanka has moved only between group 1 and group 3.

### 8.2.3 Cashew

According to the analysis performed on cashew, 15 (18.07%) among 83 countries could gain comparative advantage in exporting cashew to the world market.

1. Moving into the position of Sri Lanka gaining the comparative advantage in exporting cashew to the world market, only the Vollrath RCA index passes for the country. In contrast, the BRCA, RSCA, NRCA and the AI indexes imply a disadvantage.
2. India, Cote d'Ivoire, Tanzania, Brazil, Ghana, Benin, Nigeria, Indonesia, Guinea, and Cambodia, respectively, can be identified as the leading countries that gained comparative advantage between 2000 and 2019.
3. Bangladesh, India, Hong Kong, Jordan, Korea, Kuwait, Oman, Singapore, Thailand, Cambodia, Kazakhstan, Brazil, Canada, El Salvador, Guatemala, Jamaica, Guinea, Brazil, Cameroon, Ivory Coast, Mali, Nigeria, South Africa, Togo, Belarus, Croatia, Denmark, France, Germany, Hungary, Lithuania, Norway, Slovakia, Slovenia, Sweden, Austria, Belgium, Czech Republic, Spain, Switzerland, and United Kingdom recorded a positive trend in comparative advantage for cashew exports.
4. According to the results unfolding by the flying gees approach, 60 countries were categorized into group one with no gains and negative trade balance, where Mexico and Nicaragua shifted from group three to group one, and Sri Lanka reduced the strength of comparative advantage over cashew and downgraded to group one.

### 8.2.4 Lime and Lemon

There are 25 (26.88%) among selected 93 countries that gained the comparative advantage between 2000 and 2019 over lime and lemon exports.

1. Concluding the stance of Asia, despite the results of Vollrath RCA, the region does not have much advantages countries over the period. Where it belongs to Sri Lanka as the country also experiencing a disadvantage in exporting lime and lemon to the world market. According to the calculated five indexes, Sri Lanka only gains the advantage in the Vollrath RCA. The other indexes recorded a disadvantage for Sri Lanka in exporting lime and lemons.
2. The world-leading countries gaining comparative advantage are Spain, Turkey, Argentina, Maldives, South Africa, Morocco, Chile, Uruguay, Brazil, and Egypt.
3. The countries that indicated positive trends of comparative advantage are Bangladesh, China, Kuwait, UAE, Saudi Arabia, Afghanistan, Hong Kong, Kazakhstan, Kenya, Madagascar, South Africa, Morocco, Cote d'Ivoire, Algeria, Cote d'Ivoire, , Bulgaria, Denmark, Georgia, Germany, Latvia, Luxembourg, Portugal, French Polynesia and New Zealand.

4. The movements of the countries with the four-time periods in product mapping according to the study, 41 countries continuously remained in the group one throughout the four phases of the study, as they could not gain either a comparative advantage or positive trade balance. It could not identify movements of the position of Sri Lanka, and continuously, the country remained in the group three while being a net exporter but without gaining a comparative advantage.

### **8.2.5 Mango**

According to the indexes reviewed on mango, 27 countries could gain comparative advantage at least from three indexes. Hence, the status of the comparative advantage for exporting mango to the world market, 32.53% among selected 83 countries, can be recognized as gaining advantage over the period.

1. Stating the position of Sri Lanka about the gaining comparative advantage over mango, only the Vollrath RCA index passes for Sri Lanka, and according to the reviewed other indexes, BRCA, RSCA, NRCA and AI Sri Lanka came across disadvantage for exporting mango to the world market.
2. Mexico, India, Brazil, Peru, the Netherlands, Thailand, the Philippines, Pakistan, Ecuador, and Israel are the most advantageous countries.
3. Oman, Thailand, Cambodia, Jordan, Kuwait, Brazil, Cuba, Costa Rica, Ecuador, Honduras, Mexico, Nicaragua, Peru, St. Lucia, Uruguay, Venezuela, Burkina, Ghana, Guyana, Namibia, Madagascar, Bulgaria, Croatia, Denmark, Estonia, Finland, Georgia, Germany, Hungary, Netherlands, Poland, Portugal, Slovenia, Spain, and Sweden implied a positive trend for comparative advantage.
4. The general observation of the movement of mango exporters in the product map is above as most countries have moved between group 1, group 2, and group 3. Sri Lanka has not moved any group and stayed only in group 3, where there is comparative disadvantage but as a net exporter.

### **8.2.6 Orange**

It can be detected that 31 countries gained the comparative advantage from 2000 to 2019 for orange exports in the overall context, indicating that 32.97% of countries among 94 selected countries achieved the comparative advantage in exporting oranges to the world market.

1. Identifying the position of Asia, despite the results of Vollrath RCA, the region does not have much advantages countries over the period, where Sri Lanka belongs to, as the country also experienced a disadvantage in exporting oranges to the world market throughout the period. In concluding reviewed indexes on Sri Lanka, all the five indexes recorded a comparative disadvantage for the country between 2000 and 2019.

2. Spain, South Africa, Egypt, Greece, Morocco, Turkey, Australia, Uruguay, Argentina, and Lebanon are the prominent countries that achieved comparative advantage between 2000 and 2019.
3. Afghanistan, Bangladesh, China, Kazakhstan, Kuwait, Hong Kong, Malaysia, Pakistan, Chile, Mexico, Nicaragua, Peru, El Salvador, Jamaica, St. Vincent, Algeria, Egypt, Uganda, Belgium, Bulgaria, France, Greece, Latvia, Luxembourg, Portugal, Slovenia, Spain, Fiji, New Zealand, and Australia are the countries shown an upward trend of comparative advantage in the orange exporting market.
4. The product mapping concludes that Sri Lanka stagnated in group one during the four stages, indicating that the country could not enhance the comparative advantage and as positive trade balance over oranges.

### **8.2.7 Papaw**

According to the assessed five indexes for papaw, it can be discovered that 22 countries gained the advantage by exporting papaw to the world market, indicating that 33.84% of countries among 65 selected countries achieved the comparative advantage in exporting papaw to the world market.

1. The indexes were remarking advantage over a few countries, indicating that Sri Lanka experienced an advantage in exporting papaw to the world market through the period as all the five indexes passed for the country.
2. Considering the South Asian countries reviewed, Sri Lanka is the leading among the considered countries. Further, recognizing the world's top countries that achieved comparative advantage, respectively Mexico, Brazil, Malaysia, Guatemala, the Philippines, Jamaica, Ecuador, Costa Rica, Sri Lanka, and Fiji, can be stated.
3. Sri Lanka recorded a positive trend for comparative advantage in the world papaw export market, signifying that the country could gain over papaw exports. Bangladesh, China, Cambodia, Israel, UAE, Brazil, Guatemala, Jamaica, Mexico, Uruguay, Cameroon, Kenya, Madagascar, South Africa, Ghana, Morocco, Uganda, Austria, Czech, Finland, Germany, Latvia, Luxemburg, Poland, and Portugal are the rest of countries that depicted positive trend of comparative advantage over papaw exports.
4. The product mapping unfolds that there are movements in the position of Sri Lanka from group three to group four, implying that the country was able to be at the identical position after remaining in group three for the first- and second-time phases.

### **8.2.8 Pineapple**

In the pineapple exporting market, it can be identified that 19 countries gained the comparative advantage throughout the study where 23.22% of the countries among

the selected 90 were able to achieve the comparative advantage over exporting pineapple to the world market.

1. Among the two countries experiencing the advantage in the Asian region, Sri Lanka was able to attain the advantage over the period in exporting pineapple to the world market. According to the above five indexes, Sri Lanka passes all indexes on comparative advantage, being the only country that passed all the indexes for the region.
2. The most beneficial top ten countries are Costa Rica, Belgium, the Philippines, Netherland, Cote d'Ivoire, Ecuador, Honduras, Portugal, Ghana and Guatemala respectively. Thus, most of the top rankers are scattered around the world.
3. As identified by the findings of Sri Lanka, despite the country has gained over pineapple exports, there is a negative and insignificant trend of comparative advantage shown for pineapple exports. In addition, Bahrain, Japan, Kuwait, the Philippines, Singapore, UAE, Oman, Hong Kong, Canada, Colombia, Costa Rica, Cuba, Dominica, El Salvador, Uruguay, Paraguay, Dominica, Chile, Guatemala, Peru, Benin, Botswana, Ivory Coast, Guyana, Mauritius, Madagascar, Rwanda, South Africa, Togo, Croatia, Georgia, Germany, Hungary, Ireland, Italy, Latvia, Netherland, Slovakia, Slovenia, United Kingdom, Russian Federation, Denmark, Norway, Poland, Serbia, and New Zealand earn a positive trend of comparative advantage being competitors for Sri Lankan pineapple exports.
4. The movement of Sri Lanka in the product mapping implies that over the four periods, the country was able to gain a positive trade balance over pineapple exporting, and despite 2005-2009, the country gained the benefits of comparative advantage too.

In concluding the determinants of comparative advantage over the identified two crops, it can be identified that according to the performed models, the determinants highly influenced the comparative advantage of the countries. The study revealed that per capita GDP, government expenditure, and FDI are significant and positively impacted on comparative advantage, while there is a negative impact on TOT. Hence, to strengthen the countries' comparative advantage, improvements in identified determinants have to be considered.

### **8.3 Policy Implications**

The findings of this study reveal that Sri Lanka is in the international competitive position in pineapple and papaw exports in the world market, and the country is among the leading exporters of those fruits. Regarding papaw, Sri Lanka is in a better position as the trend of comparative advantage has increased from 2000-2019 while staying in the internationally competitive and net exporter position. Therefore, papaw production is one of the internationally efficient crops in Sri Lanka's agricultural sector. Allocation of land and other resources from agriculture and other sectors will benefit

Sri Lanka. As papaw export holds the net exporter position, more exports can generate foreign exchange for higher returns.

Pineapple is also an internationally competitive fruit crop in the country while enhancing forex reserves. However, a declining trend of international competitiveness over the period from 2000 to 2019 warrants scrutiny into the pineapple export sector. Given the high competition from top players in the world market, if Sri Lanka loses its pineapple export, it is more difficult to recapture the world market. An immediate encouragement is required in this regard, the government is able to intervene through fiscal and monetary policy instruments. As Sri Lanka holds a net exporter position in pineapple exports too there is motivation and room for the development of this sector. Having occupying an efficient position in the agricultural sector, devoting more resources towards the pineapple production and export sector too will enhance the sector's efficiency.

A critical finding of this study is that it was able to find leading exporters with the highest comparative advantage and established survival in the identical position during the whole study sub-time period. This implies that they can meet the global market demand while maintaining the global consumers' needs in terms of quality, tastes, and preferences. These finding signals that Sri Lanka's investment need in developing such kind of export quality varieties. Private-public partnership plays a vital role in improving the export supply chain of the country by providing all related information and infrastructure. Investment in research and development, in this case, is vital. However, since it may take a significant time to produce an output of R & D, as a short-term strategy, Sri Lanka can come up with bilateral trade in quality raw material trade and pineapple production trade.

Although there is a comparative advantage of exporting papaw and pineapple from Sri Lanka, the export share of Sri Lanka is low as compared to other leading countries. In this case, Sri Lanka is able to increase the exports by acquiring a suitable place in the global value chain in supplying the required production in terms of quality and taste to leading exporters.

One of the important findings of this study is that capital-labour ratio, and FDI has promoted comparative advantage of both pineapple and papaw. Hence, to strengthen the country's comparative advantage, improvements of identified determinants have to be considered.

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