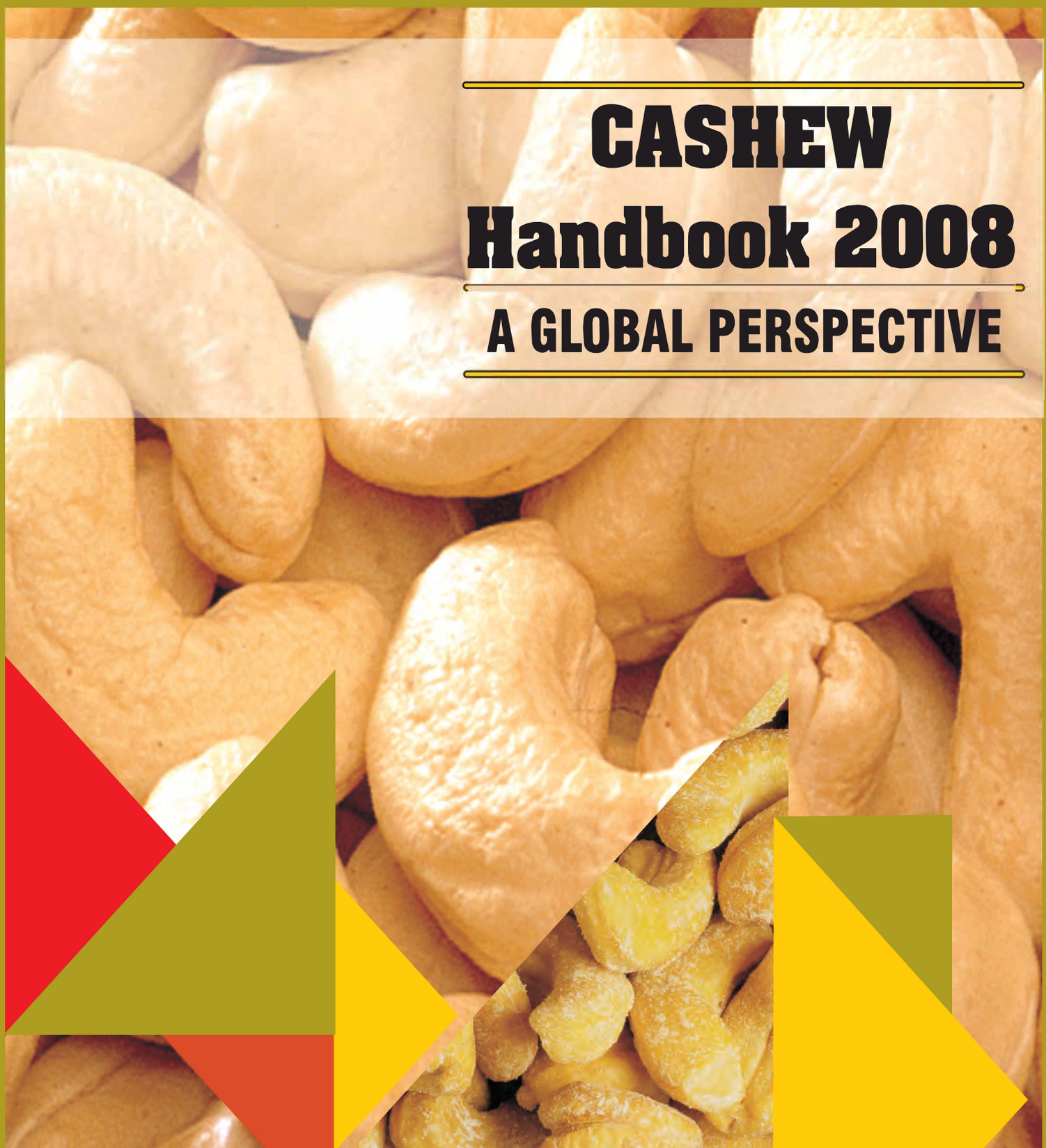

CASHEW Handbook 2008

A GLOBAL PERSPECTIVE

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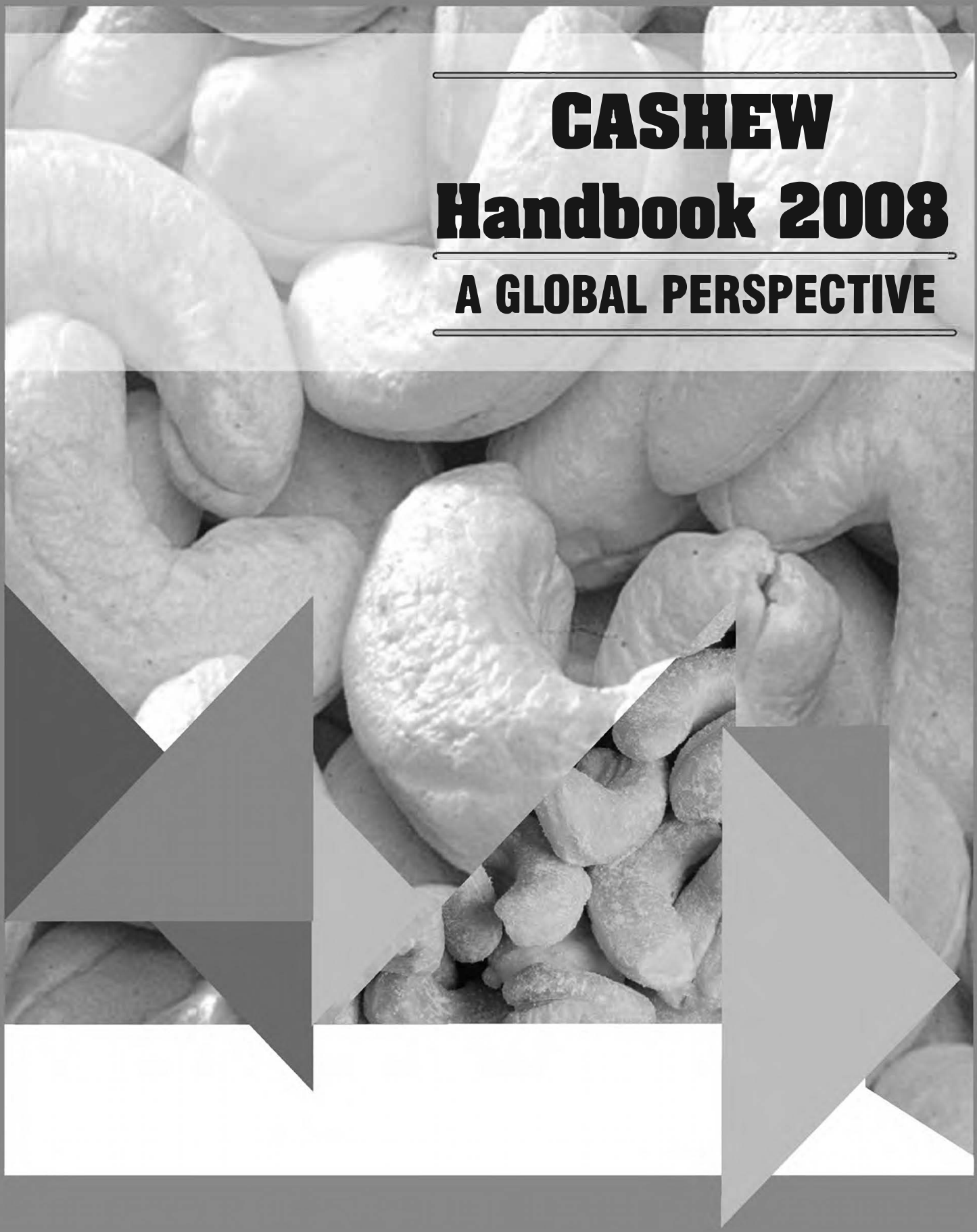

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Cashew Handbook 2008

A Global Perspective

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Foreword

*This publication - "**Cashew Handbook 2008 - A Global Perspective**" being brought out by Eventell Global Advisory Pvt Ltd is a timely one and is bound to benefit all stakeholders of the cashew industry, namely, raw nut producers, processors, cashew kernel buyers, by-product users, suppliers of technology, logistics, quality systems firms, supplier of capital, Government agencies and retail consumers.*

I note that the Handbook contains detailed information on all aspects of cashew production, processing, statistics on export, price trends, etc. which will provide a deep insight into the working of the cashew industry in India and outside. The book also has useful information on the world trade in other treenuts like almonds, pistachios, walnuts, macadamia nuts, etc. The publication contains a section carrying experts' opinion on the future of the industry and ways and means to achieve greater heights.

A lot of planning and effort has obviously gone into making this publication an exhaustive reference book for any one interested in world cashew trade. I appreciate and congratulate the publishers for bringing out this excellent publication.

I wish the publication all success.

P. Bharathan Pillai
Chairman
The Cashew Export Promotion Council of India
Kochi 682016

Preface

Dear Readers,

There are best of times and there are worst of times. Perhaps we are in the midst of decadal best times when it comes to the cashew industry. This is the time for reflection, for investing into the future to grow and develop the cashew industry to the next level. 'Cashew Handbook 2008- A Global Perspective', a sequel to 'Indian Cashew Handbook – 2002', is an attempt to focus the attention of the industry on some of the core themes for future, taking into account current and historic trends in production, consumption and global trade.

Last six years have seen major breakthroughs in the cashew industry – formation of global alliance for cashew, spectacular growth of Vietnam cashew industry and lastly, emergence of new demand centres. In the coming years, we believe Global Alliance for Cashew could provide the necessary thrust in branding cashew as a 'wholesome nutritious food', while Vietnam's progress would be emulated by aspirant producers of raw nuts. As rightly emphasized in the India Cashew Vision 2020 document, India's strong demand for kernel would necessitate a business model based on local production of raw nuts, in an era of unaffordable energy prices and increasing logistics costs. Integration of environment and energy aspects into the cashew industry is another natural step forward for value enhancement.

We thank all the members of the Indian cashew community, especially, the Cashew Export Promotion Council of India (CEPCI) – its Chairman and other office bearers- for readily coming forward and encouraging us in bringing out this handbook. We would be failing in our duty if we do not acknowledge the contribution of experts on special topics.

This project, conceived two years ago, has been executed successfully by Ms. Meena, commodity analyst, with the support of members from research and marketing teams.

Lastly, we have put in our best efforts. We await your feedback and suggestions to take the research effort forward. Your participation and suggestions are valuable to us. Do write to us about the usefulness of this handbook in 'understanding the present and shaping the future of the cashew industry'.

Best wishes,

July 08, 2008

Executive Summary

Cashew is an important tree nut traded worldwide. Long time ago, cashew was largely consumed by the rich and royal, but in recent days, increased health awareness has enticed people to consume more nuts. A production share of 32 per cent among all other tree nuts at global level has undoubtedly shown the importance and usage of cashew nuts. A comparison of nutrient contents of important nuts has shown that nutrient realization per Dollar is more in cashew nuts than in other nuts such as almond, brazil nut, hazelnut, macadamia nut, pistachio and walnut.

The global area under cashew was 3.38 million hectares with production of 2.13 million tons in 2006-07. The higher area under cashew cultivation has been witnessed in West Africa followed by India, Brazil and Vietnam. Cashew has witnessed a production growth of 8.9% per annum between 1996-97 and till date. In terms of output, India ranks first followed by West Africa and Vietnam. Though India and Vietnam are large producers of cashew nut, they import significant quantity of raw nut to meet their increased processing capacity. African countries process only 12-14% of their output and export the rest in raw form to India and Vietnam. On the Cashew nut shell liquid front, India has potential to produce 0.2 million tons of CNSL, but it produces only 0.05 million tons currently. Given the current scenario, opportunity to Indian cashew sector is plenty.

The cashew kernels exports from India and Vietnam have shown a growth of 3.6 and 28 per cent respectively per annum from 1999-2000 to till date. The major destinations for Indian cashew kernels are USA, the Netherlands, UAE, UK and Japan. For Vietnam kernels, USA, China, European countries, Russia and Japan are the major markets. On the consumption front, USA is the leading consumer of cashew kernels in the world.

Cashew kernels prices are climbing up and ruling at USD 3.55/lb (FOB price of Indian W-320) currently. This is higher than the past record level of USD 3.16/lb in 1999. Factors such as the lower production from the major cashew growing countries including Vietnam, Brazil and Indonesia and increased demand for cashew kernel have triggered the Bull Run. The comparison of W-320 cashew prices at Indian domestic and export market has shown that the prices are higher at the domestic market. This could be mainly attributed to preference for higher-grade kernels in the export market besides rising demand for the same within India. The firming up kernels price gives the indication of tight supply, which in turn has been reflected in the higher price levels of raw nut. The result of price forecast has indicated that the prices would move up or would be in the range bound at the higher level till the end of current year.

Table of Contents

List of figures

List of Tables

List of Annexure

List of Acronyms

° C	Degree Celsius
$	US Dollar
%	Per cent
ACA	African Cashew Alliance
AFI	Association of Food Industries
AP	Andhra Pradesh
ARIMA	Auto Regressive Integrated Moving Average
CAGR	Compound Annual Growth Rate
CBN	Central Bank of Nigeria
CEPCI	Cashew Export Promotion Council of India
CNSL	Cashew Nut Shell Liquid
DA	Dearness Allowance
DCCD	Directorate of Cashew and Cocoa Development
DEPB	Duty entitlement passbook
DGCI & S	Director General of Commercial Intelligence and Statistics
DGFT	Director General of Foreign Trade
EU	European Union
FAO STAT	Food & Agricultural Organization Statistics
Ha	Hectare
HYV	High Yielding varieties
i.e.,	That is
Kg	Kilo gram
KSCDC	Kerala State Cashew Development Corporation
lb	Pound
LWP	Large White Pieces
m^2	Metre squared
MAI	Market Access Initiative
MARD	Ministry of Agriculture and Rural Development
MDA	Market Development Assistance
NEPC	Nigerian Export Promotion Council
NRCC	National Research Centre for Cashew
RCN	Raw Cashew Nut
Rs	Rupees
S	Splits
SB	Scorched Butts
SWOT	Strengths Weakness Opportunity & Threat

SWP	*Small White Pieces*
UAE	*United Arab Emirates*
UK	*United Kingdom*
USA	*United States of America*
USD	*US Dollar*
VINACAS	*Vietnam Cashew Association*
Vs	*Versus*
W-320	*White Wholes*

Introduction

Introduction to Global Cashew Industry

Cashew, botanically termed as *Anacardium occidentale,* belongs to the family Anacardiaceae. It is generally called as cashew in English but it has several other names around the world. In France it is called as 'cajou' and 'acajou' and in Spain as 'maranon', in India and Sri Lanka as 'cadju', in Portugal as 'caju', in Italy as 'anacardio', in Germany as 'Acajuban', in East Africa as 'mkanju' and in Indonesia as 'jambu mente' (Andrighetti et al, 1989).

The evergreen cashew tree tolerates a wide range of moisture levels and soil types but commercial production is advisable only in well-drained, sandy loam or red soils. The cashew tree is most frequently found in coastal areas, which is also evident from the Figure- 1.5 (global distribution of cashew). Although cashew can withstand high temperatures, a monthly mean temperature of 25°C is found to be optimal and yearly rainfall of 1000 mm is sufficient for production. The cashew tree is vigorous, fast growing under favourable conditions and it may reach a height of 40 to 50 feet. Though cashew tree is yielding many more useful products, cashew kernels are considered as the most important produce, which is consumed mostly as snack and as food ingredients. Besides edible nut, cashew tree also yield cashew fruit, which is used to manufacture jams, candy and alcoholic drink, popularly called as "fenny" in Goa (India) and cashew nut shell liquid (CNSL), which is an important industrial raw material for resin manufacture and the shells that can be burned to provide heat for the decorticating operation.

The average life span of a cashew tree is 25 years. But a tree which was planted during 1888 is seen on the beach at Pirangi do Norte, 24 kilometers from Natal; Brazil also has the world's largest cashew tree with a circumference of 500 meters, occupying an area of 7,300 m^2. The tree can yield about 80,000 nuts per year during cropping season.

Cashew tree

Cashew trees flourish in extreme heat in the tropics. The seedling trees flower in the third year after planting where blossoming takes place between November and January. Nuts germinate within four days when

lying on wet soil. The Figure- 1.1 depicts the stages of growth of cashew nut from flower to nut maturity.

Figure- 1.1. Cashew nut development from flower to maturity

The duration from pollination to nut maturity in cashew varies between 55 and 65 days, depending on the soil and climatic conditions, location and variety used. Grafts are the best planting materials and 156 to 200 grafts are required to plant a hectare of land under normal systems of planting. Under good management, from a hectare of well-managed adult cashew plantation, planted with high yielding varieties of cashew, three to four tons of raw nuts (750 to 1000 kg of kernels) can be obtained per annum.

Origin

Cashew nut, originated in Brazil and brought to the world by the Portuguese, is one of the most nutritious nuts with a compelling taste. It was introduced into India during 16th century. No doubt, it is grown in over 32 countries of the world and consumed by one and all around the globe. The world produces around 2.1 million tons per annum of cashew with an average yield of 700 pounds of raw cashew nut per acre (780 kg/ hectare) of land.

Cashew seasonality

The availability of cashew nut has been witnessed all round the year as the cashew nut is harvested during different months at different origins.

It can be seen from the Figure- 1.2 that cashew availability is more during November to June and the availability is less during July to October. According to cashew price seasonality, the prices are at peak during July to October on account of less availability and the coincidence of major festivals in those months. The cashew nut arrivals of India, Vietnam, Ivory Coast, Nigeria and Ghana coincide with one another whereas the arrivals of Brazil, Indonesia and other African countries like Tanzania, Benin, Mozambique, Kenya coincide. Senegal and Guinea Bissau supply cashew nuts to the World during July and August.

Figure- 1.2. Cashew arrival seasons from different countries

It can also be seen from the Figure- 1.2 that the quantum of arrivals of nuts is more from India i.e., nearly 29% of cashew has been from India only. Cashew nut from Vietnam contributes 16% to the total raw cashew nut production followed by Brazil (14%) and so on.

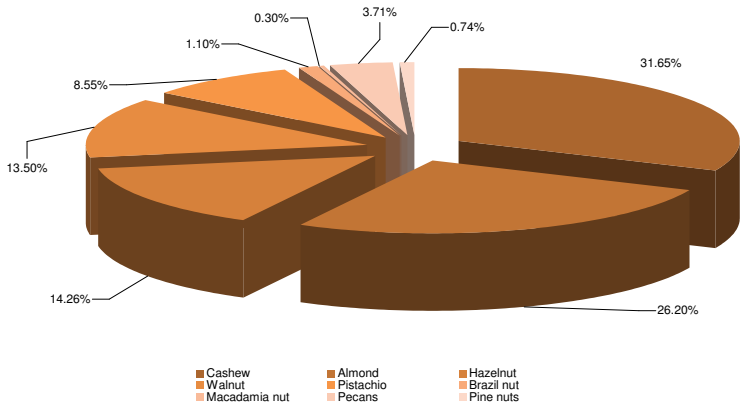
Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	% contribution to total RCN production
India													29.07
Brazil													14.06
Vietnam													16.41
Ivory Coast													9.38
Tanzania													4.69
Guinea Bissau													4.69
Indonesia													5.39
Benin													2.11
Nigeria													3.52
Mozambique													3.05
Senegal													0.70
Kenya													0.23
Ghana													0.70

Production size of all tree nuts

The consumption of tree nuts has assumed a greater role in today's life style since it reflects an individual's standard of living and status in the society. The consumption pattern of tree nuts has grown enormously over the years. Among the important tree nuts, cashew nut occupies an important place in consumer's platter. If we analyze the market size of

cashew nut in total tree nut production we can realize the importance and place of cashew nut in the dry nut consumption.

Figure- 1.3. Production size of Tree nuts by quantity in tons (2006-07)



Production size of all tree nuts in raw form (Cashew nut, almond, walnut, pistachio, hazel nut, macadamia nut, Brazil nut, pecans and pine nuts) at global level accounts nearly 6.74 million tons currently as seen in the Figure- 1.3. Among all nuts, Cashew accounts for about 32% followed by almond (26.2 per cent), hazelnut (14.26 per cent), walnut (13.5 per cent), pistachio (8.55 per cent) and pecans (3.7 per cent). The other nuts like Brazil nut, macadamia nut and pine nut contribute meager share to the total tree nut production.

Table-1.1. Growth in production of all tree nuts from 1995-96 to 2006-07

Tree nuts	Production	CAGR
Cashew*	2133000	8.90
Almond	1766127	3.79
Hazelnut	960907	1.57
Walnut	910000	4.34
Pistachio	576000	2.76
Brazil nut	73960	4.04
Macadamia nut	19900	2.64
Pecans	250000	-
Pine nuts	50000	-

Source: FAO STAT, Foreign Agricultural Service, USDA and other news sources

Note: * Indicates production data taken from various news sources

The Compound Annual Growth Rate (CAGR) of all important tree nuts in the Table- 1.1 has shown that the Cashew nut production has grow at the rate of 8.9% annually from 1995-96 to 2006-07. The CAGR of

other tree nuts such as almond, walnut, hazelnut, pistachio, Brazil nut and macadamia nut witnessed the growth of 3.79 per cent, 4.34 per cent, 1.57 per cent, 2.76 per cent, 4.04% and 2.64% respectively. Overall, it can be concluded that the Cashew nut dominates in market size of tree nuts and also has huge growth potential compared with other tree nuts.

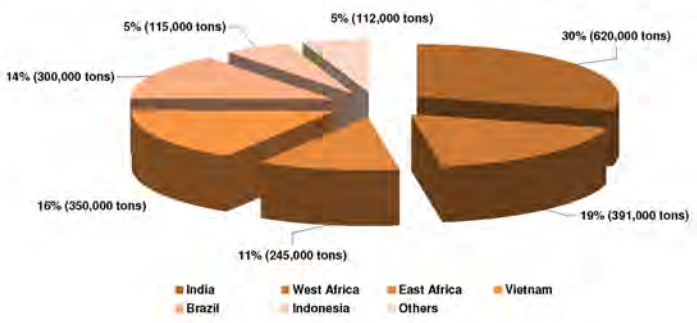
Global Cashew production

The global Cashew production during 2006-07 was nearly 2.1 million tons from an area of 3.37 million hectares. It can be seen from the Figure- 1.4 that India ranks first in output with 620,000 tons, which has contributed nearly 30% to world output followed by West Africa (18.33 per cent) and East Africa (11.49 per cent). Meanwhile, Vietnam and Brazil have contributed nearly 16.5% and 14% respectively. Indonesia had the share of about 5 per cent, while other countries have contributed the rest in the total output.

The Cashew nut has been introduced to India in 16th century in order to prevent soil erosion only. Later the kernels from this nut become a major source of income for most of the people in coastal tropical regions of India.

Though the African countries are producing Cashew nuts in large scale, they export more than 80% in raw form to India and other South-East Asian nations. This is due to lack of necessary infrastructure and modern technology in those countries.

Figure- 1.4. Per cent Contribution of major countries in total RCN production 2006-07



Source: FAO STAT & Various news sources

Global Cashew cultivation distribution

Cashew nut is cultivated in almost all the continents across the globe. The cultivation has been distributed in many regions in India, Vietnam, Thailand, Indonesia, West and East African countries, and Brazil. Cashew nut is also cultivated in some parts of Sri Lanka, Australia, etc.

Figure- 1.5. Global Cashew distribution

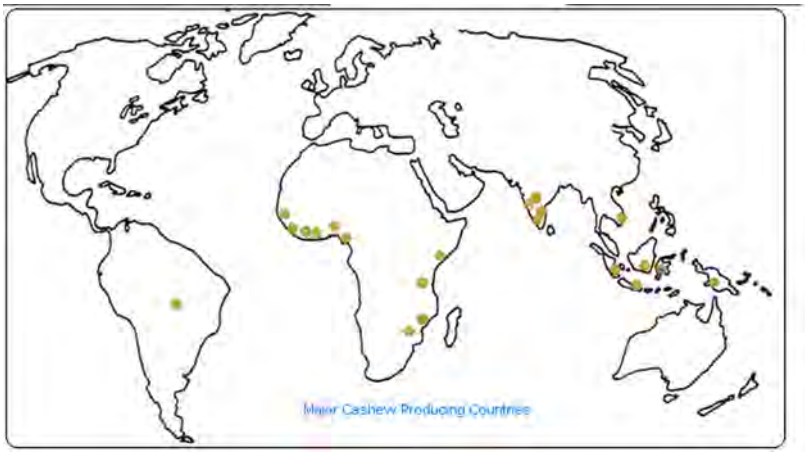


Figure- 1.5 indicates the major Cashew producing countries in the world. It has been cultivated in the lower half of the globe i.e., nearer to the equatorial line. It is also to be noted that most of the Cashew producing countries are mainly concentrated in coastal areas.

Among the countries producing cashew, the Asian countries alone contribute about 65% of global production followed by African countries, with a share of 30% in the total production.

Cashew processing

The major Cashew nut processing countries at global level are India, Vietnam and Brazil. Each of these countries have distinct advantage in processing i.e., India able to process more of best quality cashew nuts right from the inception. Vietnam is expanding the processing capacity to meet its rising output (due to higher yield) besides to process the imported raw nut. Brazil is also practicing their mechanical method of processing, which compensate the labour unavailability in the country. Overall, the processing capacities of these major processing countries have been increasing year after year with respect to size and operational efficiency.

Cashew kernels consumption

USA has remained as the biggest consumer of cashew from long ago followed by India and other EU countries. The increasing health awareness among the people, higher per capita income and standard of living has kept the Cashew consumption at zenith. Other than these traditional countries, there are new entrants into Cashew consuming countries list. Overall, the CAGR of Cashew kernels consumption has stood at 11.6% between 1996 and 2005.

The leading consuming country USA had had the share of 40% of total global consumption in 2006. In India, the kernels consumption has increased by 8.75% annually from 1996 to 2006. The consumption is expected to increase with a rate of 7.88% per annum till 2012. The consumption of other major processing countries Vietnam and Brazil has also increased by 5.6 and 6.8% per annum respectively.

The direction of change in Cashew kernels supply from major countries has shown that India and Vietnam are the stable suppliers to USA over the period of 1996 to 2007.

Cashew is perhaps one of the few commodities that travel maximum distance between the time it is harvested and consumed. This has been the way the industry has evolved in the past. In recent times, Vietnam has demonstrated value enhancement through two important aspects to the Cashew industry. The one aspect is productivity improvement at the farm level and the other is corporate form of organization at the processing level with emphasis on consistency in quality and innovation in packaging.

The global commodity boom has shown positive sign on African economy, despite a weak political infrastructure. Perhaps, this is one of the best times to develop Cashew processing in Africa. High crude oil prices and its subsequent effects on logistic costs could be taken advantage of by the African processors to supply processed nuts to consuming markets.

Increasing energy prices have had an impact on the food crops. The world has started looking at sugarcane and corn for fuel. No more sugar industry is a single product industry. No more rice mills are only for extracting rice from paddy. These industries are striving to extract maximum value from by-products. Why should Cashew be different? Is it not the time to look

into energy dimensions hidden in Cashew- such as ethanol from Cashew apple, power from de-oiled shell waste and so on?

The present handbook is designed in such a way to address all the above issues both national and international context.

Reference

Andrighetti, L. Bassi, G.F. Capella, P. de Logu, A.M. Deolalikar, A.B. Haeusler, G. Malorgio, G.A. Franca, F.M.C. Rivoira, G. Vannini, L. & Deserti R. 1989. The world Casheweconomy, L'Inchiostroblu, Italy.

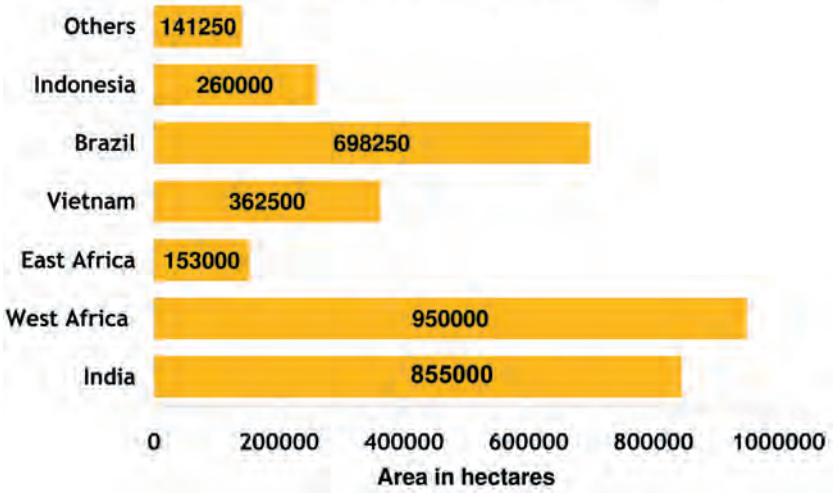
Raw Cashew Nut

CHAPTER 2.1.

Cashew Nut Area in the Major Growing Countries

Cashew nut is cultivated in more than 30 countries in about 3.38 million hectares with global production of 2.13 million tons. India is the leading producer (620,000 tons from 855,000 hectares), exporter of Cashew kernels (worth Rs. 25 billion) as well as importer of raw Cashew nuts (worth Rs.21 billion).

Figure- 2.1.1. Global cashew area in 2006-07



The Cashew acreage in the major producing countries is given in the Figure- 2.1.1. It can be inferred from the figure that the area under Cashew cultivation was much higher in African countries particularly in West African countries (28%) followed by India (25%). Brazil had a share of 21% in terms of area under crop but a lower productivity has kept the country in fourth position with respect to production. The Cashew acreage in Vietnam was only 10.7% of the total global area. The higher yield levels have reserved the third position to Vietnam in terms of output.

CAGR of Cashew acreage in the major processing countries

The area under Cashew cultivation in India has witnessed 4% growth (CAGR) during 1960's and the similar growth was also witnessed during 1970's as shown in the Table-2.1.1. The growth rate of area was lower i.e.,

1.83% during 1980's whereas during 1990's and 2000-2006 the area has registered a growth of 3.5% and 3.75% respectively.

Table- 2.1.1.CAGR of area in the major Cashew processing countries

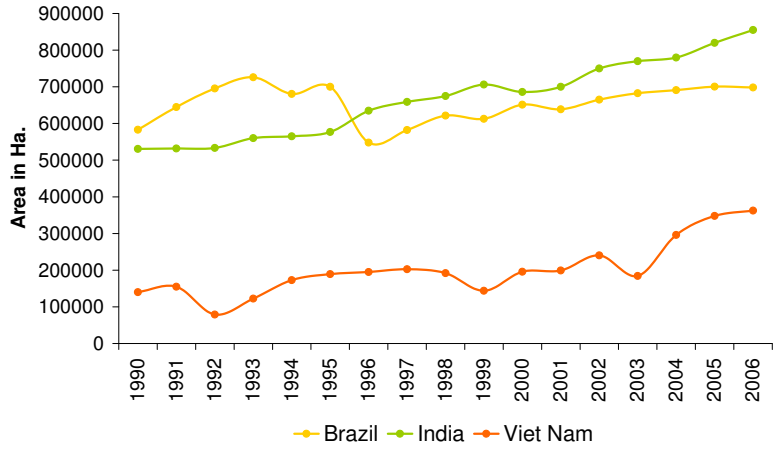
Country	Period	CAGR (%)
India	1960's	4
	1970's	4
	1980's	1.83
	1990's	3.5
	2000-2006	3.75
Vietnam	1960's	20
	1970's	8
	1980's	39
	1990's	5
	2000-2006	12
Brazil	1990's	- 0.9
	2000-2006	1.56

Cashew area in Vietnam has grown tremendously in 1960's by 20% and during 1970's the area has witnessed a growth of 8%. The area has again witnessed a robust annual growth of 39% during 1980's. About 12% growth has witnessed during the period between 2000 and 2006.

Though Brazilian area has witnessed a negative annual growth of 0.9% during 1990's, the increasing global demand for Cashew has influenced the acreage later. It has recorded a positive growth of 1.56% during the period between 2000 and 2006.

Area under Cashew cultivation in the major processing countries

Figure- 2.1.2. Area under cashew in the major countries



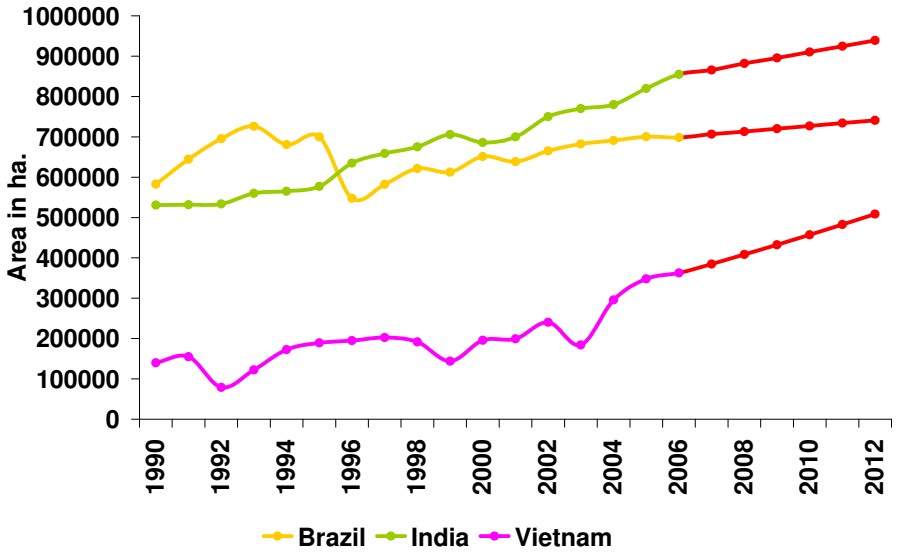
The growing demand for Cashew kernels in USA and EU countries and also the emerging domestic demand from India have induced the major growing countries such as India, Vietnam, Brazil and African countries to increase their acreage under Cashew. The higher acreage has resulted in increased employment opportunities and higher earnings for the stakeholders in Cashew sector through foreign exchange. The expansion in Cashew area over the years is as shown in the Figure- 2.1.2.

The Cashew area from 1990 to 2006 in India has been increasing by 3.1% (CAGR). Vietnam has witnessed an annual growth of 6.2% whereas Brazil's growth was only 0.42% during the above said periods.

Cashew acreage forecast

The forecast given in the Figure- 2.1.3 have indicated that the area under Cashew cultivation has an up trend for India, Vietnam and Brazil. According to the vision by Ministry of Agriculture and Rural Development (MARD) of Vietnam, the area under Cashew cultivation is likely to reach 450,000 hectares by 2010. The forecasted figures are also nearest to this vision at 457,266 hectares by 2010.

Figure- 2.1.3. Forecasted area under cashew till 2012



Important Cashew growing regions in the major processing countries

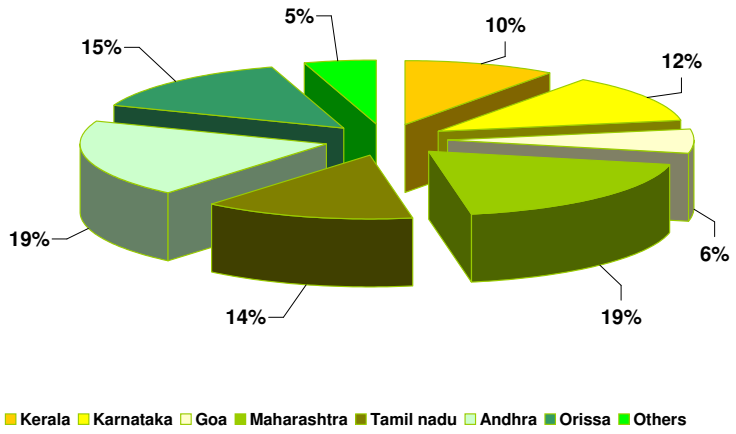
Table-2.1.2. Major Cashew growing regions

Countries	Growing regions
India	Andhra Pradesh, Maharashtra, Karnataka, Kerala, Orissa, Tamil Nadu, Goa, West Bengal and some parts of North Eastern states.
Brazil	States of Ceará, Rio Grande do Norte, Piauí, Maranhão, Paraíba and Bahia. Cashew production is mainly concentrated in North East regions of Brazil.
Vietnam	Binh Phuoc, Bu Dang, Phuoc Long, Dong Phu, Daknong, Dak lak province and Dak Rlap. In Vietnam, Cashew nut planted areas are mostly in the south eastern parts.

Cashew acreage in India

Figure-2.1.4 depicts the area under Cashew cultivation in the major growing states of India. It is evident from the figure that the area was higher in Andhra Pradesh (171,000 ha) and Maharashtra (164,000 ha) followed by Orissa (125,000 ha), Tamil Nadu (123,000 ha), Karnataka (102,000 ha), Kerala (80,000 ha), Goa (55,000 ha) and other states like West Bengal, Gujarat and Assam.

Figure- 2.1.4. Area under cashew in India (2006-07)



Source: DCCD, Cochin, Kerala

In terms of area under Cashew cultivation, Kerala has shown a negative growth of 4.15% (CAGR) during the period 1990-2006 (Table-2.1.3). The

negative growth in Kerala was due to crop diversification from Cashew nut to rubber (the realization from rubber was found to be higher) and the recent shortage in labourers particularly for shelling activities in processing. Meanwhile, the 'other countries' such as Gujarat, Assam, etc., have registered a higher growth of 24% followed by Maharashtra (12.72%). Andhra Pradesh and Orissa has shown an annual growth of 5.96% and 5.33% respectively for the aforesaid period. Overall during 1990-2006, the area under Cashew in India has witnessed a growth of 3.13% annually.

Table- 2.1.3. CAGR of Cashew acreage in India (1990-2006)

States	Area
Kerala	-4.15
Karnataka	2.09
Goa	1.48
Maharashtra	12.72
Tamil Nadu	1.11
Andhra Pradesh	5.96
Orissa	5.33
West Bengal	2.2
Others	24.8
Total	3.13

Annexure- 2.1.1. Forecasted area under Cashew till 2012 (in hectares)

Year	Brazil	India	Vietnam
1990	582818	530869	140000
1991	644608	531849	155000
1992	695483	533549	79000
1993	726140	560000	122500
1994	680615	565000	172700
1995	699936	577000	189400
1996	547720	635000	194900
1997	582210	659000	202500
1998	621419	675000	191800
1999	612735	706000	143700
2000	651169	686000	195600
2001	638556	700000	199200
2002	665014	750000	240200
2003	682503	770000	184200
2004	691059	780000	295900
2005	700367	820000	348100
2006	698250	855000	362500
2007	706689	865798	384475
2008	713027	882217	408485
2009	720285	895483	432598
2010	727140	910518	457266
2011	734171	924561	482553
2012	741126	939160	508429

Annexure- 2.1.2. Area under Cashew in the major countries (in hectares)

Year	Brazil	India	Viet Nam
1961	-	200000	1000
1962	-	200000	1000
1963	-	215000	1000
1964	-	215000	1000
1965	-	230000	1000
1966	-	241314	3000
1967	-	249024	3000
1968	-	257107	3000
1969	-	265698	3000
1970	-	281171	3000
1971	-	302732	5000
1972	-	320034	5000
1973	-	328294	5000
1974	-	350887	5000
1975	-	361443	5000
1976	-	374653	7000
1977	-	375702	7000
1978	-	385895	7000
1979	-	419692	7000
1980	-	447376	8000
1981	-	464465	9500
1982	-	481043	17000
1983	-	492492	30000
1984	-	501953	59000
1985	-	509768	90000
1986	-	518379	115000
1987	-	522998	130000
1988	-	527395	97000
1989	-	529287	110000
1990	582818	530869	140000
1991	644608	531849	155000
1992	695483	533549	79000
1993	726140	560000	122500
1994	680615	565000	172700
1995	699936	577000	189400
1996	547720	635000	194900
1997	582210	659000	202500
1998	621419	675000	191800
1999	612735	706000	143700
2000	651169	686000	195600
2001	638556	700000	199200
2002	665014	750000	240200
2003	682503	770000	184200
2004	691059	780000	295900
2005	700367	820000	348100
2006	698250	855000	362500

Source: FAO Stat

Annexure- 2.1.3. State wise Cashew nut acreage in India (in '000 ha)

Year	Kerala	Karnataka	Goa	Maharashtra	TN	AP	Orissa	WB	Others	Total
1990-91	155	74	45	23	96	71	60	7	1	532
1991-92	155	74	45	23	96	71	60	7	1	534
1992-93	156	75	46	48	96	72	60	7	1	560
1993-94	156	75	46	51	97	72	60	7	1	565
1994-95	156	75	48	58	97	73	61	7	2	577
1995-96	119	84	50	67	77	118	102	9	10	635
1996-97	119	85	51	80	79	121	105	9	10	659
1997-98	120	87	52	104	81	121	109	9	16	701
1998-99	122	89	53	119	83	101	114	9	16	706
1999-00	122	91	54	121	85	103	84	9	17	686
2000-01	100	91	55	121	86	130	90	8	19	700
2001-02	100	90	55	143	90	135	110	9	18	750
2002-03	100	92	55	148	92	136	120	9	18	770
2003-04	101	94	55	148	95	136	124	9	18	780
2004-05	102	95	55	160	105	150	126	9	18	820
2005-06	80	100	55	160	121	170	120	10	21	837
2006-07	80	102	55	164	123	171	125	10	24	854

Source: Directorate of Cashew & Cocoa Development, Cochin, India

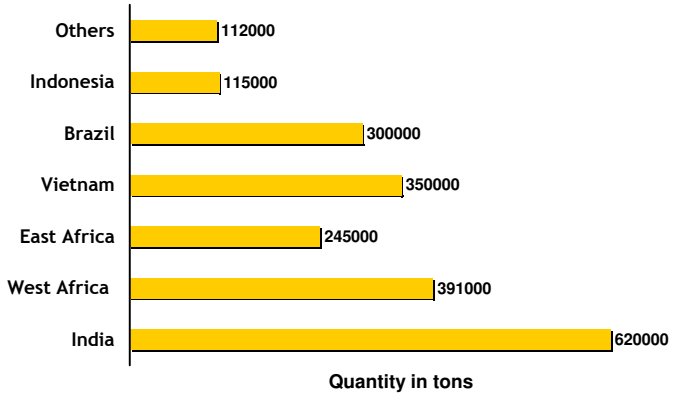
CHAPTER 2.2.

Trends in Cashew Nut Production

Global Cashew nut production

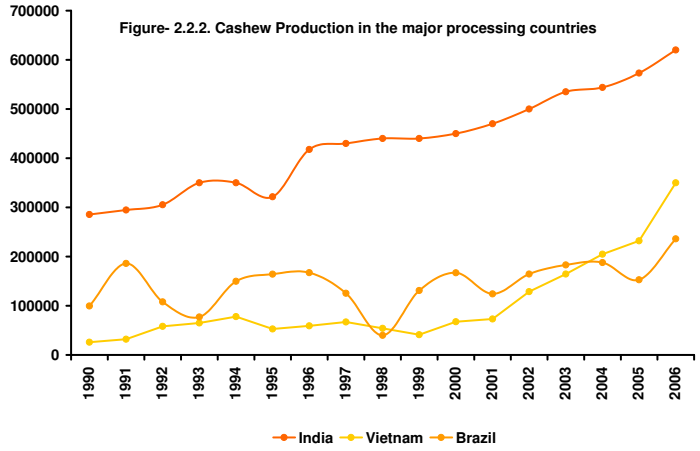
The Cashew nut production in 2006-07 is given in the Figure-2.2.1. It is obvious from the figure that India was the leading producer of Cashew nut (620,000 tons) followed by West African countries with 391,000 tons. The third largest producer, Vietnam has an output of 350,000 tons followed by Brazil and East African countries. Thus, the total global production was 2100,000 tons.

Figure- 2.2.1. Global cashew production in 2006-07



Cashew nut production in the major processing countries

Figure- 2.2.2. Cashew Production in the major processing countries



The production of Cashew nut over the years from 1990 to 2006 has increased across the major producing countries. It is clear from the Figure-2.2.2 that the production of Cashew in India has been increasing from 1990 to 2006. It can also be inferred that till 2003 Brazil was the second

largest producer among the major processors, afterwards Vietnam has overridden the Brazilian production and attained position No.2 with an output of 350,000 tons. Brazilian output was only 236,140 tons for the same period.

CAGR of Cashew production

CAGR of Cashew production from 1960 to 2006 is shown in the Table-2.2.1. According to FAO data given in the table that India's production has been growing with an annual growth rate of around 4% during the three decades started from 1960's to 1980's. During 1990-99 and 2000-06 the production has shown a growth of 5.5% and 5.3% respectively. According to DCCD, Cochin data, the Indian production has shown 6.4% growth in 1990-99 and 5.3% in 2000-06.

Table- 2.2.1. CAGR of Cashew production (in %)

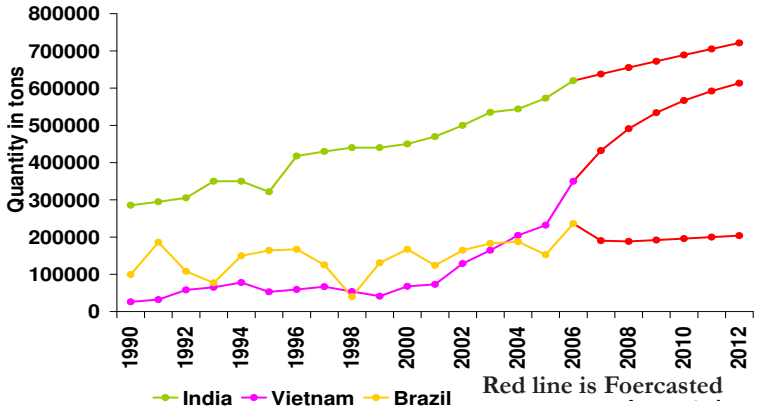
Production	India	Vietnam	Brazil
1961-69	4.79	20.09	12.52
1970-79	4.11	7.98	12.58
1980-89	4.84	5.44	6.37
1990-99	5.51	4.87	-3.07
2000-06	5.29	31.68	5.83

Source: FAO Stat

According to FAO data, the higher growth in Vietnam output was recorded during the decade of 1960's. The data from other news sources have showed that the production growth has peaked during 1960's, 80's and 2000-06. Brazilian output has taken a dip during 1990's and then it recovered during 2000-06.

Cashew Production Forecast

Figure- 2.2.3. Forecasted cashew production till 2012



The predicted Cashew production of India and Vietnam in Figure-2.2.3 has shown an increasing trend for the next five years up to 2012, whereas Brazil has witnessed a declining trend for the next five years. According to the forecast, Indian output is likely to reach 688,830 tons by 2010 and Vietnam output will touch 566,630 tons by 2010. Meanwhile, by 2010 the Brazilian output is expected to reach 195,842 tons only.

Indian Cashew production scenario

The annual processing capacity of Indian Cashew industry is 1.2 million tons. However, the domestic production is only 50% of this processing capacity and it is insufficient to meet the raw nut requirement. India is depending upon African countries at the larger extent for utilizing the full capacity of its processing sector, which in turn provides employment opportunities particularly to rural women. Now, Vietnam has emerged, as one of the largest processor next to India. Hence, competition is rising in sourcing the raw nuts from other major producing countries like Africa. The need of the hour to Indian Cashew industries is to increase the production potential either by increasing productivity or by increasing the area under cultivation. This requires indigenous raw nut production to be enhanced to more than 2.1 million tons by 2020. Then only it can sustain and retain the acme position in the international trade in the long term.

The growth rate of Cashew production in India

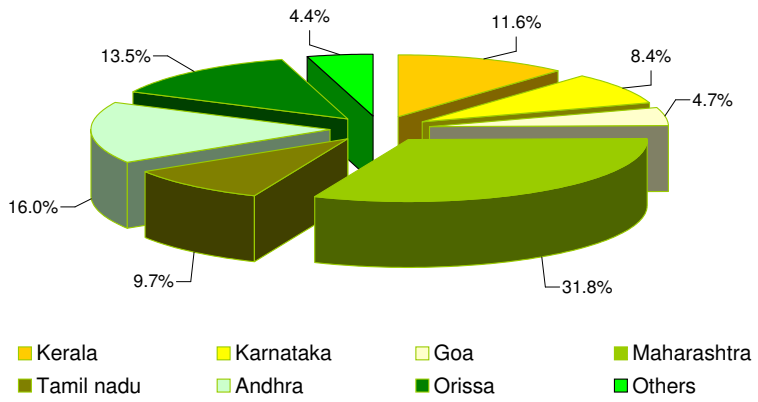
The CAGR of Cashew nut production in India has shown a growth of 4.4% from 1990 to 2006. Though Indian Cashew nut production has been increasing over the years due to area expansion, their productivity is very less. The main reason behind this low yield was about 300,000 hectares of Cashew under senile plantation in India. The state wise Cashew output has showed that the annual growth of Cashew production from Maharashtra and Tamil Nadu was higher at 12% and 10% respectively. Almost all the states like Karnataka, Goa, Andhra Pradesh, Orissa, West Bengal has witnessed a positive growth from the year '90 - '06. The production growth was negative in Kerala - it has shown a negative growth of 5.14% annually from '90-'06.

Table- 2.2.3. CAGR of state wise production in India (1990 to 2006)

States	CAGR of Production
Kerala	-5.14
Karnataka	3.72
Goa	5.44
Maharashtra	12.15
Tamil Nadu	10.41
Andhra Pradesh	6.16
Orissa	6.39
West Bengal	7.23
Others	34.94
Total	4.44

Share of different state in total Cashew production

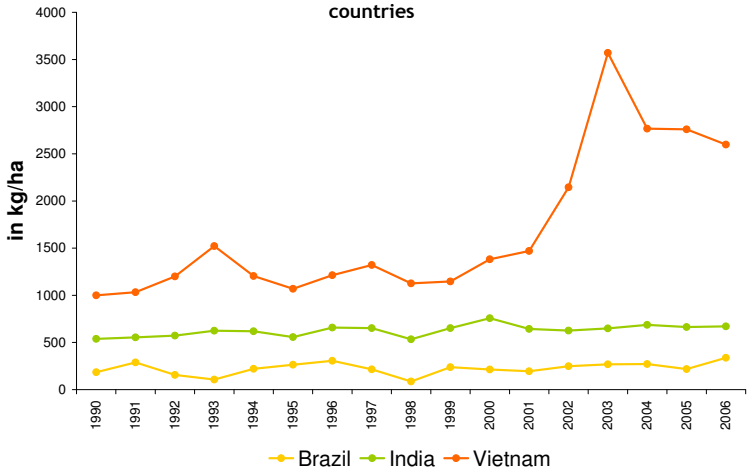
Figure- 2.2.4. Cashew nut production in India (2006-07)



It is evident from the Figure-2.2.4 that the contribution of Maharastra to India's Cashew production was higher at 197,000 tons with a share of 32% followed by Andhra Pradesh (99,000 tons) and Orissa (84,000 tons). The share of Kerala, Tamil Nadu and Karnataka was 12%, 10% and 8.4% respectively in 2006-07.

Cashew nut productivity

Figure- 2.2.5. Productivity of cashew in major cashew growing countries



The global average productivity of Cashew was 780 kg/ha. According to FAO data, the productivity of Cashew in Vietnam has been increasing over the years. The annual productivity growth of Vietnam during 2000-

06 was 13%. The average productivity was about 2500 kg/ha. The Indian productivity (665 kg/ha) has shown a negative growth during the same period i.e., 0.77%, whereas Brazilian productivity was much lower at 330 kg/ha. However the productivity of Brazil has increased by 6.3% during 2000-06.

According to the Directorate of Cashew and Cocoa Development (DCCD) of India, the annual Indian Cashew productivity has increased by 1.17% from 1993-94 to 2006-07. The current productivity of India is well above the world average at 820 kg/ha, but very less when compared to Vietnam.

Annexure- 2.2.1. Forecasted output of Cashew nut in tons

Year	Brazil	India	Vietnam
1990	99367	285590	26000
1991	185965	294590	32000
1992	107955	305310	58000
1993	77098	350000	65000
1994	149804	350000	78000
1995	164156	321640	52800
1996	167211	417830	59100
1997	125397	430000	66900
1998	39836	440000	54000
1999	130841	440000	41200
2000	167123	450000	67600
2001	124073	470000	73100
2002	164539	500000	128800
2003	183094	535000	164400
2004	187839	544000	204700
2005	152751	573000	232000
2006	236140	620000	350000
2007	190354	637746	432374
2008	188442	655117	491085
2009	191823	672137	534078
2010	195842	688833	566631
2011	199939	705227	592250
2012	204044	721340	613264

Annexure- 2.2.2. Cashew nut production in tons

Year	India	Vietnam	Brazil
1961	85000	700	9670
1962	88000	700	11987
1963	92000	700	13621
1964	95000	700	9643
1965	100000	700	13789
1966	103818	2100	13677
1967	114182	2100	24181
1968	118542	2100	23683
1969	120438	2100	23443
1970	123319	2100	20309
1971	127223	3500	28602
1972	130000	3500	35000
1973	129766	3500	36936
1974	135451	3500	34901
1975	144254	3500	20490
1976	161536	4900	36800
1977	162457	4900	60000
1978	165323	4900	77000
1979	171817	4900	65000
1980	180266	5600	75000
1981	185250	6500	74000
1982	195760	7000	80000
1983	201440	7700	90000
1984	210870	8500	74000
1985	221330	9000	115000
1986	234480	10000	120000
1987	245580	12000	75000
1988	260260	8000	128080
1989	274330	8500	136130
1990	285590	26000	99367
1991	294590	32000	185965
1992	305310	58000	107955
1993	350000	65000	77098
1994	350000	78000	149804
1995	321640	52800	164156
1996	417830	59100	167211
1997	430000	66900	125397
1998	440000	54000	39836
1999	440000	41200	130841
2000	450000	67600	167123
2001	470000	73100	124073
2002	500000	128800	164539
2003	535000	164400	183094
2004	544000	204700	187839
2005	573000	232000	152751
2006	620000	350000	236140

Source: FAO & various news sources

Annexure- 2.2.3. Cashew nut production from FAO data

Year	Brazil	India	Vietnam
1961	9670	85000	700
1962	11987	88000	700
1963	13621	92000	700
1964	9643	95000	700
1965	13789	100000	700
1966	13677	103818	2100
1967	24181	114182	2100
1968	23683	118542	2100
1969	23443	120438	2100
1970	20309	123319	2100
1971	28602	127223	3500
1972	35000	130000	3500
1973	36936	129766	3500
1974	34901	135451	3500
1975	20490	144254	3500
1976	36800	161536	4900
1977	60000	162457	4900
1978	77000	165323	4900
1979	65000	171817	4900
1980	75000	180266	5600
1981	74000	185250	6500
1982	80000	195760	10000
1983	90000	201440	20000
1984	74000	210870	40000
1985	115000	221330	60000
1986	120000	234480	80000
1987	75000	245580	100000
1988	128080	260260	80000
1989	136130	274330	100000
1990	107664	285590	140000
1991	185965	294590	160000
1992	107955	305310	94800
1993	77098	350000	186400
1994	149804	321640	208000
1995	185229	417830	202400
1996	167211	430000	236400
1997	125397	360000	267600
1998	54124	460000	216000
1999	145437	520000	164800
2000	138608	450000	270400
2001	124073	470000	292800
2002	164539	500000	515200
2003	183094	535000	657600
2004	187839	544000	818800
2005	152751	573000	960800
2006	236140	620000	941600

Source: FAO stat

Annexure- 2.2.4. Cashew nut productivity in kg/ha

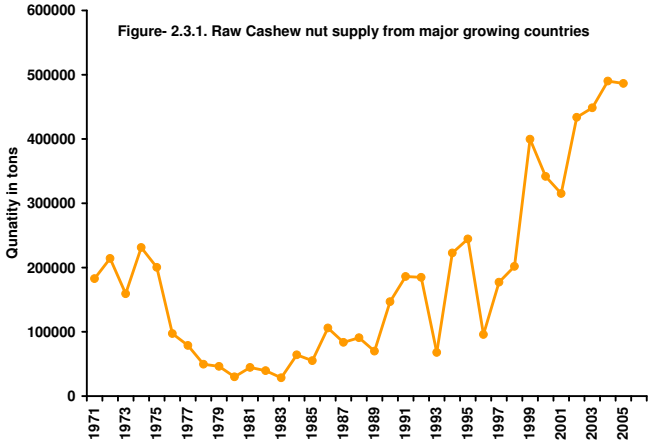
Year	Brazil	India	Vietnam
1961		425	700
1962		440	700
1963		427.91	700
1964		441.86	700
1965		434.78	700
1966		430.22	700
1967		458.52	700
1968		461.06	700
1969		453.29	700
1970		438.59	700
1971		420.25	700
1972		406.21	700
1973		395.27	700
1974		386.03	700
1975		399.11	700
1976		431.16	700
1977		432.41	700
1978		428.41	700
1979		409.39	700
1980		402.94	700
1981		398.85	684.21
1982		406.95	588.24
1983		409.02	666.67
1984		420.1	677.97
1985		434.18	666.67
1986		452.33	695.65
1987		469.56	769.23
1988		493.48	824.74
1989		518.3	909.09
1990	184.73	537.97	1000
1991	288.49	553.9	1032.26
1992	155.22	572.23	1200
1993	106.18	625	1521.63
1994	220.1	619.47	1204.4
1995	264.64	557.44	1068.64
1996	305.29	658	1212.93
1997	215.38	652.5	1321.48
1998	87.1	533.33	1126.17
1999	237.36	651.56	1146.83
2000	212.86	758.02	1382.41
2001	194.3	642.86	1469.88
2002	247.42	626.67	2144.88
2003	268.27	649.35	3570.03
2004	271.81	685.9	2767.15
2005	218.1	663.42	2760.13
2006	338.19	670.18	2597.52

Source: FAO stat

CHAPTER 2.3.

Raw Cashew Nut Supply by Major Exporters

The major countries, which export Raw Cashew Nut (RCN) to India and Vietnam, were Ivory Coast, Guinea Bissau, Indonesia, Tanzania, Benin, Ghana, Mozambique, Nigeria and Senegal. The RCN exports by major countries are given in the Figure-2.3.1. It is clear from the figure that the exports from these countries have grown at the rate of 17% annually from 1971 to 2005.



Source: FAO Stat

CAGR of global imports

Among the major RCN supplying countries to the world market, Guinea-Bissau's growth was tremendous with about 76% CAGR over the period of 1996 to 2005 (Table- 2.3.1). Ghana has also witnessed a higher growth of nearly 60%. Besides, African countries, Indonesia has shown an annual growth of 14.5% in raw nut supply to the global market.

Table- 2.3.1. CAGR of important countries exporting RCN

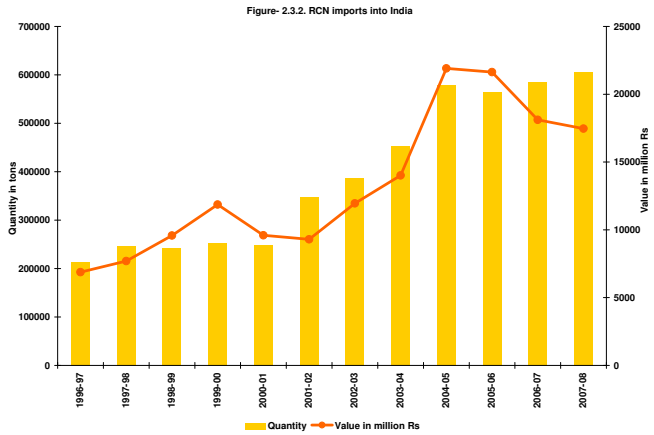
Countries	CAGR (%)	Quantity in tons (2005)
Ivory Coast	29	140010
Guinea-Bissau	76	93490
Indonesia	14.5	65960
Benin	14.8	42870
Mozambique	39.6	33490

Tanzania	-2.54	32390
Ghana	59.8	31260
Others	11.25	28410
Nigeria	40.46	17280
Senegal	-14.84	1360
Total	17	486520

Source: FAO Stat

Though most of the countries have showed a positive growth in RCN supply during the period, Tanzania and Senegal have recorded a declining trend over the years.

RCN imports into India



The quantity of RCN imports into India has been increasing from 1996-07 to 2007-08 as illustrated in Figure-2.3.2. The quantity of RCN imports into India during 1996-97 was 212,866 tons and it has increased to 605,970 tons in 2007-08. The import of RCN in value term has also recorded significant growth during the period from 1996-97 to 2005-06. Due to Rupee appreciation against US dollar, the value of RCN imports has declined during 2006-07 and 2007-08.

Table-2.3.2. RCN imports into India (quantity, value and unit value)

Year	Quantity (in tons)	Value (in million Rs)	PUV
1996-97	212866	6876	32.30
1997-98	247182	7696	31.13
1998-99	241561	9580	39.66
1999-00	253577	11862	46.78

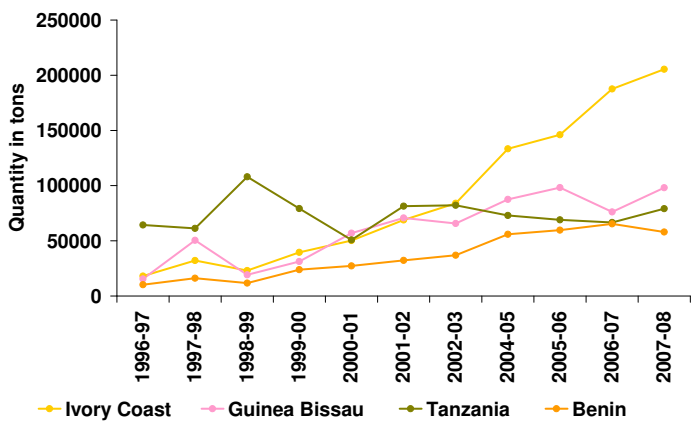
2000-01	248728	9601	38.60
2001-02	348625	9301	26.68
2002-03	386547	11948	30.91
2003-04	452898	14009	30.93
2004-05	578884	21909	37.85
2005-06	565400	21630	38.26
2006-07	586044	18116	30.91
2007-08	605970	17468	28.83

Source: Various customs houses, India, Note: PUV – Per Unit Value

The CAGR of RCN import quantity as shown in Table-2.3.2 has indicated that the import has grown 11.54% annually, whereas the growth in terms of value was 10.33%. Per unit value of RCN has been fluctuating over the years from 1996-97 to 2007-08. The price of RCN in 2007-08 was much lower against its previous levels due to the strengthening of Indian Rupee against US dollar.

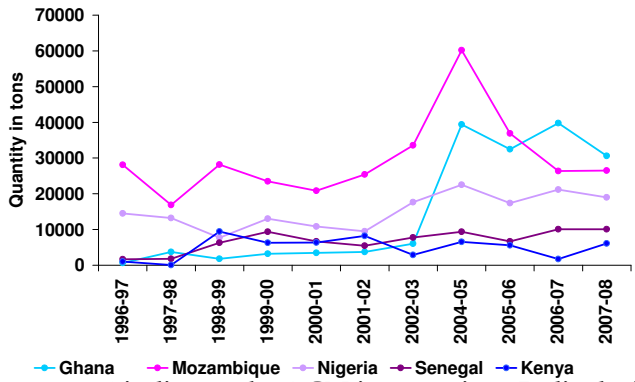
RCN imports into India from major countries

Figure- 2.3.3. India's import from top four African countries



The top four major African countries, which export RCN into India are Ivory Coast, Guinea Bissau, Tanzania and Benin. Imports of RCN by India on the basis of country of origin are given in the Figure-2.3.3. According to the figure, imports from the above said countries have fluctuated much. Ivory Coast, Guinea Bissau, Tanzania and Benin accounted for 78 to 82% of total RCN imports by India. Among these countries, most of the countries are West African countries except Tanzania.

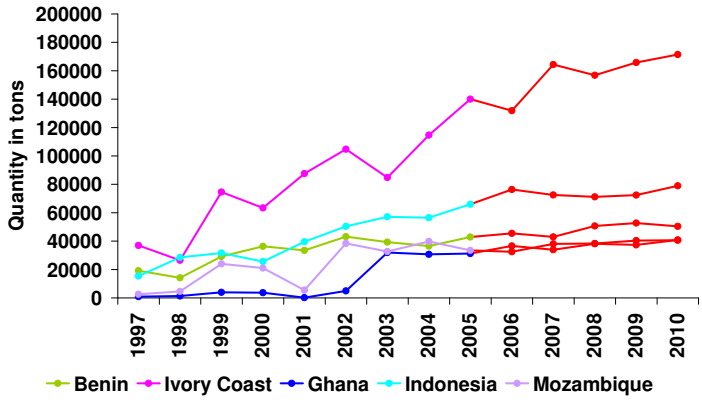
Figure- 2.3.4. India's import from the other African countries



The Figure- 2.3.4 indicates the RCN imports into India during 1996-97 to 2007-08 from the other African countries. The countries such as Ghana, Mozambique, Senegal, Nigeria and Kenya have contributed to the extent of 18 to 22% to imports.

Projected RCN imports from African countries

Figure- 2.3.5. Forecasted quantity of RCN supply from major countries

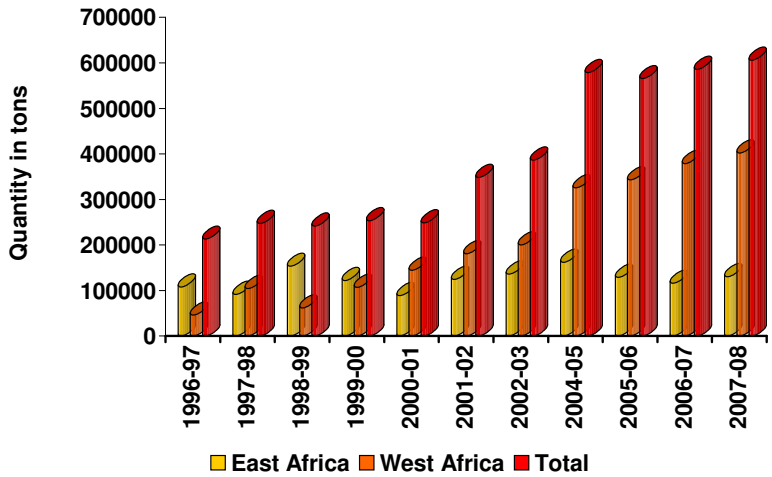


The projected figures of RCN exports from important African countries have shown in the figure- 2.3.5. This has given a signal that the exports from the major exporter Ivory Coast would continue to increase till 2010. Meanwhile, the exports from other countries would witness growth.

African countries share in India's RCN import

The share of African countries in Indian import over the years is given in the Figure- 2.3.6. It can be inferred from the figure that during 1996-97 to 1999-2000 the share of East African countries (Tanzania, Nigeria,

Figure- 2.3.6. African countries share in India's Import



Mozambique and Kenya) in Indian import have increased constantly. But the share of West African countries such as Ivory Coast, Guinea Bissau, Benin, Senegal, Burkina, Togo, Ghana and Mali has increased by two to three-fold during this period. The CAGR of East African countries export from 1996-97 to 2007-08 was only 2%, whereas the West African countries have shown a remarkable growth of 24%.

Change in direction of RCN import into India

It can be seen from the Table- 2.3.3 that the countries like Ivory Coast, Guinea-Bissau, Benin and Indonesia were stable suppliers of RCN to India during the period of 1996-97 to 2007-08. Though Mozambique, Kenya was also the major suppliers of RCN to India, they were unstable suppliers because of their less probability retention.

Table- 2.3.3. Transition probability matrix for RCN imports into India

Countries	Ivory Coast	Guinea - Bissau	Indonesia	Benin	Mozambique	Nigeria	Kenya
Ivory Coast	0.26	0.27	0.10	0.00	0.25	0.12	0.00
Guinea - Bissau	0.45	0.15	0.29	0.00	0.03	0.04	0.05
Indonesia	0.81	0.00	0.17	0.02	0.00	0.00	0.00
Benin	0.00	0.00	0.32	0.68	0.00	0.00	0.00
Mozambique	0.00	0.80	0.00	0.00	0.00	0.11	0.09
Nigeria	0.00	0.20	0.16	0.63	0.00	0.00	0.00
Kenya	0.24	0.75	0.00	0.00	0.01	0.00	0.00
Vietnam	0.80	0.00	0.00	0.20	0.00	0.00	0.00

It is evident from the table that Benin has higher retention probability of 0.68 which indicates that it can retain 68% of its India's import share by

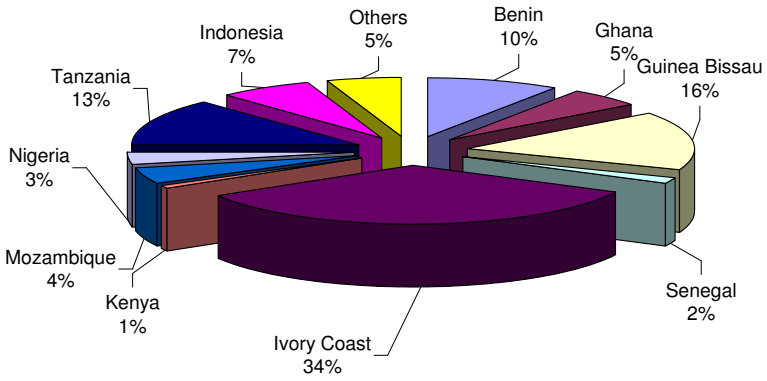
gaining 63% of Nigeria share and 20% of Vietnam share. At the same time, it has lost the remaining 32% of its share to Indonesia.

The next stable exporter of RCN to India was Ivory Coast, which can retain 26% of its own share in India's RCN import and lost 27%, 25%, 12% and 10% of its share to Guinea-Bissau, Mozambique, Nigeria and Indonesia respectively. However, it has gained 81%, 80%, 45% and 24% of Indonesia's, Vietnam, Guinea-Bissau and Kenya's share over the period of 1996-97 to 2006-07. Overall, the net gain for Ivory Coast from Indonesia and Guinea –Bissau was 71% and 18% respectively. The other stable markets for India's RCN import were Indonesia (with retention capacity of 17%) and Guinea-Bissau (with the retention capacity of 15%). Guinea-Bissau has gained 80%, 75% and 27% share from Mozambique, Kenya and Ivory Coast, while lost 45% to Ivory Coast and 29% to Indonesia. Hence, overall it lost 18% to Ivory Coast.

RCN import by India during 2007-08

The RCN imports by India during 2007-08 have given in the Figure- 2.3.7.

Figure- 2.3.7. RCN import into India in 2007-08



It is evident from the figure that the RCN imports from Ivory Coast (205,405 tons with 34% contribution to India's total import) was higher in 2007-08 followed by Guinea-Bissau (16%) with the import quantity of 98,056 tons. The other major countries from where India has been importing RCN were Tanzania (79,109 tons with 13% share), Benin (57,982 tons with 10% share) and Indonesia with 7% share (40,659 tons).

India's RCN Import forecast

RCN import by India has been forecasted till 2012. This has given an indication that imports will touch around 785,756 tons by 2012.

Table- 2.3.4. Forecasted RCN imports by India

Year	RCN import	Year	RCN import
1996	212866	2005	565400
1997	247182	2006	586044
1998	241561	2007	605970
1999	253577	2008	642617
2000	248728	2009	678335
2001	348625	2010	714148
2002	386547	2011	749952
2003	452898	2012	785756
2004	578884		

If the RCN supplies at the global level increase, the major processing countries India and Vietnam will be able to meet their increased processing capacity.

Annexure- 2.3.1. RCN supply by major Cashew growing countries (in tons)

Year	Benin	Ivory Coast	Ghana	Guinea-Bissau	Indonesia	Mozambique	Nigeria	Senegal	Tanzania	Others	Total
1970	780	0	0	1190	0	66250	1000	0	87020	25110	181350
1971	0	0	0	660	0	53380	1000	0	115860	11880	182780
1972	860	0	0	950	0	67530	1000	0	127430	16460	214230
1973	770	0	0	0	0	33200	1000	0	113630	10670	159270
1974	0	0	0	1270	0	72900	1000	0	134190	21810	231170
1975	1250	0	0	0	0	65590	1000	0	117000	15530	200370
1976	0	0	0	970	0	13820	1000	0	67540	13950	97280
1977	0	40	0	1150	20	0	1000	0	74760	1850	78820
1978	0	110	0	0	60	0	1000	0	44200	4280	49650
1979	0	120	0	400	90	0	1000	0	39590	5040	46240
1980	0	30	0	930	370	0	1000	0	9060	18540	29930
1981	0	540	0	2350	780	0	1000	0	25150	14830	44650
1982	0	720	0	1500	1630	0	1000	0	15220	19430	39500
1983	0	1540	0	2000	1810	0	1000	0	10510	11630	28490
1984	20	1450	0	8000	2210	0	1000	0	33500	18030	64210
1985	0	3100	0	6620	3800	0	230	0	26180	15120	55050
1986	750	5450	0	5930	7590	0	2290	0	60860	23170	106040
1987	0	4290	0	10470	7000	0	4350	0	30680	26860	83650
1988	0	1850	0	10500	8390	0	9750	600	26710	33100	90900
1989	270	8490	0	9410	1210	0	9480	1090	4260	35710	69920
1990	1170	4330	0	8400	3220	20	13980	0	10760	104950	146830
1991	3080	8090	0	16920	14600	0	5700	2290	21050	114340	186070
1992	3530	8790	0	5500	19290	13970	13630	1060	27730	91230	184730
1993	8480	3090	0	30	18160	60	2420	2120	20	33420	67800
1994	9480	11610	570	28420	38620	7370	16110	1150	46190	63190	222710
1995	8730	24670	310	30990	28100	20110	22010	1310	75280	32980	244490
1996	11200	7020	0	0	27210	1820	2510	0	33590	12410	95760
1997	19180	36930	880	650	15360	2630	860	2110	81550	17070	177220
1998	14160	26460	1350	1370	28600	4600	650	6980	99890	17730	201790
1999	29220	74550	3960	30730	31640	24030	15970	14910	161540	13230	399780
2000	36370	63380	3630	56930	25620	21080	13810	10	98610	22290	341730
2001	33460	87570	170	16890	39550	5450	4930	3160	96490	27510	315180
2002	43120	104770	4960	63110	50390	38450	19060	4500	75340	30100	433800
2003	39330	84810	31990	71690	57090	32660	22010	290	71450	37150	448470
2004	36560	114650	30700	80850	56490	39730	18790	910	82300	29240	490220
2005	42870	140010	31260	93490	65960	33490	17280	1360	32390	28410	486520

Source: FAO Stat

Annexure- 2.3.2. Forecasted supply of RCN from major producing countries

Year	Benin	Ivory Coast	Ghana	Indonesia	Mozambique	Nigeria	Senegal	Tanzania	Others
1970	780	0	0	0	66250	1000	0	87020	25110
1971	0	0	0	0	53380	1000	0	115860	11880
1972	860	0	0	0	67530	1000	0	127430	16460
1973	770	0	0	0	33200	1000	0	113630	10670
1974	0	0	0	0	72900	1000	0	134190	21810
1975	1250	0	0	0	65590	1000	0	117000	15530
1976	0	0	0	0	13820	1000	0	67540	13950
1977	0	40	0	20	0	1000	0	74760	1850
1978	0	110	0	60	0	1000	0	44200	4280
1979	0	120	0	90	0	1000	0	39590	5040
1980	0	30	0	370	0	1000	0	9060	18540
1981	0	540	0	780	0	1000	0	25150	14830
1982	0	720	0	1630	0	1000	0	15220	19430
1983	0	1540	0	1810	0	1000	0	10510	11630
1984	20	1450	0	2210	0	1000	0	33500	18030
1985	0	3100	0	3800	0	230	0	26180	15120
1986	750	5450	0	7590	0	2290	0	60860	23170
1987	0	4290	0	7000	0	4350	0	30680	26860
1988	0	1850	0	8390	0	9750	600	26710	33100
1989	270	8490	0	1210	0	9480	1090	4260	35710
1990	1170	4330	0	3220	20	13980	0	10760	104950
1991	3080	8090	0	14600	0	5700	2290	21050	114340
1992	3530	8790	0	19290	13970	13630	1060	27730	91230
1993	8480	3090	0	18160	60	2420	2120	20	33420
1994	9480	11610	570	38620	7370	16110	1150	46190	63190
1995	8730	24670	310	28100	20110	22010	1310	75280	32980
1996	11200	7020	0	27210	1820	2510	0	33590	12410
1997	19180	36930	880	15360	2630	860	2110	81550	17070
1998	14160	26460	1350	28600	4600	650	6980	99890	17730
1999	29220	74550	3960	31640	24030	15970	14910	161540	13230
2000	36370	63380	3630	25620	21080	13810	10	98610	22290
2001	33460	87570	170	39550	5450	4930	3160	96490	27510
2002	43120	104770	4960	50390	38450	19060	4500	75340	30100
2003	39330	84810	31990	57090	32660	22010	290	71450	37150
2004	36560	114650	30700	56490	39730	18790	910	82300	29240
2005	42870	140010	31260	65960	33490	17280	1360	32390	28410
2006	45464	131913	36584	76361	32461	20264	1637	65630	28060
2007	42984	164363	33947	72540	38008	22141	1910	63204	28350
2008	50634	156818	38167	71161	38318	22181	2183	72433	27197
2009	52740	165773	37343	72411	40369	22615	2433	73107	30441
2010	50372	171486	40863	78963	40627	23936	2661	68097	31573

Annexure- 2.3.3. Import of RCN into India (Quantity in tons)

Countries	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Benin	10213	16140	11680	23829	27239	32239	36905	-	55958	59695	65420	57982
Ghana	632	3725	1795	3198	3475	3745	6039	-	39376	32469	39804	30595
Guinea Bissau	15455	50522	19228	31231	56929	70685	65750	-	87483	98176	76126	98056
Indonesia	6862	32628	18829	20941	9178	39092	38757	-	67603	67225	60959	40659
Ivory Coast	18096	32229	23085	39524	50219	68875	84006	-	133335	146045	187612	205405
Kenya	1004	79	9428	6311	6382	8193	2891	-	6533	5581	1719	6071
Mozam bique	28101	16895	28162	23508	20822	25424	33553	-	60201	36865	26367	26489
Nigeria	14507	13220	7699	13001	10859	9511	17619	-	22543	17397	21154	18991
Senegal	1679	1818	6297	9360	6679	5448	7759	-	9360	6682	10084	10064
Tanzania	64355	61311	108046	79209	50821	81450	82140	-	72971	69034	66600	79109
Others	51962	18615	7312	3465	6125	3963	11128	-	23521	26231	30199	32549
Total	212866	247182	241561	253577	248728	348625	386547	452898	578884	565400	586044	605970

Source: DGFT & Various custom houses

Annexure- 2.3.4. Import of RCN into India (Value in Million Rs.)

Countries	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Benin	323	498	394	989	1056	781	1066	-	1837.06	2338.29	2051.63	1652.24
Ghana	20	113	64	129	134	80	171	-	1279.13	1256.93	1183.45	746.47
Guinea Bissau	532	1605	791	1564	2704	1939	2413	-	3386.65	4389.49	2409.08	2566.63
Indonesia	228	1096	719	964	388	1249	1337	-	3358.9	2659.41	2138.15	1613.69
Ivory Coast	520	834	802	1626	1899	1665	2366	-	4248.11	5206.33	5477.16	4851.55
Kenya	28	3	406	292	219	237	82	-	243.9	195.89	54.38	180.2
Mozam bique	873	489	1042	1059	621	660	871	-	2356.56	1291	772.56	1018.3
Nigeria	370	344	230	457	319	196	400	-	600.28	548.32	557.29	399.11
Senegal	60	59	270	463	228	131	264	-	334.74	263.32	314.67	247.12
Tanzania	2121	2110	4589	4174	1771	2278	2634	-	3428.05	2492.09	2255.16	3384.73
Others	1801	545	273	145	262	85	343	-	836.03	988.43	902.7	807.98
Total	6876	7696	9580	11862	9601	9301	11948	14009	21909.41	21629.5	18116.23	17468.02

Source: DGFT & Various custom houses

CHAPTER 2.4.

Cashew Scenario in India

India is the leading producer of both raw Cashew nut and kernels at global level. Besides these, it is also a major importer of raw Cashew nut for processing and second largest consumers of Cashew kernels after USA. It contributes nearly 30% of the global Cashew production of 2100,000 tons. The Cashew season in India starts from March to June. The total area under Cashew cultivation in 2006-07 was 850,000 hectares with the production of 620,000 tons and average productivity of 820 kg/ha. The CAGR of area and production in India was 3.1% and 4.4% for the past 14 years period from 1993-94 to 2006-07.

Cashew nut acreage is highly concentrated in East coast regions (Tamil Nadu, Andhra Pradesh, Orissa, and West Bengal) i.e., about 50% of area under Cashew than West coast regions (Kerala, Karnataka, Goa, and Maharashtra) contribute 47% of acreage. With respect to output, the West coast regions contributes nearly 56% of the total production compared with merely 41% from the East coast region. The reasons for this gap between area and production were more acreage under senile plantations in East Coast regions and availability of high yielding varieties in Goa and Maharashtra.

Apart from the traditional Cashew-growing states, Cashew is also being grown to a certain extent in states like Gujarat and Assam. Among all these states, Andhra Pradesh and Maharashtra have major share of the total area under Cashew cultivation.

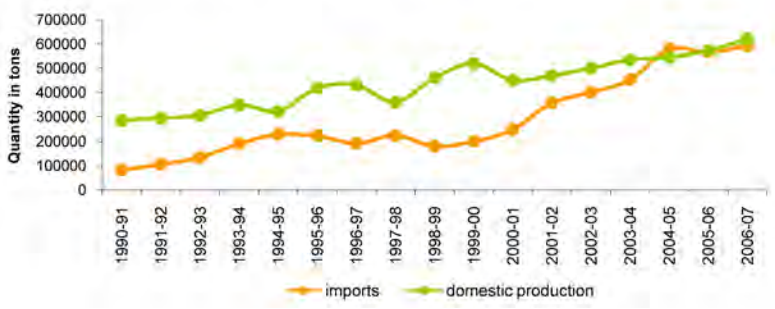
India exports around 100 to 125 thousand tons of Cashew kernels per annum. The major buyers of Indian kernels are United States, Netherlands, UAE, UK and Japan. The Cashew trade in India is mostly concentrated in places like Kollam (Kerala), Mangalore (Karnataka), Jeypore (Orissa), Vetapalam and Phalasa (Andhra Pradesh) and Mumbai (Maharashtra).

Though India is the leading producer of Cashew kernels, the opportunity in utilizing the by-products is not been fully exploited. There is lot of scope for Cashew Nut Shell Liquid (CNSL), Cashew husk and Cashew apple.

India's share in Cashew production and imports

Figure- 2.4.1 indicates that the RCN imports into India have been increasing over the years from 1990-91 to till date along with the domestic production. It is interesting to note that the domestic production and imports have witnessed higher growth after 2000. The growth in imports and its contribution the total supply in the country are significant currently. More or less, imports have equal share with domestic production since 2004-05. The higher processing capacity and more demand from domestic and other consuming countries have prompted to source more RCN and kept the total availability at higher levels.

Figure- 2.4.1. RCN imports vs Domestic production



When we look at the share of domestic production to total availability since 1990-91 to till date, it was mostly in the range of 65-77% during 1990's. After 2000, it has declined and reached the level of 48%. On the other hand, import's share in the total availability has been increased from 22% in 1990-91 to about 50% currently.

Although close to half of the world Cashew nuts has been processed in India, increasing imports and declining domestic production of RCN in total availability is becoming a threat to Indian Cashew industry. The best ways to get rid of these problems are rejuvenation and re-plantation of Cashew trees to increase the productivity.

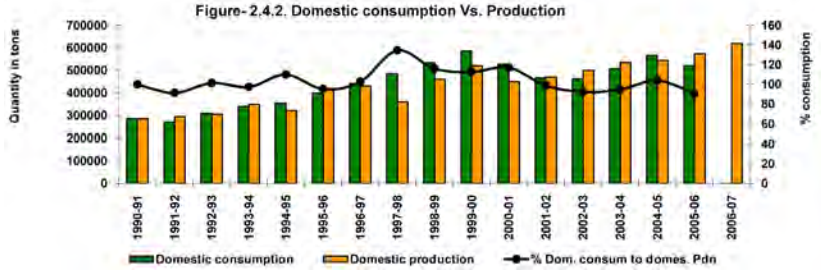
In the current budget (2008), Indian government has allotted Rs.11 billion package for the revival of crops like Cashew, coconut, and pepper. It is expected that this would help Cashew growers in a much better way to replant their crops with new high yielding varieties.

Domestic Cashew consumption vs. production in India

In India, the Cashew nut production has shown a growth rate of 4.8% annually from 1990-91 to 2006-07. Likewise, the consumption of Cashew has also showed an annual growth rate of 4.7%.

Figure-2.4.2 shows that the Cashew production in 1990-91 was fully consumed by domestic consumers. But the production has outstripped consumption in the year 1991-92. After 2000-01 the share of domestic consumption to total production has declined. The reason might be increased area under cultivation during these periods. Moreover, the demand for Indian Cashew in the global market pushed up the exports.

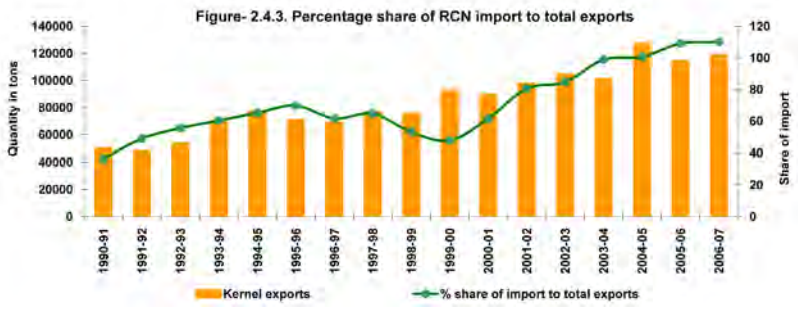
Figure- 2.4.2. Domestic consumption Vs. Production



Though India is the leader in Cashew production and exports, in the year 2006-07 the country has lost its first position in exports to Vietnam. The later has increased its processing capacity and turned itself as competitor to India. At the same time, rising domestic consumption has also restricted the expansion of overseas markets. The increase in Cashew consumption in domestic as well as in international markets provides good opportunity for stakeholders in Cashew sectors.

RCN imports taking large share in kernels exports

Figure- 2.4.3. Percentage share of RCN import to total exports



The kernel to RCN conversion ratio is 4 i.e., the average out-turn of

kernels from raw Cashew nuts is 25%. If we convert the kernel exports equivalent to raw Cashew nut, then the trend has showed that over the years (from 1990 to till date) the kernel exports have been increasing along with raw Cashew nut imports.

Annexure- 2.4.1. Total production of Cashew nut in India during 2006-07

States	Area	Production
West coast		
Kerala	80	72
Karnataka	102	52
Goa	55	29
Maharashtra	164	197
W.Coast total	401	350
East coast		
Tamil Nadu	123	60
Andhra Pradesh	171	99
Orissa	125	84
West Bengal	10	10
E.Coast total	429	253
Others	24	17
Total	**854**	**620**

Source: DCCD, Cochin, India

Annexure- 2.4.2. RCN imports in to India vs domestic production

Year	Imports	Domestic production	Total availability	% Import to total	% Domestic production to total
1990-91	82639	285590	368229	22.44	77.56
1991-92	106080	294590	400670	26.48	73.52
1992-93	134985	305310	440295	30.66	69.34
1993-94	191322	348350	539672	35.45	64.55
1994-95	228109	321640	549749	41.49	58.51
1995-96	222819	417830	640649	34.78	65.22
1996-97	192285	430000	622285	30.90	69.10
1997-98	224968	360000	584968	38.46	61.54
1998-99	181009	460000	641009	28.24	71.76
1999-00	200584	520000	720584	27.84	72.16
2000-01	249318	450000	699318	35.65	64.35
2001-02	356566	470000	826566	43.14	56.86
2002-03	400659	500000	900659	44.49	55.51
2003-04	452898	535000	987898	45.84	54.16
2004-05	578884	544000	1122884	51.55	48.45
2005-06	565400	573000	1138400	49.67	50.33
2006-07	592604	620000	1212604	48.87	51.13

Source: DCCD, Cochin, India

Annexure- 2.4.3. Domestic consumption share in domestic production

Year	Total availability	Export equivalent of RCN	Domestic consumption equivalent of RCN	Domestic production	Domestic consumption as% of dom. production
1990-91	368229	1472916	285590	285590	100.00
1991-92	400670	1602680	269360	294590	91.44
1992-93	440295	1761180	309750	305310	101.45
1993-94	539672	2158688	339600	348350	97.49
1994-95	549749	2198996	353930	321640	110.04
1995-96	640649	2562596	398230	417830	95.31
1996-97	622285	2489140	441620	430000	102.70
1997-98	584968	2339872	484470	360000	134.58
1998-99	641009	2564036	534020	460000	116.09
1999-00	720584	2882336	586070	520000	112.71
2000-01	699318	2797272	527260	450000	117.17
2001-02	826566	3306264	465410	470000	99.02
2002-03	900659	3602636	462350	500000	92.47
2003-04	987898	3951592	507290	535000	94.82
2004-05	1122884	4491536	565890	544000	104.02
2005-06	1138400	4553600	519770	573000	90.71
2006-07	1212604	4850416		620000	0.00

Annexure- 2.4.4.Import of RCN into India - kernel to RCN conversion ratio 4

Year	Exports	RCN equivalent for exports	Imports	% share of import to total exports
1990-91	49874	199496	82639	41.42
1991-92	47738	190952	106080	55.55
1992-93	53436	213744	134985	63.15
1993-94	69884	279536	191322	68.44
1994-95	77000	308000	228109	74.06
1995-96	70334	281336	222819	79.20
1996-97	68663	274652	192285	70.01
1997-98	76593	306372	224968	73.43
1998-99	75026	300104	181009	60.32
1999-00	92461	369844	200584	54.23
2000-01	89155	356620	249318	69.91
2001-02	97550	390200	356566	91.38
2002-03	104137	416548	400659	96.19
2003-04	100828	403312	452898	112.29
2004-05	126667	506668	578884	114.25
2005-06	114143	456572	565400	123.84
2006-07	118540	474160	592604	124.98

Annexure- 2.4.5. State wise Cashew nut production in India (in '000 tons)

Year	Kerala	Karnataka	Goa	Maharashtra	Tamil Nadu	Andhra Pradesh	Orissa	West Bengal	Others	Total
1990-91	142	26	14	30	12	38	29	3	0.33	**295**
1991-92	143	27	14	32	13	40	32	4	0.34	**305**
1992-93	152	31	15	44	19	45	39	4	0.34	**349**
1993-94	140	32	16	47	19	47	43	4	0.36	**348**
1994-95	119	26	17	38	22	59	37	3	0.30	**322**
1995-96	140	38	18	69	31	72	43	7	1	**418**
1996-97	134	52	20	80	30	60	40	6	8	**430**
1997-98	100	35	25	60	30	50	45	6	9	**360**
1998-99	130	40	20	85	35	80	50	8	12	**460**
1999-00	100	60	30	125	45	100	40	8	12	**520**
2000-01	76	42	25	98	59	75	59	6	10	**450**
2001-02	87	40	30	103	46	86	59	7	12	**470**
2002-03	90	40	30	110	50	90	70	8	12	**500**
2003-04	95	46	32	120	51	95	71	9	16	**535**
2004-05	64	43	26	174	53	88	74	8	14	**544**
2005-06	67	45	27	183	56	92	78	10	15	**573**
2006-07	72	52	29	197	60	99	84	10	17	**620**

Source: DCCD, Cochin, India

Annexure- 2.4.6. State wise Cashew nut Productivity in India (in kg/ha)

Year	Kerala	Karnataka	Goa	Maharashtra	Tamil Nadu	Andhra Pradesh	Orissa	West Bengal	Others	Total
1993-94	925	500	370	1246	203	723	812	596	299	**694**
1994-95	781	400	390	1100	232	880	679	490	250	**631**
1995-96	1000	550	410	1440	330	1000	720	870	560	**720**
1996-97	1140	690	430	1570	390	830	670	870	870	**835**
1997-98	850	460	530	1500	390	690	750	860	610	**740**
1998-99	1100	500	420	1500	460	800	750	890	860	**800**
1999-00	850	700	610	1470	540	1100	670	900	800	**900**
2000-01	765	500	500	1050	750	650	700	900	750	**710**
2001-02	870	470	590	880	570	720	570	780	760	**710**
2002-03	890	470	660	1000	570	740	810	890	760	**760**
2003-04	890	500	690	1100	600	750	850	760	790	**800**
2004-05	900	680	660	1200	610	840	810	800	800	**810**
2005-06	900	700	690	1300	640	880	860	950	650	**815**
2006-07	900	700	690	1500	670	890	860	1000	700	**820**

Source: DCCD, Cochin, India

CHAPTER 2.5.

African Cashew Industry

African countries contribute nearly 30% to the global Cashew production. The production of raw Cashew nuts in Africa during 2006-07 was 636,000 tons and about 85% of the raw nuts produced has been exported. The major Cashew producing countries in the African continent are Ivory Coast, Guinea-Bissau and Tanzania. They are ranked 4th, 5th and 6th respectively in the group of major Cashew producers in the global market after India, Vietnam and Brazil.

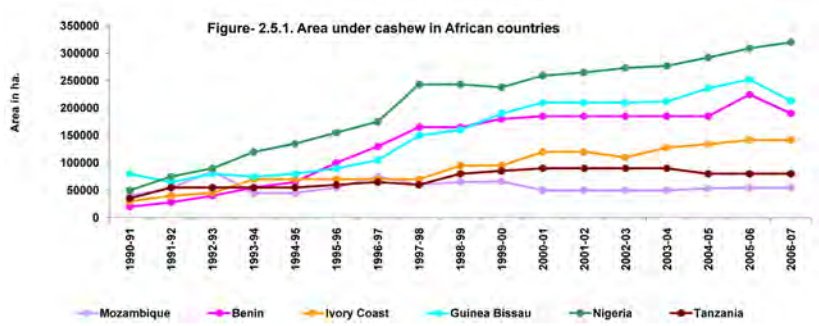
In Africa, Cashew has been produced in two seasons. In East Africa, Cashew has been harvested during September to January and coincides with the harvesting season of Brazil. Meanwhile in West Africa, Cashew has been harvested during January to June and coincides with the harvesting period of India and Vietnam. The important East African countries, which are producing Cashew nuts are Tanzania, Nigeria, Mozambique and Kenya. Likewise the important West African countries, which are producing Cashew nuts, are Ivory Coast, Guinea Bissau, Benin, Senegal, Burkina, Togo, Ghana, Mali and Guinea-C. In African countries, more than 2.6 million people have involved in Cashew production with an average holding of 1 to 3 hectare. Here, yield of Cashew per tree is only 2-4 kg.

Table- 2.5.1. Cashew production in different African countries during 2006-07

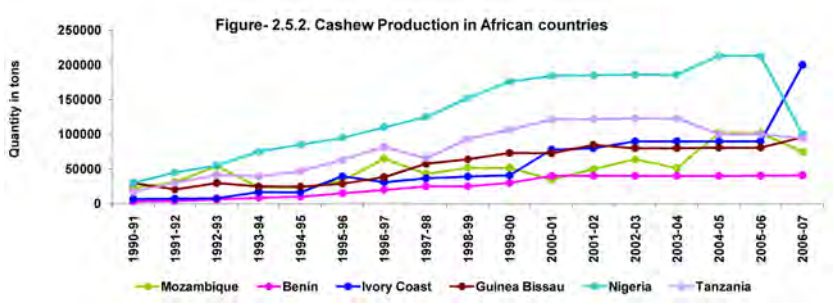
Countries	Production in tons	% to total Output
Ivory Coast	200,000	31.45
Guinea Bissau	100,000	15.72
Tanzania	100,000	15.72
Nigeria	75,000	11.79
Mozambique	65,000	10.22
Benin	45,000	7.08
Senegal	15,000	2.36
Ghana	15,000	2.36
Togo	5,000	0.79
Kenya	5,000	0.79
Burkina	5,000	0.79
Mali	3,000	0.47
Guinea-C	3,000	0.47
Total	**636,000**	**100.00**

It is clear from the Table-2.5.1 that among the Cashew producing countries in Africa, Ivory Coast is the major producer (200,000 tons), which is contributing 31% to total African production followed by Guinea Bissau and Tanzania (15.72% each), Nigeria (11.79%), Mozambique (10.22%), Benin (7.08%), Senegal and Ghana (2.36% each). The other countries contribution is very meager to the total output.

African Cashew scenario



The area under Cashew in African countries was shown in Figure- 2.5.1. The Cashew nut area in Mozambique, Tanzania have remained almost steady from 1990 to till date, whereas the area under Cashew in the other countries like Nigeria, Guinea Bissau, Benin, and Ivory Coast has been increased over the years. If we look into the production pattern in Figure-2.5.2, the output has been increasing in Guinea Bissau and Ivory Coast, while in other countries it has shown a mixed pattern from 1990 to till date.



Cashew nut processing in African countries

Nigeria is the largest processor in East African countries followed by Mozambique. Nigeria process nearly 33% of their Cashew production domestically and the remaining has been sent to India and Vietnam for processing. Meanwhile, Mozambique process 35 to 40% of their produce and the remaining has been sent for processing to other countries. Tanzania

also process about 10-15% of raw Cashews domestically and Kenya process higher share of raw Cashews among the East African countries.

It is interesting to note that though West African countries are producing nearly 400,000 tons of raw Cashews against 250,000 tons in East African countries, the processing activities were much limited in West African countries compared to East African countries.

It is evident from the Table- 2.5.2 that the West African countries process only 4-5% of their produce except Burkina Faso, which process about 20% of its production.

Table- 2.5.2 Countries processing capacity with respect to total production (In tons)

Countries	Production	Domestic processing
Ivory Coast	200000	10000
Guinea Bissau	100000	5000
Tanzania	100000	10000 – 15000
Nigeria	75000	24400
Mozambique	65000	22750 – 26000
Benin	45000	1800
Senegal	15000	0
Togo	5000	0
Ghana	15000	750
Kenya	5000	3000
Burkina	5000	1000
Mali	3000	0
Guinea-C	3000	0
Total	636,000	78700 – 86950

Overall, the African countries are processing 12-14% of their domestic production and exporting much of their Cashew in raw form to the major processing countries like India, Vietnam and Brazil.

Among the raw nuts producers in West Africa, Guinea Bissau Cashews are considered as superior ones followed by Beninese produce. Since Mozambique process 35 – 40% of its produce domestically, it exports Cashew kernels to The Netherlands, South Africa and Italy. In East African countries, Kenyans are earning more income due to their higher processing capacity of 60%.

The Major Cashew producing regions in Africa

Country	Growing Regions
Cote D'Ivoire	Abidjan, Napieoledougou, Natio-Kobadara
Guinea Bissau	Bissau
Tanzania	Mtwara, Lindi, Coast, Ruvuma, Tanga
Nigeria	East - Enugu, Abia, Imo, Anambra, Ebonyi and cross-river states. West – Oyo, Osun, Ondo, Ekiti, and Ogun states Middle belt – Kwara, Kogi, Nassarawa, Benue, Taraba, Niger and FCT North West – Sokoto and Kebbi States.
Mozambique	Nampula, Zambezia, Sofala and Cabo Delgado
Benin	Zou – Nord, Borgou, Donga, Atacara, Collines, Couffo and Plateau
Senegal	Casamance region, Dakar
Ghana	Brong Ahafo, Jaman, Wenchi, Atebubu, Kintampo Techiman and Asunafo district
Kenya	Kwale, Kilifi, Malindi and Lamu districts

SWOT analysis

Strengths

- Africans countries are the major producers and main suppliers of raw Cashew nut to the World markets.
- There is huge potential for more Cashew cultivation because of land and labour availability.
- African Cashew Alliance is a major supportive factor for African Cashew industry. It is a private-public partnership that aims at promoting the African Cashew sector from production to consumption.

Weakness

The major weaknesses in African Cashew cultivation are:

- Lack of well performing planting materials
- Cashew plants attacked by parasites and poor management
- Lower margin earned by the Cashew growers in African countries because they are selling the produce mostly in raw form.

The major weaknesses to most of the African countries with respect to processing are:

- Cashew processing equipments are not manufactures locally so they have to depend on other countries, which incurs much cost for transport

- Lack of finance for purchasing Cashew processing machineries
- Lack of market access for kernels
- There is no national export brand and no credible quality certification, which makes the country's kernels lack recognition in the international market.

Opportunity

- Techno Serve has assessed there is possibility of new processing plants emergence in many African countries in future.
- African Cashew Alliance (ACA) and West African Trade Hub (WATH) acts as a facilitator for African Cashew trade. The ACA enables Cashew stakeholders to exploit the sector's potential for economic growth and employment. Its members include representatives along the complete value chain.
- According to TechnoServe, the Cashew processing in Africa could generate annual revenues as high as $500 million by 2015, of which 40% would go to wages for manual labour and the remaining $300 million would be with them as net profit.
- Recently Nigerian Export Promotion Council (NEPC) and Central Bank of Nigeria (CBN) have formed strategic partnership with six other bodies to actualize a Cashew export promotion scheme. The group is expected to evolve strategies for addressing production, processing and marketing problems in the Cashew business.

Threat

- Declining output in proportion to total global output. i.e., besides the increase in world Cashew production, Africa's share has decreased over the years.
- Bush fires in Cashew plantations leads to cut down in Cashew production.
- The lack of processing in African countries leads them to depend more on other countries and thereby these countries forgoing the benefits of Cashew kernels production and exports.

Annexure- 2.5.1. Cashew area in important African countries (in ha)

Year	Mozambique	Benin	Cote d'Ivoire	Guinea Bissau	Nigeria	Tanzania
1990-91	40000	20000	30000	80000	50000	35000
1991-92	54000	28000	40000	64580	75000	55000
1992-93	85000	40000	45000	80000	90000	55000
1993-94	45000	55000	70000	75000	120000	55000
1994-95	45000	65000	70000	80000	135000	55000
1995-96	55000	100000	70000	90000	155000	60000
1996-97	75000	130000	70000	105000	175000	65000
1997-98	60000	165000	70000	150000	243000	60000
1998-99	65000	165000	95000	160000	243200	80000
1999-00	66000	180000	95000	190000	238000	85433
2000-01	50000	185000	120000	210000	259000	90000
2001-02	50000	185000	120000	210000	265000	90000
2002-03	50000	185000	110000	210000	273000	90000
2003-04	50000	185000	128000	212000	277000	90000
2004-05	53197	185000	133922	236136	292000	80000
2005-06	54616	224707	141696	252121	309000	80000
2006-07	54616	190000	141696	213000	320000	80000

Source: FAO Stat

Annexure- 2.5.2. Cashew production in important African countries (in tons)

Year	Mozambique	Benin	Cote d'Ivoire	Guinea Bissau	Nigeria	Tanzania
1990-91	22524	3000	6500	30000	30000	17060
1991-92	31134	4000	7500	20824	45000	29850
1992-93	54217	6000	7700	30000	55000	41300
1993-94	23935	8500	16900	25000	75000	39300
1994-95	23000	10000	16400	24793	85000	46600
1995-96	33423	15000	39400	29007	95000	63400
1996-97	65000	20000	31200	38580	110000	81700
1997-98	43325	25000	36544	57887	125000	65400
1998-99	51716	25000	39275	64000	152000	93200
1999-00	51894	30000	40795	73156	176000	106500
2000-01	35000	40000	78000	72725	184000	121200
2001-02	50000	40000	80000	85000	185000	121900
2002-03	64000	40000	90000	80000	186000	123000
2003-04	51200	40000	90000	80000	186000	123000
2004-05	102000	40000	90000	81000	213000	100000
2005-06	102000	40000	90000	81000	213000	100000
2006-07	75000	41000	200000	96000	100000	94000

Source: FAO Stat & Various News source

CHAPTER 2.6

Cashew Supply and Demand Scenario in the Major Countries

1. India

The increased processing capacity in India is favouring higher production and RCN imports from other countries, as it is evident from the Table- 2.6.1. According to DCCD, Cochin the total processing capacity of India was 1.3 million tons and the total availability of RCN for processing was 1.24 million tons in 2007.

Table- 2.6.1. Supply and demand scenario for India

Year	RCN Prodn.	Import	Total Supply	Total kernel production	Kernel export	Domestic kernel consumption	Total demand (RCN equivalent of kernels)
1996	417830	212866	630696	157674	68663	89011	630696
1997	430000	247182	677182	169296	76593	92703	677184
1998	440000	241561	681561	170390	77076	93314	681560
1999	440000	253577	693577	173394	96805	76589	693576
2000	450000	248728	698728	174682	89155	85527	698728
2001	470000	348625	818625	204656	97550	107106	818624
2002	500000	386547	886547	221637	94911	126726	886548
2003	535000	452898	987898	246975	100828	146147	987900
2004	544000	578884	1122884	280721	126669	154052	1122884
2005	573000	565400	1138400	284600	114141	170459	1138400
2006	620000	586044	1206044	301511	118540	182971	1206044
2007	637746	605970	1243716	310929	114340*	196589	1243716
2008	655117	642617	1297734	324434	117073	207361	1297734
2009	672137	678335	1350472	337618	118671	218947	1350472
2010	688833	714148	1402981	350745	120288	230457	1402981
2011	705227	749952	1455179	363795	121904	241891	1455179
2012	721340	785756	1507096	376774	123521	253253	1507096

Note:

1. Total kernel production and domestic kernel consumption figures are estimated based on 25% kernel recovery.
2. The figures in red colour indicates the estimated by ARIMA model
3. The total demand in last column was derived by converting the total kernel production to RCN equivalent.
4. * Indicates the actual kernels export from India during 2007-08 (April-March)

The forecasted figures of RCN production and RCN imports shows that both are likely to meet Indian vision on processing capacity to increase by 1.5 million tons by the year 2012. On demand side, the domestic kernel consumption has witnessed an annual growth rate of 8.88% from 1996 to 2006. The CAGR for the projected figures till 2012 has showed that the domestic consumption may grow by 7.35% annually. However, the kernels export has showed a growth of 5% annually. On supply side, the production and raw nuts import from other countries have witnessed 4% and 11.5% growth annually. During 2007, Indian kernels export was lower against 2006 due to the strengthening of Rupee against Dollar and competition from Vietnam.

Overall, the supply-demand projection for Indian Cashew industry shows a bright future to the stakeholders who involved both in supply chain and value chain of Cashew. Higher growth can be attained through higher expansion in production as well as import of raw nuts. Thus, it is expected to fulfill the increased processing capacity of Cashew sector.

II. Vietnam

Table- 2.6.2. Supply and demand scenario for Vietnam

Year	RCN Production	Import	Total Supply	Total kernel production	Kernel export	Domestic kernel consumption	Total demand (RCN equivalent of kernels)
1996	59100	51310	110410	27603	6080	21523	110410
1997	66900	116110	183010	45753	22750	23003	183010
1998	54000	128130	182130	45533	21050	24483	182130
1999	41200	124130	165330	41333	15800	25533	165330
2000	67600	184010	251610	62903	35000	27903	251610
2001	73100	210560	283660	70915	41000	29915	283660
2002	128800	250130	378930	94733	63000	31733	378930
2003	164400	291660	456060	114015	80000	34015	456060
2004	204700	339360	544060	136015	100000	36015	544060
2005	232000	326790	558790	139698	103000	36698	558790
2006	350000	306992	656258	164064	127000	37064	656258
2007	432374	278853	709740	177435	140000*	37435	709740

Note:

1. Data for production and export till 2005 from various news sources
2. The consumption figures till 2005 from FAO STAT (converted RCN to kernel equivalent based on 25% recovery). For 2006 and 2007 it was

projected minimum by 1% growth.
3. Import figures were arrived by subtracting production from total demand (export and domestic demand)
4. The total demand in last column was derived by converting the total kernel production to RCN equivalent.
5. *Indicates estimated exports from Vietnam but it couldn't meet this target due to actual lower production leads to export default by some of the new entrants in Cashew kernels trade.

The Vietnam supply and demand equation has showed that the supply during 2007 was 709,740 tons including the domestic production as well as raw nuts imports from African countries. On supply side, both production and raw nut imports have witnessed an annual growth of 22.6% and 18.2% respectively. Meanwhile on demand side, the kernel exports from Vietnam and domestic kernel consumption has shown a growth of 29% and 5.6% annually.

Vietnam has surpassed India in Cashew kernels export during 2006. Thereafter, India has regained its position of leading exporter of Cashew kernels as Vietnam's export is expected to be lower this year against its estimated level of 140,000 tons.

III. Brazil

Table- 2.6.3. Supply and demand scenario for Brazil

Year	RCN Production	Import	Total Supply	Total kernel production	Kernel export	Domestic kernel consumption	Total demand (RCN equivalent of kernels)
1996	167211	0	167211	40975	36230	4745	163900
1997	125397	49713	175110	43778	36350	7428	175110
1998	39836	104924	144760	36190	31890	4300	144760
1999	130841	0	130841	30468	24100	6368	121870
2000	167123	0	167123	40108	33590	6518	160430
2001	124073	11947	136020	34005	29360	4645	136020
2002	164539	0	164539	36163	30120	6043	144650
2003	183094	10926	194020	48505	41570	6935	194020
2004	187839	34371	222210	55553	47440	8113	222210
2005	152751	53149	205900	51475	41860	9615	205900
2006	236140	12046	248186	62047	51951	10096	248186
2007	190354	19560	209914	52478	41878	10601	209914

Note:

1. Production figures till 2007 and consumption figures till 2005 from FAO STAT
2. Consumption figures till 2005 from FAO STAT and 2006 and 2007 was estimated if it increases 5% annually.
3. Kernel exports also from FAO STAT till 2005 and 2006 and 2007 was estimated based on the past movement.
4. The RCN import was calculated by subtracting total production from total demand.
5. The total demand in last column was derived by converting the total kernel production to RCN equivalent.

The supply and demand equilibrium of Cashew kernels in Brazil has witnessed that the production in Brazil has been increasing over the years from 1996 to 2007 with an annual growth of 3%. Meanwhile, the estimated imports have showed a growth of 1.1% annually. On demand side, both kernels export and domestic consumption have showed an annual growth of 6.8% and 4.3% respectively.

Though India and Vietnam have witnessed a significant growth in production and exports, Brazil did not show any significant change over the years.

R C N Processing

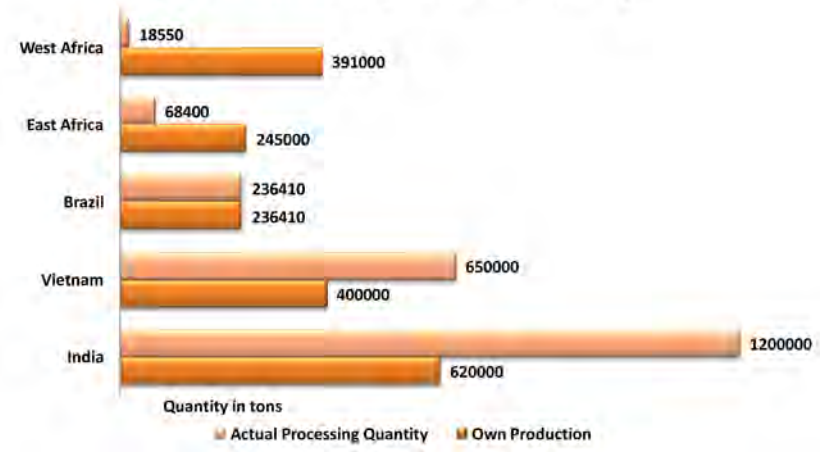
CHAPTER 3.1.

Cashew Nut Production vs Processing

Cashew nut production is largely a function of land availability with suitable agro-climatic condition combined with prudent farm operations. Thus, one observes Cashew nut being produced across geographies albeit at varying degrees of scale and productivity.

On the other hand, processing of Cashew nut for kernels is driven by different set of competencies. Availability of skilled yet affordable manpower, investment capital for setting up manufacturing facilities and financing trade and lastly, access to profitable market for the output are the key drivers that decide processing location. Countries or regions that have been able to mobilize these have emerged successful. Africa as a region has not been able to leverage its raw nut production advantage. On the other hand, India and Vietnam have consistently excelled in processing. Since inception, India has held its dominant position in the Cashew nut processing. The availability of better processing technology and skilled manpower is considered to favour the Cashew nut processing industries in India.

Figure-3.1.1. Cashew nut production Vs Processing



Source: DCCD, India, FAOSTAT & various news sources

In general, India, Vietnam, Brazil and African countries are the major Cashew nut processors in the world. Figure- 3.1.1 indicates that India and Vietnam has installed processing capacity in excess of their own raw nut production. Indian processing capacity is 1200,000 tons, while its raw nut availability is nearly half of that only. Likewise, Vietnam has an installed processing capacity of 650,000 tons, while its own production of raw nuts is 400,000 tons. African countries act as feeder to India and Vietnam. Brazil follows an advanced processing technology that is less manpower intensive. However, value realization is believed to be lower in Brazil against the realization achieved in Vietnam and India.

Traditionally, most of the raw nut from East Africa was shipped into India for processing and subsequently, re-exported as kernels. Manual processing, such as that practiced in India, tends to give higher yield of whole kernels than the mechanized methods in use in Brazil (Errington and Coulter, 1989).

The processing methods currently followed in India are drum roasting and steam boiling. About 60% of the processors are following steam-boiling method, while remaining 40% follows drum-roasting method. The quantity of kernel recovered in drum roasting is slightly lower, compared with steam boiling, as spoiled nut burns completely, while it is being roasted.

Vietnam Cashew nut Processing

Encouraged by high economic value, Vietnam has placed a strong emphasis on developing Cashew cultivation and processing. Vietnam has about 60 Cashew processing factories during 2000 with the total annual capacity of 220,000 tons of raw Cashew nuts. Now, it has been increased to some 200 processing factories with the total capacity of 600,000 tons a year. Vietnam can export 115,000 tons of Cashew nut a year thereby it can earn $500 million per year. The method of processing used in Vietnam is more or less similar to Indian processing methods. Hence, the recovery and quality are also approximately same in both the countries.

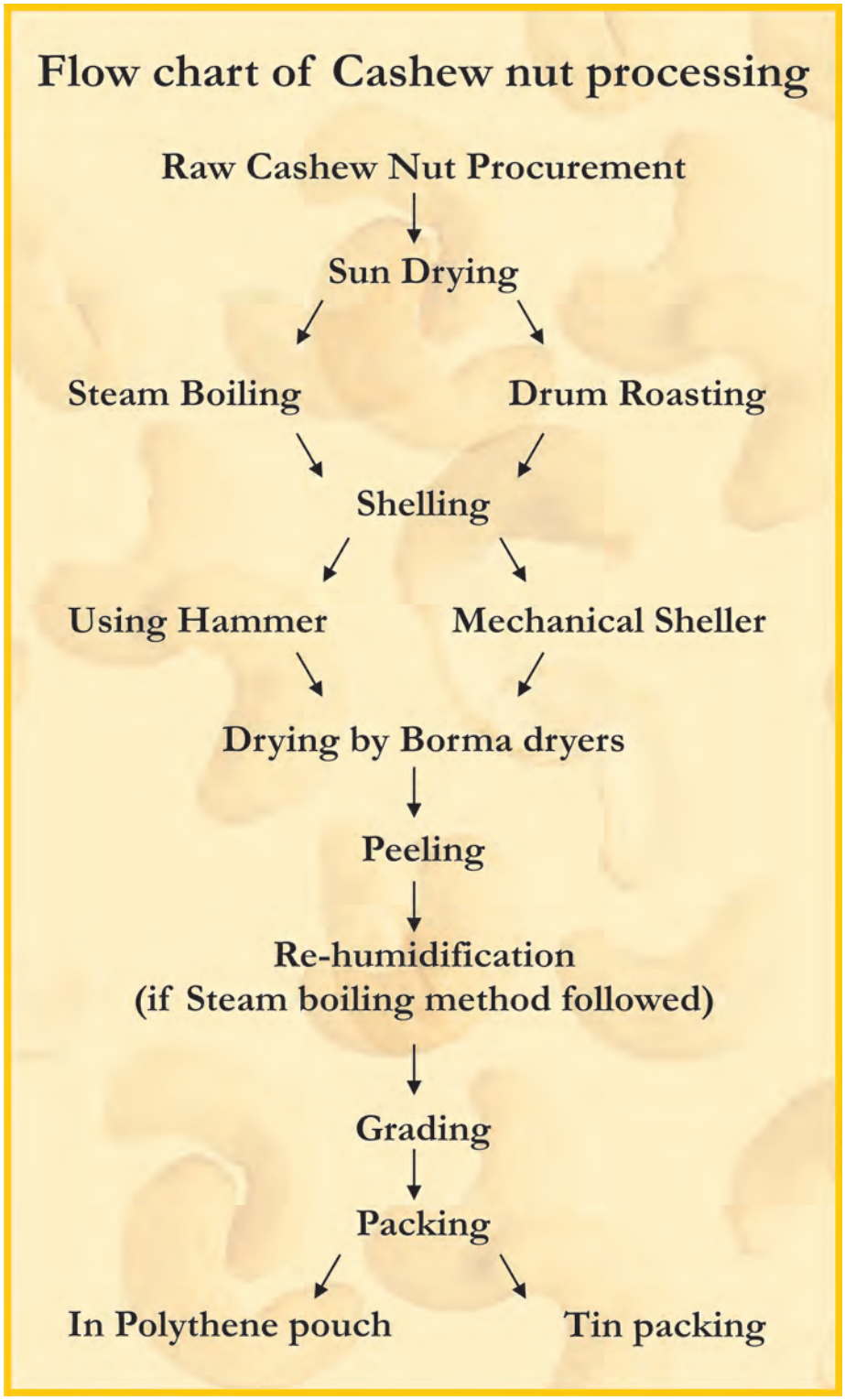
Brazil Cashew nut processing

Unlike India and Vietnam, Brazil follows a mechanized method of processing. Hence, the recovery of wholes grade is lesser in the country.

The mechanization in processing can't be followed in India because Cashew industry is highly a labour-intensive one and able to provide employment to nearly 500,000 people around the country.

Table-3.1.1. Cashew processing industry in Vietnam and India

Aspects	Indian processing industry	Vietnam processing industry
Installed capacity	1200,000 tons of RCN per year as on 2007	600,000 tons of RCN per year as on 2007
Number of units/ factories	Over 2000	200
Per cent share of large units (5000 – 10000 tons per year)	60	50 – 60
Per cent share of own RCN	40 -50%	60 – 70%
Factories HACCP certified	60%	40 – 50%
Labour cost inflation per annum	About 8 – 10%	>10%
Domestic demand for kernels	55-62%	25-28%
Key challenges	Raw nuts at affordable rates Wage rates Transportation costs Exchange rate fluctuation	Labour migration to urban areas Bank finance availability Raw material sourcing Increasing profitability of other plantation crops such as rubber, coffee
Key strengths	Quality Product range	• Packaging innovation • Cost competitiveness


Flow chart of Cashew nut processing
Raw Cashew Nut Procurement
Sun Drying
Steam Boiling
Drum Roasting
Shelling
Using Hammer
Mechanical Sheller
Drying by Borma dryers
Peeling
Re-humidification
(if Steam boiling method followed)
Grading
Packing
In Polythene pouch
Tin packing

CHAPTER 3.2.

Cashew Nut Processing in India

The cashew-processing unit in India was started at Mori of Rajahmundry in the 18th century. Afterwards in the beginning of the 19th century, it has been extended to Palasa and Vetapalem. There was a rapid growth in Palasa region due to the easy availability of raw nuts from adjoining districts and the neighbouring state.

The processing methods followed in India during 2002 were drum roasting, oil bath roasting and steam boiling. In the country, about 66% of the processors including the states such as Kerala, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal followed the drum roasting method. Nearly 27% of the processors followed steam-boiling method including states such as Karnataka, Goa and Maharashtra. Only few industries (7 per cent) followed an outdated method of processing called oil bath roasting in 2002.

Now, the processing scenario in India has changed and the processing practice of 2002 has been reversed i.e., about 60% of the processors follow steam boiling and the remaining 40% of the processors opt for drum-roasting methods currently. Processing cost of steam boiling is slightly higher than drum roasting. However, steam boiling has an added advantage of CNSL extraction as an extra benefit. According to the processors, the nut recovery is good in steam boiling when compared to drum roasting, while the taste and shelf life of Cashew kernels are good in drum roasting.

Table-3.2.1. Cashew growing states and processing regions in India

States	Processing regions and districts
Andhra Pradesh	Tuni in East Godavari district, Palasa in Srikakulam district, Vetapalam in Prakasham district, and Rajmundry in West Godavari district.
Maharashtra	Vengrula
Orissa	Chatrapur, Puri, Ganjam, Koraput, and Navarangpur
Tamil Nadu	Panruti (Cuddalore district) and Kanyakumari
Karnataka	Mangalore
Kerala	Kollam
Goa	Goa
Gujarat	Valsad, Dang districts

Currently, the drum roasting method is followed in states like Tamil Nadu (Panruti), Andhra Pradesh (Palasa) and Kerala (Cochin). The steam boiling method is followed in states such as Karnataka (Mangalore), Orissa, Goa and Maharashtra.

In Karnataka and Maharashtra, 100% of the processors follow steam-boiling method. In Andhra Pradesh, the processors in Tuni district are following steam boiling (50 per cent) and the processors in Palasa districts adapting drum-roasting method (50 per cent). In Goa, 90% steam boiling and 10% drum roasting is being followed.

In Orissa, 50% of drum roasting and 50% of steam boiling methods is being followed, while in Kollam 90% of the processors use drum roasting technique and only 10% follows the steam boiling method.

The Cashew processing units in the important Cashew processing states in India was given in the Table-3.2.2. It can be inferred that the processing capacity of states has been expanded much in the recent days but the capacity utilization is much lower.

Table-3.2.2. Cashew processing industry in India during 2005-06

States	Processing units (Nos.)	Capacity (tons)	Utilization (tons)		
			Indigenous	Import	Total
Kerala	432	700,000	67,000	320,000	387,000
Karnataka	266	65,000	45,000	20,000	65,000
Goa	45	21,000	21,000	-	21,000
Maharashtra	350	20,000	20,000	-	20,000
Tamil Nadu	417	565,000	294,000	225,000	519,000
Andhra Pradesh	175	95,000	92,000	-	92,000
Orissa	60	11,000	11,000	-	11,000
West Bengal	30	8,000	8,000	-	8,000
Chattisgarh	3	-	-	-	0,000
NE States	22	15,000	15,000	-	15,000
Total	**1800**	**1500,000**	**573,000**	**565,000**	**1138,000**

Source: DCCD, Kochi, India

The number of processing industries in India during 2005-06 were 1800 units with processing capacity of up to 1500,000 tons. But the actual quantities of raw Cashew nut processed through these units were about 1140,000 tons. The raw

Cashew nut availability for these processing units from domestic production was 573,000 tons and through import was 565,000 tons. Thus availability totaled at 1140,000 tons in 2005-06. The current availability of raw nut from domestic as well as from imports is estimated at 1240,000 tons.

Procedures followed for processing

Raw nut procurement: Raw nuts are generally bought through commission agents from interstates and from foreign countries to meet the Indian processing capacity of 1200,000 tons.

Storage, drying of raw nuts: Raw nuts are kept stored in gunny bags with 80 kg capacity in warehouse. Processors feel that hilly area nuts can be stored up to two years, without spoilage in warehouse, whereas nuts from the coastal areas can be stored just about 4-5 months. Through sun drying, the moisture content is reduced to 8% (dry basis) in storage.

The raw nuts can be processed through drum roasting or steam boiling methods.

- **Drum Roasting:** Drum roasting machine consists of feed hopper, rotary drum, gears and water tanks with sprinklers and a surface. A feeding tank/hopper can contain 800-kg raw nuts. As the moisture content and size of the nut has an impact on the qualitative efficiency of kernels in drum roasting, roasted nuts are tested for their quality to optimize feed rate and drum revolutions.

- **Steam Boiling:** Under the steam boiling process, a cylindrical drum with a hopper on the top for feeding raw Cashew nuts is used. A boiler is used for generating steam and is sent to the drum through a pipe at the bottom. The pipe is connected to a perforated central stem and laterals inside the drum. A steam gauge is fitted with a valve for controlling pressure to the steam pipe connecting the steam generator and drum. Cashew shell cake is used as fuel and it requires about 50 kg of cake to steam boil a batch of 320 kg of raw nuts. The crucial parameters, i.e., steam pressure and duration, vary from industry to industry, due to various factors such as variation of the origin of raw nuts, capacity and efficiency of boiler, skill of a labourer, etc.

- **Shelling:** Skilled women labourers are involved in the shelling section. Roasted nuts are tapped gently in the shelling section,

two-three times manually, with the use of wooden mallets and this impact force helps the nut to crack and the kernel is separated. The raw nuts processed through steam boiling method are shelled by means of mechanical decorticator or a hand cum foot-operated cutter is used for shelling. The nuts are placed one by one between two blades and cut to the depth of the shell. A hand lever is used for breaking open the shell. Another labourer separates the opened nuts and shells. Due to the tiring nature of shelling, the labourers exchange positions. The output of two workers ranges from 50-100 kg raw nuts per day. The average production is in the range of 11-25 kg per day per pair. Partial mechanisation of shelling and steam boiling results in release of shell oil that can affect workers' hands. One must be careful during cutting, as to avoid injury to labourers during the process. The shelling percentage is normally around 25. The average recovery of wholes is about 92 per cent. Roasted nuts are mixed with ash, so that skin damage against CNSL can be avoided. The out turn of wholes is taken into consideration for wage calculation.

- **Kernel Drying:** After separation from the shells, the kernel is dried to bring down the moisture and loosen the adhering testa by means of Borma dryers. The nuts are placed in trays with wire mesh bottoms and loaded into chambers that are built with either brick or metal. The trays are arranged in a trolley and in turn, put inside the chamber. The drying chamber gets hot air from the generator where spent shells, after extracting CNSL, are burnt as a source of heat. The kernels inside the chamber are put through varying temperatures and require highly skilled labourers for avoiding scorching of kernels. Positions of trays are changed at regular intervals of time for maintaining uniform heating. The drying percentage in borma dryer has been worked out at 4-5 per cent.

- **Peeling:** Peeling of dried kernels is done manually by sharp edged small knife. The operational capacity ranges from 7-8 kg/head/day. As like shelling the out turn of wholes is taken into consideration for wage calculation. On an average, 70% of wholes are recovered by this method. Preliminary grading of 7-10 grades is completed in this section. Those to be rejected are separated in the peeling section and graded as black baby

bits, completely spoiled, white reject and difficult to peel.

- **Re-humidification:** The kernels processed through steam boilers have to undergo this process to prevent excessive breakage by handling and transport after final grading. Kernels are kept in a high humid room for a few hours till they come back to a moisture content of 5% (maximum limit).

- **Grading and packing:** Grading is done according to specifications laid down by the Cashew Export Promotion Council of India. More than 25-30 grades are sorted out for domestic market and export. Grading is done manually. Cleanliness is maintained in this section to a great extent. Different grading lists are available for export and indigenous supply of kernels. Grading of whole kernel is based on counts, i.e., the number of whole kernels per pound. The main groups are white wholes, that are sub-divided into counts 200/210, 220/240, 300/320, 400/450 and 500/520, Butts-wholes with small pieces chipped off, white splits-kernel halves, LWP (Large White Pieces) of size over 60 mm, SWP (Small White Pieces) of sizes < 40 mm, scorched grades showing some discolouration due to over roasting, shrivelled or spotted or dessert kernels.

- The permissible moisture content at the end of grading is in the range of 3-5% (dry basis) and kernel must be free from any impurities and odour. For maintaining hygienic condition, either plastic or aluminium containers are used for shifting from section to section.

- **Packing:** Tin containers of 25-pound or 50-pound capacity are used for packaging kernel and these tins are packed in carton boxes. In a kernel-filling machine, 4-6 tins are placed on a vibrating platform, while filling by a chute. Blowers that are provided across the chute remove dust and kernels with less weight. The tins are vaccumised and flushed with CO_2 with the help of VITAPACK machine and sealed afterwards. The use of CO_2 brings down oxidative rancidity and also assists in checking leakage. Any leakage in filled containers can be detected by the hollow sound that comes out while tapping the sides of the tin. Tin tester is also used for checking airtight packing by dipping in water.

- Flexible Packaging (Moulded Vaccum Packaging) with nitrogen, as inert gas is a better method for bringing down the heaviness and incurs less cost of packing. MVP system produces consistent rectangular blocks that range in size from 500 gm to 25 kg. This is a big improvement in quality production with the advantages of transport, handling, display, stock count, etc. The vacuum barrier bag and cardboard box are fully recyclable. The rectangular shape of primary packs ensures that the movement is minimum during transportation and handling, providing the maximum protection to the contents. The removal of air and gas flush bring down the incidence of rancidity and bacterial growth.

- **Capital investment:** In a Cashew nut processing unit, the highest amount is invested on buildings (64.94 per cent), followed by machinery, equipment, (22.08 per cent) and land at an overall level. The big capital investment is due to provision of workplace for processing units, as it is labour intensive.

- W320 is a benchmark grade meant for analysing the qualitative efficiency of Cashew processing. The out turn of kernels depends on the quality of raw nut, efficiency of roasting and kernel drying and the dexterity of labour.

- According to the processors, nearly 30-40% of W-320 grade are produced all over the world, which has higher demand from US and EU countries. Meanwhile, W-180 and W-240 grade kernels have higher demand in Middle East countries.

Current status of Cashew processing in India

In India, eastern states are regions of promise for Cashew as they have shown rapid development in cultivation and process over the last two decades. There could be continual improvement based on interaction and provision of knowledge and technology. The major Cashew processing centres in the east coast, Tuni in Andhra Pradesh and Jeypore in Orissa are now attracting the attention of Cashew manufacturers from the west coast due to the availability of raw Cashew and cheap labourers in these regions.

According to governement sources, Chhattisgarh state will set up three Cashew nut processing units in the iron ore rich Bastar region. The three units will be set

up at Kumharvand, Karmari and Turenaar. These are remote areas having tribal stronghold. The units would be equipped for processing nuts including shelling, peeling, grading into different sizes and colours in accordance with standard grading, drying or humidifying and packing.

The total area under Cashew production in Chhattisgarh is about 10,000 hectare, of which 2,000 hectare is in Bastar region. The present productivity of Cashew is 480 kg/ha in the state, while the national average is about 700-800 kg/ha. Three private firms are already operating processing units in Bastar region to tap the rich potential of Cashew nut production in the Bastar region.

In the states like Karnataka, Goa and Maharashtra, the Cashew processors are mostly following steam-boiling methods. Hence, more scope for Cashew nut shell liquid production at the large extent from these states to satisfy the increasing global demand for this liquid is expected.

Reference:

Errington, M. & Coulter, J.P. 1989. The International Market for Cashew Products. Overseas Development Natural Resources Institute, Chatham, Kent, UK.
Indian Cashew Handbook 2002, Eventell Global Advisory Pvt Ltd Bangalore –560 008.

CHAPTER 3.3.

Cashew Processing - Analysis of Cost Structure in India

India has been better placed in Cashew nut processing among the countries in the world due to the availability of better processing technology. Moreover, India has tradition and enjoys high reputation in quality Cashew kernel production.

Table-3.3.1. Comparison of RCN processing cost (Rs/ kg of raw nut) during 2002 and 2008

Processing stages	2002	2008	
		Tin packing	Plastic pouch packing
Drying raw nuts	0.15	0.27	0.27
Steam boiling & sun drying	0.18	1.33	1.33
Shelling of nuts	1.28	7.25	7.25
Kernel drying	0.19	0.27	0.27
Cooling	-	0.27	0.27
Peeling	1.26	1.96	2.10
Grading	0.57	1.57	1.57
Packaging	1.53	-	-
(1) If tin packaging	-	1.38	-
(2) If plastic pouch packing	-	-	0.56
Total	5.16	14.29	13.61

Note: The processing cost in Tamil Nadu obtained through primary survey is taken for calculation for 2008. For 2002, the cost has been taken from Indian Cashew Handbook 2002.

The comparison of processing cost of Cashew nut during 2002 and 2008 is given in the Table- 3.3.1. It indicates that in 2002 the cost of processing was Rs.5.16/kg of raw nut, while it is Rs.14.29/kg for packing through tin and Rs.13.61/kg for plastic pouch packing in 2008. The labour cost constitutes most of the share in the total cost, except packaging; all other costs purely indicate labor cost.

Table-3.3.2. Details of the labour cost in Cashew processing

Operations	Cost of Male labour	Cost of Female labour
Steam boiling and drying of raw nuts Kernel drying in borma dryer Cooling and Packaging	Rs.85/day	
Shelling		Rs.5.4/kg + Rs.14.80 DA (if the quantity of shelling crosses 6 kg)
Peeling		Rs.6/kg + Rs.14.80 DA (if the quantity of peeling crosses 5 kg)
Grading		Rs.5/kg + Rs.14.80 DA (if the quantity of grading crosses 7 kg)

Table-3.3.2 indicates that the wages vary with stages of processing. For example, shelling operation, a woman can shell maximum of 8 kg per day and per kg shelling cost is Rs.5.40 + Rs.14.80 DA (Dearness Allowance has been given in addition to the wage if the shelled quantity exceeds 6 kg a day). In case of peeling operation, a female labour can peel at the maximum of 7-8 kg per day and per kg peeling cost is Rs.6 + Rs.14.80 DA (the dearness allowance is provided if she peels more than 5 kg/day). The next activity carried out by women labour - grading involves a cost of Rs.4.80/kg. The wages for grading operation are given based on the whole grade recovery. On an average, a women labour is able to grade a maximum of 10 kg per day. Here also the DA will be given if they grade more than 7 kg.

Packaging of kernels can be done in tin or in plastic pouch. The traders prefer to pack in plastic pouch if the consignment is for exports, and tin packing if it is within the country. Usually the packing capacity of a tin is 11.34 kg, which is kept inside a carton (having 2 tins with capacity of 22.68 kg). The cost of a tin is Rs.52 with carrying capacity of 11.68 kg, whereas the plastic pouch cost is Rs.30 with capacity to carry 22.68 kg.

Tin package cost is escalating because its prices is linked with the price

of steel. However tin has recyclability i.e., nearly 40% of the tin could be reused so that we can recover Rs.40 (if a carton is used for packaging) when the tin containers are sold.

The main advantage of processing raw Cashew nut through steam boiling method is the realization of CNSL with superior quality and the shell cake can be reutilized for fuel purposes.

Wage inflation in Cashew processing

It can be noticed from the Table-3.3.1 that the processing cost in 2008 has increased more than twice against its 2002 levels.

The male labour involved in steam boiling and drying in 2002 was earning Rs.45/day, whereas wage has increased to Rs.85/male labour currently. Shelling cost (excluding DA) during 2002 was Rs.2.70/kg for woman labour but the current wage is Rs.5.40/kg (excluding DA). Likewise peeling cost was Rs.3.22/kg in 2002 but the current wage is Rs.6/kg.

CHAPTER 3.4.

SWOT Analysis of Cashew Industries in Major Processing Countries

Indian Cashew industry

Strengths

1. India is the leader in both Cashew nut production and kernels exports in the world.
2. The increase in domestic Cashew consumption in India would pave the way for Cashew industry growth.
3. The area under Cashew has been expanding in India. The Directorate of Cashew and Cocoa Development is taking steps to increase the area under Cashew to one million hectares by 2012.
4. In the processing front, India has better technology and inexpensive and semi- skilled labor.
5. Higher processing capacity i.e., 1.2 million tons per annum has kept India at the leading position in the processing front.
6. Manual processing provides good quality kernels and the realization of wholes is also higher compared to the competing countries. Hence Indian Cashew kernels fetch good demand and commend high price in the international markets.
7. India's Cashew industry was the first to use quality control for improvement of performance. The ISO 6477 standard was introduced in 1988 in India.
8. India also has a long tradition and good reputation as a high quality processor of Cashew.
9. Chattisgarh state in India is going to set up three Cashew nut processing units particularly in the remote areas having tribal stronghold.
10. There is no import duty for raw Cashew nut imports into India.

Weaknesses

1. Lower productivity due to senile plants and lack of good agricultural practices. According to studies, nearly 34% of the total Cashew crops in India are senile plants.
2. Cashew growers are not adopting high yielding varieties for planting.
3. Though India has higher processing capacity, the raw nut availability is very low (only 50% of total processing capacity) and

the processors have to depend on other African countries for their processing requirement.

4. Difficulties in getting labour for manual processing of raw nut.
5. The cost of processing has been increasing and pose a threat to processors on account of higher input costs like freight, labour, etc.,
6. There is not much research on CNSL and apple usage in India. Mostly the Cashew apple was wasted in the plant itself even though it has lot of scope to be converted into so many products like jam, juice, jelly and alcoholic drink like "fenny". Likewise India is the leading producer of Cashew kernels hence the by-products Cashew shell are abundant. Though India's CNSL and its products have good export enquiries from other countries, the actual production (45,000 tons) is far below the potential production of 200,000 tons.

Opportunities

1. The production in the competing countries like Brazil and Vietnam are expected to decline this year, which paves good opportunity to Indian Cashew processors to increase their exports.
2. Indian Cashew growers can adopt high density planting as is the practice followed in Vietnam to increase the production.
3. To carry research and development activities, India has research stations working on Cashew such as Directorate of Cashew and Cocoa Development (DCCD), National Research Centre for Cashew (NRCC) concentrating on varietal development and improvement in forward linkage along with backward linkage like Cashew Export Promotion Council of India (CEPCI).
4. In some of the major Cashew producing and processing states, separate Cashew manufacturers associations and Cashew development corporations exist to deal with the issues related to Cashew for their state specific and to promote trade in their state.
5. In traditional Cashew growing areas, DCCD has planned to undertake re-plantation of senile plants to increase the productivity.
6. Under the eleventh plan (2007–12), the Government of India has decided to take up Cashew cultivation in a big way in Chattisgarh, Jharkhand and the Northeastern region.
7. In the 2008 budget, Indian government has allotted Rs.11 billion

package for the revival of Cashew along with coconut and pepper. This would help Cashew growers in a much better way to replant their crops with new higher yielding varieties. This would provide a renaissance to Indian Cashew sector, as it will reduce the dependency on imports of RCN from other countries to a large extent.

8. The emerging concept of organic/bio-dynamic Cashew is likely to get good place in international arena.
9. The research and development of value added Cashew products turn the attention of international consumers towards Indian Cashew. The initiative of Kerala State Cashew Development Corporation (KSCDC) on Cashew products like Cashew vita, Cashew powder, Cashew soup powder and Cashew bitz under CDC Cashews is a one such example.

Threats

1. The Government of India has decreased the Duty Entitlement Passbook (DEPB) rate to 1.5% from the existing rate of 3 per cent, which is expected to hurt the exporters to a large extent.
2. Decline in area under cultivation in the major Cashew growing state of Kerala.
3. Lower production with respect to total processing capacity increases the dependency on other countries for raw materials.
4. The emerging competition from Vietnam in Cashew exports.
5. Increasing crude oil prices and Rupee movement against US dollar

Vietnam Cashew industry

Strengths

1. Higher productivity due to good agricultural practice as well as high density planting.
2. Vietnamese planned to increase Cashew nut productivity to 4000 kg/ha from the current level of 2000 kg/ha.
3. At present, Vietnamese Cashew processors are exporting their kernels to about 40 countries like US, China, Holland, Australia, UK and Germany.
4. During 2006-07, Vietnam surpassed the leading kernels exporter India and gained the title of leading exporter with the export turnover of $650 million.

Weakness

1. Though Vietnam expanded their processing it is facing shortage in labour availability i.e., the sector now has approximately 300,000 workers, meeting only 60% of the demand of processing plants.
2. Vietnamese Cashew firms have to pay an import tariff of 5 to 7.5% on raw Cashews, which restricts their competitiveness in the global market. They also exempt import duties, but only on imported raw Cashews that can be processed for export within 275 days. However, most domestic Cashew processors and exporters have failed to meet these requirements and cannot benefit from the incentives.
3. The current default by the exporters for shipment due to unexpected escalation of processing cost shake the reliability of Vietnam exporters.

Opportunity

1. Research and development on modern equipments for production and processing and research on High Yielding Varieties aimed at improving quantity and quality.
2. Vietnam Cashew Association (VINACAS) has set a target of increasing their export turnover to $700 million by 2010 and $820 million by 2020.

Threats

1. The Vietnamese Dong has been depreciating against the US dollar continuously for the past 5-6 years. This poses threat to RCN import by Vietnam.
2. Competition from India

Brazilian Cashew industry

Strengths

1. The area under Cashew cultivation is more in Brazil when compared to the second largest Cashew growing country, Vietnam.

Weakness

1. Though Brazil has higher area under Cashew, the productivity of Cashew is much lower i.e., the yield of Cashew in Brazil is around 350 kg/ha, which is much below the world average of 780 kg/ha.
2. As Brazilians follow mechanical processing methods, the realization of good quality (whole grades) is poorer while splits and pieces are more.

3. The mechanical processing methods give more broken nuts, which fetch half of a value of whole nut and the quality of nut also deficient in taste, colour and flavour which contributed to lower price realization to Brazilian exporters.

Opportunities

1. Brazil is very near to most of the major Cashew consuming countries like US and EU countries hence it can take advantage of logistic costs on Cashew trade against India and Vietnam.

2. Productivity can be improved once Brazil follows good agricultural practices, planting of HYV through proper research and development.

Threats

1. Competition from India and Vietnam

CHAPTER 3.5.

Prospects of Cashew Nut Shell Liquid in India

Cashew shell is a hard woody outer coverage of cashew nut. It occupies nearly 70% of cashew nut weight and the kernel occupies the remaining part. Though the kernel is the major valuable produce from cashew nut, the shell also has an economic value. Besides kernel, the shell yields Cashew Nut Shell Liquid (CNSL), which is dark reddish brown viscous liquid. The shell oil represents one-fourth of the mass of an unshelled nut and is approximately equal to that of the kernel. The cashew nut shell liquid contains 80% Anacardic acid, 10-15% Cardol and small amounts of other materials notably the methyl derivatives of Cardol.

Uses of CNSL

1. About 75% of CNSL produced is used in manufacture of friction particle, which is used for the automotive industry.
2. The CNSL and the resins containing cardanol have found significant applications in brake lining for cars and clutch disks.
3. Surface coatings containing CNSL have an excellent glossy appearance with optimum levels of hardness.
4. The resin of CNSL is added to paint and synthetic varnishes in order to control their properties and to reduce their cost. Its ability to destroy the termites combined with its anti-microbic action is known since a long time and is used in protection of the hulls of boats.
5. Paints and varnishes made from CNSL have superior properties than those of conventional oils or synthetic resins. Incorporating sulphur in CNSL has made varnishes resistant to water and gasoline.
6. The resins of CNSL give excellent lacquers, which are more resistant than vegetable and mineral oils. Lacquers developed from CNSL could be used for itnsulation, protective coatings for furniture, buildings, automobiles, etc.
7. The resins of CNSL alone or in combination have significant qualities of impermeability and can be used in the coating of roofs.
8. The resin of CNSL modified with phosphorus is added to cement. This material adheres well to porous bricks, steel and the concrete.
9. In laminating industry it is used for reducing brittleness and improving the flexibility of the laminates.
10. Using CNSL, a novel and cheaper liquid crystalline polyester has been synthesized that can substitute for polymer fibres and films in speciality applications.
11. CNSL is also used in nano-technology for targeted drug delivery.

12. In tropical medicine, CNSL has been used in treating leprosy, elephantiasis, psoriasis, ringworm infections and warts.
13. The cashew nut shell cake from CNSL extraction can be used as a good source of fuel for cashew nut processing.
14. The by-product of CNSL, Cardanol especially chlorinated products of cardanol and hydrogenated cardanol are found to have pesticidal action.
15. The various components of cardanol can be suitably modified to obtain emulsifiers and surface active agents, dyestuffs, antioxidants, plasticizers, stabilizers, accelerators, curatives, reclaiming agents and ion-exchange resins.

Global CNSL production

The global cashew nut shell liquid production is 125,000 tons (http://www.adarshsanoor.com/cnsl.asp), in which India's share is 36% (i.e., 45,000 tons). Brazil CNSL production during 2004 was 37,000 tons.

Prospects for CNSL production in India

The total processing capacity of cashew industry in India is 1200,000 tons. The availability of cashew shell after processing these 1200,000 tons of raw nuts is 840,000 tons. The cashew nut shell liquid recovery varies from 20-24% i.e., India's has capacity to produce 1700,000 to 200,000 tons of CNSL, but as of now it is producing about 45,000 tons of CNSL only. The gap between potential and actual production is too wide i.e., India realizes only 22-25% of its total potential. The production of CNSL is now limited to Karnataka, Goa, South Arcot district in Tamil Nadu and partially in Kollam and in Puducherry (UT).

The major importing countries of cashew nut shell liquid from India are USA, Korea republic, Japan and Zimbabwe. The enquiries for CNSL from these countries are increasing, which gives huge potential for its production and exports. Once the cashew processors realize the benefits from CNSL and its products, they could go for improved processing techniques to realize more CNSL production.

Economics of CNSL production

The shell recovery from cashew nut = 70 per cent
From 100 kg of cashew shell,
CNSL realization is 21.75 kg and Shell cake is 74 kg.
The current practice in India is to buy the shell, extract oil from it and sell

back the de-oiled cake. The net cost of cashew shell is about 65% of the vaue of CNSL. Processing cost is about 10-12% of the value of CNSL.

Projection of export realization from CNSL in India

India is exporting only 17% of its total CNSL production (45,000 tons) to countries like Japan, Korea republic, USA, Zimbabwe, China and Egypt.

If we apply the above calculations at national level, India can earn nearly Rs.83.25 crores at current level of production of 45,000 tons at current costs. If India is producing CNSL with full potential of 170,000 to 200,000 tons, then it can realize Rs.314 to 370 crores, which is nearly 15% of export income earned through kernel exports. Mostly the cashew processing firms are themselves involved in CNSL preparation as a co-generation activity.

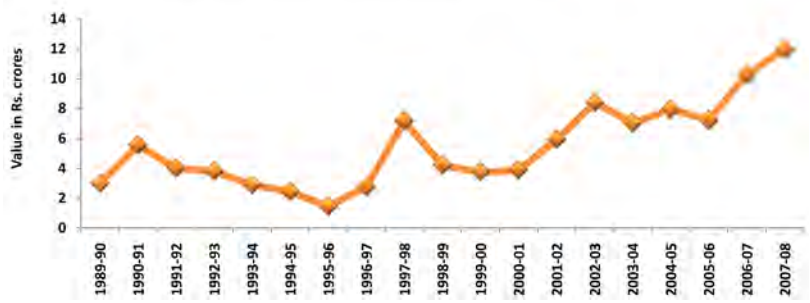
Hence, the value of CNSL and its cake puts forth enormous employment and income generating avenues to the cashew industry as a whole.

CNSL exports from India

The cashew nut shell liquid exports from India have been increasing over the years from 1989-90 to 2007-08. The CAGR of CNSL exports (quantity wise) for the above years were 4 per cent, whereas the value of exports has increased by 7% annually.

It is clear from the Figure-3.5.1 that the quantity of CNSL export has been increasing over the years because of its higher acceptance in the international markets. The export of CNSL in the year 2007-08 was 7,813 tons against its previous level of 6,139 tons. The major importing countries of CNSL from India are USA, Korea republic, Japan and Zimbabwe.

Figure-3.5.2. Value of CNSL exports from India



The value of CNSL exports has also increased over the years as shown in the Figure-3.5.2. The unit value of CNSL has declined to Rs.15.30/kg in 2007-08 against Rs.16.76 in 2006-07.

Major importers of CNSL

USA is the major importer of Indian CNSL followed by the Korean Republic, Japan, United Kingdom, China and other countries like Indonesia, Zimbabwe, Mexico, Spain, Belgium, Russia, Romania, South Africa, Malaysia, Germany, Egypt, etc. Among these countries, China and Egypt are new entrants into the CNSL trade.

Though various countries are importing CNSL from India over the years, the United States of America and Korea are highly stable buyers for Indian CNSL.

Figure-3.5.3. Country-wise CNSL exports from India

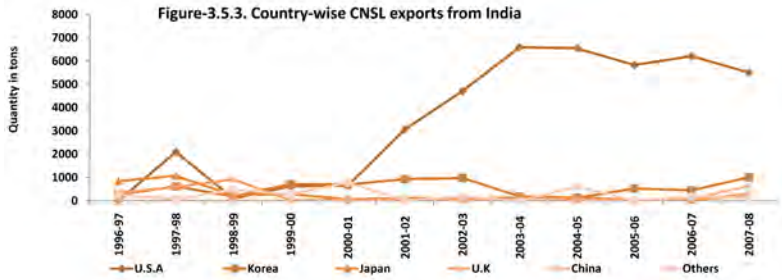
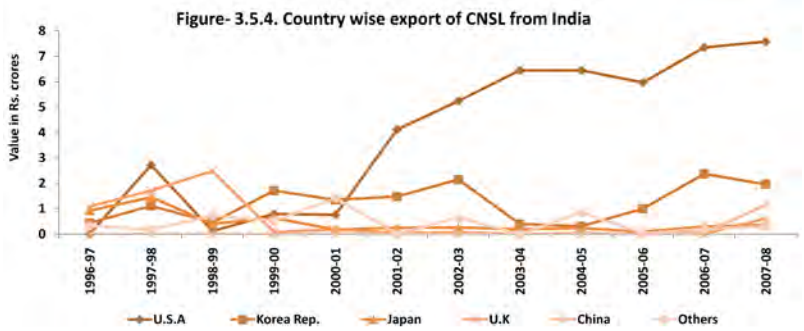


Figure-3.5.3 indicates that the quantity of CNSL exports from India to USA has increased over the years. The CAGR for CNSL exports to USA has shown significant growth of 36% from 1996-97 to 2007-08, while Korea has shown a growth of 0.04% during the same period. Meanwhile, Japan has witnessed a negative growth of 15.6% annually. The exports to other countries are varying over the years. The overall CNSL exports for the same period have shown 14% growth.

It can be inferred from Figure-3.5.3 that the value CNSL exports is also increasing over the years for USA and high fluctuations from other countries has shown that the currency movement has an impact on the value of the trade.

The USA has showed a growth of 34% in value of CNSL imports from India, whereas Korean Republic has witnessed a 3% growth and Japan stands with a negative growth of about 12% annually. The overall growth of value of CNSL exports from India stood at 9% between 1996-97 and 2007-08.

Figure- 3.5.4. Country wise export of CNSL from India



Change in direction of CNSL trade

In order to find out the change in CNSL exports direction from India, a transitional probability matrix has been formed by using Markov chain analysis.

Table-3.5.1.Direction of CNSL trade from India (1996-97 to 2007-08)

	U.S.A	Korea	Japan	U.K	China	Others
U.S.A	0.9380	0.0283	0.0070	0	0	0.0267
Korea	0.3507	0.6087	0	0	0	0.0406
Japan	0.3288	0	0.4016	0.2696	0	0
U.K	0	0.5153	0.1941	0	0	0.2906
China	0	1	0	0	0	0
Others	0.9291	0.0391	0.0317	0	0	0

The results presented in the Table-3.5.1 indicate that USA has been a stable market for Indian CNSL as reflected with higher probability retention of 0.9380 i.e., the probability that USA can retaine its share of imports from one period to another period was about 94 per cent. Likewise, Korean Republic also had a higher retention of 0.6087 i.e, about 61% and Japan had the retention capacity of 40 per cent. Meanwhile, the United Kingdom, China and 'other countries' have shown a probability of zero retention indicating that they were the unstable markets for Indian CNSL exports.

USA has taken away 35% of Korea's and 33% of Japan's market share in the world trade. At the same time, USA has lost 2.7% each of their own market shares to Korea and Other countries and 0.7% to Japan. Therefore, USA has retained 94% of its original share and lost about 6% to Korea, Japan and to 'other countries'. Over all the net gain of USA from Korea was 32.3% and from Japan was 32.3 per cent.

The next major gainer among the importers of CNSL from India was Korean Republic, which had a transitional probability of 1 from China, 0.5153 from United Kingdom, 0.0283 from USA and 0.0391 from 'other countries'. It means, the probability that the Korean Republic would gain in the export share of Indian CNSL from one period to another from China, UK, USA and 'other countries' was 100 per cent, 52 per cent, 2.8% and 3.9% respectively. Meanwhile it has lost 35% to USA and 4% to 'other countries'. Overall, Korea has retained 61% of its market share and lost 39% to USA and 'other countries' in the period between 1996-97 and 2007-08.

If we consider Japan, though it has gained 19% of UK's share, 3% of 'other countries' share and 0.7% of USA share, it lost nearly 33% of its own share to USA, 30% to UK from one period to another period. Hence, it has retained 40% of its CNSL import from India. The net loss for Japan from USA was 32.3% and from UK's was 11 per cent.

United Kingdom could not retain its original share and lost nearly 51.5% to Korea and 29% to 'other countries' and 19.5% to Japan. Meanwhile, it has gained 30% of Japan's share. UK had a net gain of 11% from Japan.

Since China is a new entrant in to the CNSL trade, it has imported nearly 32 tons in 2006-07 and 638 tons in 2007-08. During the period from 1996 till date, China has lost 100% of its share to Korea.

'Other countries' could not retain their original share and they lost nearly 93% to USA, 4% to Korea and 3% to Japan. Meanwhile, they have gained 29% of UK market share, 4% of Korea and 3% of USA. Overall 'other countries' net loss from USA was 93% and there was no loss and no gain from Korean Republic.

In brief, we can conclude from the Markov chain analysis that USA, Korea

and Japan were the stable markets and other countries were unstable markets for Indian CNSL. For Korea, USA was the major competitor, and for Japan, it was USA and UK. For UK, Korea was the main competitor and for China, Korea was the sole competitor, while for 'other countries', USA was the major competitor.

Reference:
The Seventh Asia-Pacific International Symposium on Combustion and Energy Utilization, December 15-17, 2004, Hong Kong SAR

Annexure- 3.5.1. Cashew nut shell liquid exports from India

Year	Quantity in tons	Value in Rs. Crores
1989-90	3014	3.00
1990-91	5658	5.56
1991-92	4542	4.02
1992-93	4258	3.81
1993-94	3625	2.90
1994-95	3807	2.44
1995-96	760	1.46
1996-97	1734	2.77
1997-98	4446	7.17
1998-99	1912	4.21
1999-00	1930	3.74
2000-01	2246	3.89
2001-02	1814	5.93
2002-03	7215	8.36
2003-04	6926	7.03
2004-05	7474	7.91
2005-06	6463	7.20
2006-07	6993	10.29
2007-08	7813	11.98

Source: Director General of Foreign Trade, India

Annexure-3.5.2. Country-wise export of CNSL from India (Quantity in tons)

Countries	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
U.S.A	0	2095	100	620	653	3075
Korea	263	616	185	715	697	931
Japan	848	1072	233	291	66	123
U.K	357	586	923	23	53	32
China	0	0	0	0	0	0
Others	267	77	471	281	777	17
Total	**1735**	**4446**	**1912**	**1930**	**2246**	**4178**

Countries	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
U.S.A	4710	6600	6550	5834	6214	5511
Korea	981	191	125	524	447	1010
Japan	98	135	154	31	59	206
U.K	48	0	0	0	0	317
China	0	0	32	0	81	638
Others	186	0	613	16	193	131
Total	**6023**	**6926**	**7474**	**6405**	**6993**	**7813**

Source: Director General of Foreign Trade, India

Annexure-3.5.3. Country wise export of CNSL from India (Value in Rs. crores)

	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
U.S.A	0	2.72	0.12	0.79	0.76	4.11
Korea Rep.	0.44	1.11	0.46	1.71	1.35	1.48
Japan	0.92	1.45	0.41	0.63	0.18	0.25
U.K	1.09	1.71	2.49	0.09	0.18	0.05
China	0	0	0	0	0	0
Others	0.32	0.18	0.73	0.52	1.42	0
Total	**2.77**	**7.17**	**4.21**	**3.74**	**3.89**	**5.89**

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
U.S.A	5.24	6.45	6.45	5.97	7.35	7.58
Korea Rep.	2.15	0.4	0.31	1	2.37	1.96
Japan	0.26	0.19	0.24	0.09	0.3	0.36
U.K	0.07	0	0	0	0	0.62
China	0	0	0.04	0	0.06	1.15
Others	0.65	0	0.86	0.03	0.2	0.3
Total	**8.37**	**7.04**	**7.9**	**7.09**	**10.28**	**11.97**

Source: Director General of Foreign Trade, India

Cashew Kernels

CHAPTER 4.1.

Global Cashew Kernels Export from Major Supplying Countries

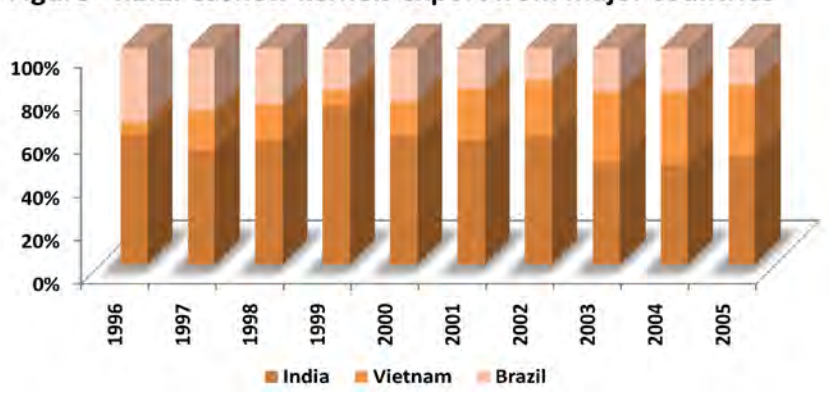
The global cashew kernels export has been increasing consistently over the years. An annual growth rate of 6.6% has been witnessed from 1996 to till date. Higher demand for kernels from USA, The Netherlands, United Arab Emirates and Saudi Arabia has led to a flourishing kernel exports from India, Vietnam and Brazil.

Growth of global cashew kernel export

The global cashew kernels exports have witnessed significant growth from 1986 to 2005. The Indian kernels export has been increasing at an annual growth rate of 6.50% from 1986 to 2005 (FAO Stat). During the period, Brazil and Vietnam kernels export has shown a positive growth, while Sri Lanka and other African countries (like Mozambique, Kenya and Nigeria) have witnessed a negative growth. Brazilian exports have registered a growth of 3.36% and Vietnam has recorded a higher growth of 21.46% from 1986 to 2005.

The share of cashew kernels export from major countries

Figure- 4.1.1. Cashew kernels export from major countries



It is evident from the Figure- 4.1.1 that the cashew kernels export from India had been fluctuating during the period from 1996 to 2005. The country has recorded higher share in 1999 and thereafter the share has been taken away by some other origins. The kernels export from Brazil had ztalso been fluctuating over the year from 1996 to 2005.

Direction of global cashew kernels exports

The direction of global cashew kernels exports has been analysed identify the reliable suppliers of cashew kernels to the world markets. Though cashew nut has been produced in more than 30 countries around the world, the exports of kernels were mainly from India and Vietnam. This could be attributed to their expanded processing capacity and tremendous growth in domestic cultivation as well. The data for this analysis has been taken from FAO Stat from 1996 to 2005. During this period, it has been identified that India and Vietnam were reliable suppliers of cashew kernels.

In order to identify the strength of countries reliability in kernels exports, a transitional probability matrix was framed by Markov chain analysis. It is clear from the Table- 4.1.1 that India and Vietnam were the stable countries for cashew kernels exports and the remaining countries are unstable. India has shown the probability retention of 0.64 i.e., it can retain about 64% of its share in global cashew kernels export. It is also evident from the table that India has last 5%, 29% and 2% share to Vietnam Brazil and Indonesia respectively from 1996 to 2005. At the same time, it has gained 24%, 59%, 43% and 83% of Vietnam, Brazil, Indonesia and Kenya market share respectively during the same period. Hence, India had net gain of 19% from Vietnam, 30% from Brazil, 41% of Indonesia and 83% from Kenya over the years 1996-2005.

Table- 4.1.1. Results of Markov chain analysis for cashew kernels exports

Countries	India	Vietnam	Brazil	Indonesia	Sri Lanka	Mozambique	Nigeria	Kenya
India	0.64	0.05	0.29	0.02	0.00	0.00	0.00	0.00
Vietnam	0.24	0.71	0.05	0.01	0.00	0.00	0.00	0.00
Brazil	0.59	0.34	0.06	0.00	0.00	0.00	0.00	0.00
Indonesia	0.43	0.00	0.47	0.00	0.00	0.07	0.00	0.03
Sri Lanka	0.00	0.00	0.15	0.00	0.00	0.85	0.00	0.00
Mozambique	0.00	0.00	0.42	0.01	0.02	0.17	0.38	0.00
Nigeria	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Kenya	0.83	0.00	0.00	0.00	0.06	0.11	0.00	0.00

The kernels export probability retention was reported to be high for Vietnam with 0.71. Thus it has retained 71% of its market share and lost remaining 24% to India and 5% to Brazil during the period 1996-2005. In the mean time, the country has gained 34% of Brazilian and 5% of Indians' share. Though Vietnam has gained 5% of India's share, its net trade effect was loss of 19% to India and net gain of 29% from Brazil.

Brazil was not a stable supplier of kernels to the world market, since it has lost 59% of its share to India and 34% to Vietnam though it has gained 47% of Indonesian share and 42% of Mozambican share, 29% of Indian share and 5% of Vietnam share. Overall, Brazil has net loss of 30% to India and 29% to Vietnam over the periods of 1996-2005.

Indonesia and Sri Lanka were considered as unstable supplier of cashew kernels. They gained very little from other countries, but lost more to other origins. Indonesia has lost 43% of its share to India, 47% to Brazil and only 7% to Mozambique. Meanwhile, Sri Lanka has lost more than 3/4th of its share to Mozambique and the remaining share to Brazil.

Some African countries had their presence in global cashew kernels export in the past, have lost their position with the emergence of new and stable suppliers. One of the major African cashews processing country, Mozambique has retained 17% of its share in global kernels exports by gaining 85% of Sri Lankan and 11% of Kenyan share. The Nigeria has lost its entire share to Mozambique, and Kenya has lost about 83% of its share to India and 11% to Mozambique, though it has gained only 3% of Indonesian share.

Overall, the major processing countries such as India, Vietnam and Brazil have strengthened their level of competition. With this, they are posing competition not only to the other countries like Indonesia, Mozambique and Kenya but also among themselves.

Indian export scenario

The cashew kernels export from India has witnessed an annual growth of 5% from the year 1996-97 to 2007-08. Though the kernels exports have been increasing steadily over the period, it has peaked in 2004-05 when the exports have reached 126,669 tons. The major importers of Indian cashew kernels are USA, The Netherlands, United Arab Emirates and 'other countries' (Saudi Arabia, Singapore, Spain, Israel. Italy, Germany, Australia, Norway, Hong Kong, Lebanon, Russia, Greece, New Zealand, Kuwait, Bahrain, Korea, Malaysia, etc.,).

The kernels exports to important cashew consuming countries have been given in the Table-4.1.2. It can be observed that the exports to USA have grown at a rate of 4.78% for the above said period. Kernel exports to The

Netherlands, UK, Japan hawe shown a negative growth rate of 0.49%, 0.56% and 0.78% respectively. The kernels exports to other countries have increased significantly during the period. Exports to UAE, France, Canada and Saudi Arabia have recorded growth of 16.96%, 5.4%, 6.97% and 15.27% respectively.

Table-4.1.2. CAGR of kernels exports from India from 1996-07 to 2007-08

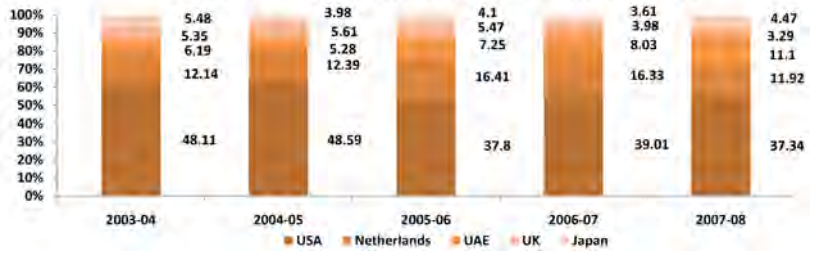
Countries	CAGR from 1996-97 to 2007-08	CAGR from 2003-04 to 2007-08	2007-08 exports in tons
USA	4.78	-5.27	42690
The Netherlands	-0.49	4.34	13627
UK	-0.56	-10.71	3758
Japan	-0.78	-3.14	5114
UAE	16.96	19.40	12690
France	5.41	11.27	4033
Canada	6.97	-14.82	659
Saudi Arabia	15.27	12.48	3422

Source: Various customs sources, India

If we look into the five-year's CAGR from 2003-04 to 2007-08, it has witnessed that the export growth was negative in the case of USA, UK, Japan and Canada. Meanwhile, it has increased in case of UAE with an annual growth of 19.4%, Saudi Arabia with 12.5%, France with 11.3% and The Netherlands with 4.34%.

The top five destinations for Indian kernels from 2003-04 to 2007-08 with their respective share in India's total kernels exports are given in the below Figure-4.1.2. Among the major destinations, USA takes a major share in India's exports followed by United Arab Emirates and United Kingdom. Though USA has major share in India's kernel exports, its share has been declining from 48% in 2003-04 to 37% in 2007-08. On the other hand, the Netherlands share has been increasing from 2003-04 to 2006-07 except for 2007-08. United Arab Emirates, Japan, France and Saudi Arabia have also witnessed higher share over the years.

Figure-4.1.2. Top Five destination for Indian cashew kernels



Direction of India's cashew kernels exports

It is evident from the Table-4.1.3 that USA, the Netherlands and United Arab Emirates were stable markets for Indian kernels, whereas United Kingdom, Japan, France and Canada were unstable markets. The higher probability retention of USA has shownd that USA has retained 76% of its share and lost 6% of its share to UK, 3% to Canada, 1% each to UAE and France. Meanwhile, the whole share of UK has been taken away by USA and it also grappled 93% of Japan share and 7% of other minor destinations share. Hence, the net gain for USA from UK was 94%.

Table-4.1.3. Quantity of Cashew kernel exports from India (in tons)

	U.S.A	Netherlands	U.K	Japan	U.A.E	France	Canada	Others
U.S.A	0.76	0.00	0.06	0.00	0.01	0.01	0.03	0.12
Netherlands	0.02	0.58	0.17	0.22	0.00	0.01	0.00	0.00
U.K	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Japan	0.93	0.00	0.07	0.00	0.00	0.00	0.00	0.00
U.A.E	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.72
France	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Canada	0.00	0.00	0.00	0.00	0.98	0.00	0.02	0.00
Others	0.07	0.15	0.00	0.06	0.10	0.10	0.00	0.52

The Netherlands had probability retention of 0.58 i.e., it has kept 58% of its market share and lost 22% its share to Japan, 17% to UK and only 2% to USA. At the same time, the country has gained 100% of France share and 7% of 'other countries' share. United Arab Emirates probability retention was 0.28 i.e., it has retained 28% of its market share and lost remaining share to 'other countries', but gained 98% of Canada's share. The unstable markets such as UK and France have lost 100% of their share to USA and the Netherlands respectively. The other unstable market Japan has lost 93% of its share to USA and 7% to UK though it has gained 22% of Netherlands's share.

Vietnam Export Scenario

At present, Vietnam is one of the major processors and exporters of cashew nut. The country has witnessed a growth of 31% annually in its exports from 1999 to 2006.

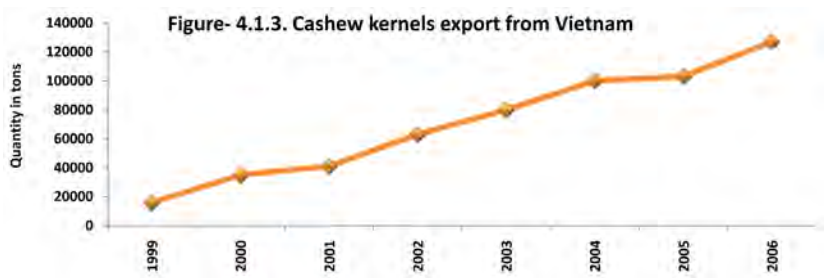
Table-4.1.4. Quantity of cashew kernels exports from Vietnam

Year	Quantity of kernels export
1999	15800
2000	35000
2001	41000
2002	63000
2003	80000
2004	100000
2005	103000
2006	127000

Source: VINACAS & Various news sources

Vietnam Cashew kernel export

Vietnam had exported mostly unprocessed cashew nuts and it was the situation throughout the 1990s. However, industry-wide efforts in upgrading processing facilities paid off when the nation surpassed Brazil to become the world's No.2 cashew nut processor and exporter in 2002. According to the Vietnam Association of Cashew Processors, Vietnam now imports raw cashews for export processing. Vietnamese cashew has been sold to 40 countries. Nearly 40% of the produce has been sent to the US, 20% to China, 20% to the Europe and the remaining to Russia, Japan and the Middle East countries.

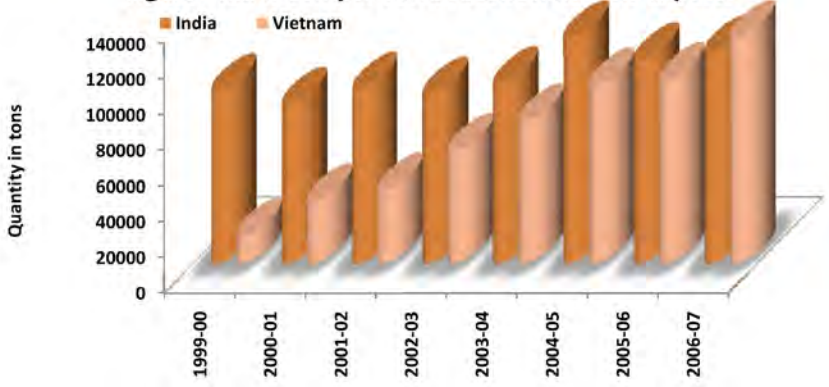


It is seen from the Figure- 4.1.3 that the cashew kernels exports from Vietnam has been in up trend and recorded a growth of nearly 28% from 1999 to 2007. The export volume during 1999 was only 15,800 tons but it has been increasing significantly and has reached 140,000 tons in 2006. With this, Vietnam has become the leading exporter of cashew kernels in

the world. It is a commendable break through in the cashew sector. The main reason behind this achievement is the higher productivity of cashew in Vietnam against the leading producer, India.

Comparison of cashew kernels exports from major processing countries

Figure- 4.1.4. Comparison of cashew kernels exports



It is evident from the Figure- 4.1.4 that the Vietnamese kernels exports have been increasing over the year from 1999-2000 to till date with a tremendous annual growth of 28%. During this period, Indian exports have been increasing at the rate of 3.6% annually. Meanwhile, Vietnam has over taken India's position of the leading exporter of cashew kernels in 2006-07. However, their production and processing capacity is still lower than the World cashew leader, India.

Brazilian cashew exports

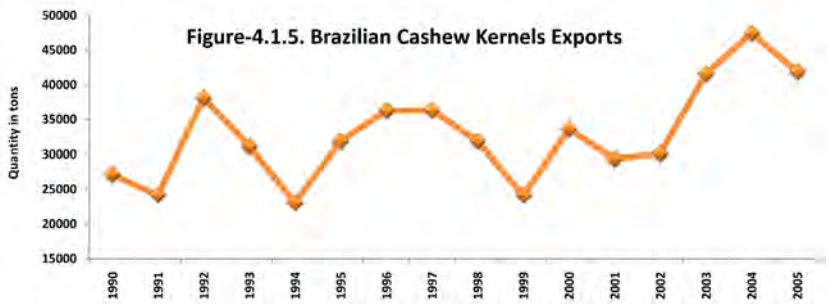
Table- 4.1.5 Country wise export of Brazilian cashew during 2003

Countries	Exports in tons	% to total
USA	29484	70.93
Canada	3132	7.53
Italy	1630	3.92
Lebanon	1207	2.90
Netherlands	832	2.00
Germany	725	1.74
France	573	1.38
Others	3984	9.58
Total	41567	100.00

The cashew kernels export from Brazil in 2003 has been given in Table-4.1.5. This has indicated the higher exports to USA i.e., about 71% of their exports share to USA only and 7.5% of their exports to Canada. Canada has imported nearly 4% of the Brazilian total exports.

The cashew nut production has shown an annual growth rate of 2.4% in Brazil from 1990 to 2005. Meanwhile, the cashew kernels exports from Brazil have shown an increase of 2.5% annually as shown in Figure-4.1.5.

In Brazil, maximum of 25% raw cashew nut equivalent of total production was retained for domestic consumption. The remaining has been exported along with the imported raw nuts from other African countries.



Source: FAO Stat

Indian Vision 2020

- CEPCI visualizes export of 275,000 tons of cashew kernels by 2020 against the current 115,000 tons. This requires Indian raw nut production to be increased to 1.9 million tons, while maintaining imports at 0.50 million tons.
- The Vision 2020 goal is to produce 1.95 million tons of cashews. Of this, the East will have to produce half of the Vision 2020 goal, which will be close to 950,000 tons. At least 200,000 tons will have to come from Tamil Nadu, 400,000 tons from Andhra Pradesh and 350,000 tons from Orissa, West Bengal, and Northeast.
- CEPCI has talso visualizes that this level of production leads to employment generation of 850 million man-days for 1.25 million workers and sustainable horticulture opportunities for one million farmers.
- The number of countries to which cashews are exported shall be increased from 60 to 125.
- CEPCI will target a compounded annual growth rate in exports to

20% `focus' countries in the new markets being explored.

- ❖ It will strive to ensure that at least 20% of the exports will be value-added and marketed under the `Made In India' brand.
- ❖ CEPCI will also strive to enhance productivity and competitiveness in cultivation and post-harvest technology of raw cashew nuts by motivating all departments under the Ministry of Agriculture at central and state levels.
- ❖ Efforts will be made to raise awareness about the nutrition value of cashew to target groups and other benefits to a larger audience. Studies will be launched to substantiate, validate and confirm the benefits to the consumer.
- ❖ Multilateral initiatives will be launched to foster co-operative and collective efforts in the promotion of cashew consumption for all-round development of the cashew economy.

Vietnam vision

- Vietnam's Ministry of Agriculture and Rural Development (MARD) has announced a strategy to develop the country's cashew sector by 2010 and 2020

- This strategy is focusing on development of high-quality cashew growing areas, setting up large processing establishments and product diversification.

- The country has planned to increase its cashew output to 666,000 tons in 2020, from expected 500,000 tons in 2010.

- It has planned to increase the acreage under cashew to 450,000 ha during 2010 and improving the productivity to 3-4 tons per hectare.

- Vietnam has also targeted cashew export revenues of 820-850 million U.S. dollars in 2020, up from estimated 560 million dollars in 2007.

Annexure- 4.1.1. Cashew kernels exports from major supplying countries (in '000 tons)

Year	India	Vietnam	Brazil	Indonesia	Sri Lanka	Mozambique	Nigeria	Kenya
1980	26.26		14.5		0.4	15.6		3.06
1981	33.69		15.53		1.11	12.2		2.62
1982	31.78		17.25		0.62	16.7		2.04
1983	36.51		19.32		0.9	5.8		1.68
1984	30.64		14.77		0.15	4.1		2.34
1985	40.58		24.98		0.29	3.1		1.86
1986	39.48	6.27	21.55		0.5	3.1		1.91
1987	35.95	9.51	15.22		1.03	6		1.51
1988	33.97	6.67	23.43		1.12	6.8		2.9
1989	45.55	5.85	27.45		1.34	6		1.02
1990	49.81	0.79	27.11		1.29	4	0.11	0.39
1991	47.91	0.56	24.12		1.7	3.32	0.18	1.25
1992	58.4	0.37	38.1		1.07	4.19	0.3	0.34
1993	69.83	32.04	31.17		0.82	21.34	10.8	0.04
1994	76.9	0.41	23.08		0.16	1.26	0.06	1
1995	70.07	0.87	31.88		0.33	1.88	0.11	0.28
1996	64.28	6.08	36.23	0.68	0.25	30.15	12.35	0.1
1997	66.17	22.75	36.35	0.94	0.6	18.76	12.66	0.25
1998	71.04	21.05	31.89	1.68	0.44	28.34	7.27	0.04
1999	92.24	9.32	24.1	2.88	0.16	2.53	1.46	0.07
2000	81.67	21.07	33.59	2.02	0.1	3.06	0.17	0.09
2001	90.4	37.78	29.36	1.54	0.19	0.57	0.12	0.05
2002	122.08	54.17	30.12	1.33	0.07	0.63	0.11	0.02
2003	98.55	67.85	41.57	3.34	0.06	0.22	0.12	0.06
2004	109.87	81.19	47.44	2.88	0.12	0.52	0.2	2.83
2005	124.97	81.33	41.86	3.45	0.3	0.92	0.16	0.53

Source: FAO Stat

Annexure- 4.1.2. Quantity of Cashew kernels exports from India to various countries (in tons)

Country	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
U.S.A	24877	29678	34793	47190	40392	48161	50146	48504	61546	43149	46246	42690
Nethe rlands	16708	17827	14222	18668	16069	13915	12053	12237	15693	18736	19360	13627
U.K	4180	5078	5375	7016	6416	6849	4840	5392	7108	6238	4715	3758
Japan	5142	5261	4925	5003	5370	4166	3828	5522	5047	4685	4279	5114
U.A.E	2156	2437	2901	3200	3688	3273	5054	6239	6690	8274	9523	12690
France	2891	1865	2313	1866	2343	2810	2135	2444	3329	3470	3558	4033
Canada	427	630	447	1547	1463	2370	1343	1354	1540	1558	1308	659
Saudi Arabia	705	1013	1110	1093	1630	1609	2094	2011	2998	2827	3357	3422
Singapore	1580	1102	1037	1088	1297	1590	480	513	510	694	318	395
Spain	411	783	571	776	1058	1219	1515	2198	2870	2648	2457	2831
Israel	1115	1170	1116	1088	1205	1167	908	508	964	752	995	695
Italy	374	883	904	986	1106	1143	909	986	1119	1236	1208	636
Germany	1506	1339	1110	560	922	1138	1485	1574	1966	1991	1770	1705
Australia	990	1939	1920	1696	762	968	1279	275	873	1114	1344	2848
Norway	0	34	38	16	175	586	413	890	1318	873	1105	1064
Hong Kong	1075	700	957	652	627	575	376	477	719	788	659	628
Lebanon	276	133	16	270	245	575	307	561	655	470	483	342
Russia	664	1190	368	363	352	547	532	1413	2331	1990	1163	873
Greece	457	874	427	434	585	522	788	830	1511	1859	1870	1867
New Zealand	303	349	382	531	229	411	268	332	201	204	212	420
Kuwait	285	258	229	351	230	376	367	847	574	863	964	812
Bahrain	166	285	244	286	454	287	354	439	362	393	477	470
Korea Rep.	305	115	108	176	80	176	132	311	213	255	397	742
Malaysia	368	229	218	66	111	132	36	40	62	191	161	299
Others	1702	1421	1345	1883	2346	2385	3269	4931	6470	8883	10611	11720
Total	68663	76593	77076	96805	89155	97550	94911	100828	126669	114141	118540	114340

Source: Director General of Foreign Trade & various customs sources, India

Annexure- 4.1.3. Value of Cashew kernels exports from India to various countries (in Million Rs.)

Country	1996-97	1997-98	1998-99	1999 -00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
U.S.A	4556	5360	7220	12328	9236	8840	9402	8816	12885	9583	9695	8383.54
Nethe rlands	3215	3328	3034	5026	3801	2540	2260	2150	3457	4088	3851	2562.72
U.K	797	957	1172	1958	1487	1250	907	956	1583	1409	955	783.93
Japan	991	970	1087	1375	1220	781	718	1020	1112	1102	913	1065.2
U.A.E	405	453	645	844	837	618	948	1024	1482	1844	2076	2756.83
France	552	298	455	474	553	589	400	436	665	758	732	755.2
Canada	75	114	101	410	325	352	252	227	314	331	260	126.78
Saudi Arabia	127	182	248	291	377	285	393	330	616	596	665	700.2
Singapore	292	182	219	277	242	241	90	92	116	136	69	85.48
Spain	77	150	129	213	248	245	284	411	648	611	524	587.3
Israel	226	241	264	313	292	244	170	97	233	174	227	155.49
Italy	72	173	188	266	262	219	170	177	237	252	262	128.67
Germany	289	231	223	151	200	178	278	261	424	422	328	323.55
Australia	179	351	401	459	173	147	240	44	184	253	259	525.65
Norway	0	6	7	4	42	96	77	159	292	199	227	208.53
Hong Kong	210	140	229	185	156	115	70	103	177	173	167	155.26
Lebanon	45	28	3	79	46	89	58	113	150	96	104	80.76
Russia	88	162	48	74	58	58	100	221	434	388	192	143.36
Greece	90	165	92	120	139	96	148	156	337	426	408	402
New Zealand	59	64	82	144	55	69	50	56	45	46	42	78.35
Kuwait	56	51	53	98	57	78	69	153	128	198	212	185.47
Bahrain	29	48	50	74	95	44	66	68	71	78	94	96.28
Korea Rep.	44	21	22	22	21	29	25	58	52	59	85	158.77
Malaysia	66	37	48	17	20	19	7	7	14	41	31	61.61
Others	313	249	284	493	556	546	613	910	1439	1887	2174	2378.04
Total	12853	13961	16301	25695	20496	17767	17795	18045	27093	25149	24552	22888.97

Source: Director General of Foreign Trade & various customs sources, India

CHAPTER 4.2.

Global Cashew Kernel Imports by Major Consuming Countries

The global cashew kernels import in the year 2005 was reported to be 286,440 tons. The Compound Annual Growth Rate (CAGR) of kernels import by countries around the world was 11.6% during the period 1999-2005. The major cashew kernels importers were USA, The Netherlands, United Kingdom, Australia, Germany and Canada. The other major countries, which import kernels, were United Arab Emirates, Russia, Japan, France and China.

USA is the major importer of cashew kernels and it can be inferred from the Figure- 4.2.1 that about 40% (i.e., 114,200 tons) of global cashew imports in 2005 was contributed by US alone. The Netherlands has contributed nearly 13% (36,180 tons) to the total imports. Meanwhile, Australia and Germany have equally contributed about 4.4% to the total imports.

Table- 4.2.1. CAGR of cashew kernels import by major countries

Countries	CAGR from 1999-2005 (%)
Australia	17.57
Canada	22.32
France	0.25
Germany	14.33
Japan	3.21
Netherlands	9.33
UK	16.85
USA	9.51
UAE	18.27
China	8.55
Russia	46.17
Others	13.78

The CAGR of cashew kernels import by major countries (as it is given in Table- 4.2.1) has witnessed that the growth was prominent in Russia from 1999 to 2005 with CAGR of 46% followed by Canada with 22%. United Arab Emirates, Australia, United Kingdom and Germany have shown a growth of 18.27%, 17.6%, 16.9% and 14% respectively.

Global major suppliers of cashew kernels

In 2005, India and Vietnam had majority of the share to the tune of nearly 78% in exports (Indian export was 114,141 tons and Vietnam was 108,800 tons). Between these two countries, India's share was 40% and Vietnam has contributed 38%.

India's kernel supply to world major importers

Table- 4.2.2 has shown that India has been loosing the share in total global imports from 2002-03 onwards except in 2004-05. The share in USA imports has been declining from 2002-03 to 2005-06. The imports from India by The Netherlands, United Kingdom, France and Russia have declined much in 2005-06 against its 2004-05 levels.

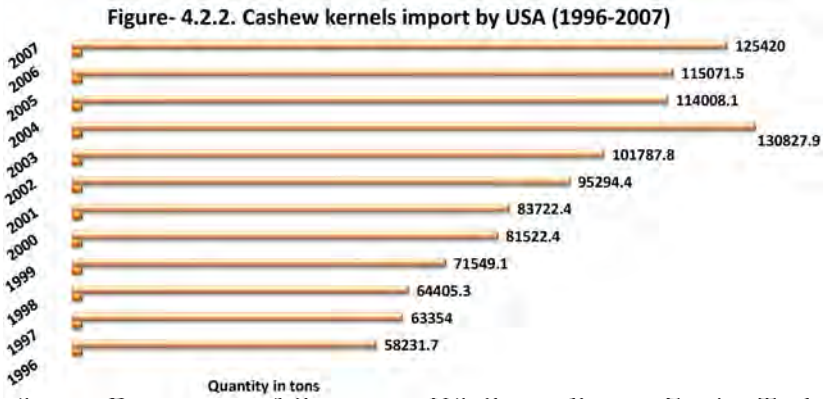
Table- 4.2.2. The share of India in major importer's of cashew kernel

Countries	2002-03			2003-04			2004-05			2005-06		
	From India	Total imports	% to total	From India	Total imports	% to total	From India	Total imports	% to total	From India	Total imports	% to total
U.S.A	50146	95420	53	48504	101770	48	61546	130870	47	43149	114200	38
Netherlands	12053	20600	59	12237	25410	48	15693	24100	65	18736	36180	52
U.K	4840	10360	47	5392	10890	50	7108	14990	47	6238	21350	29
France	2135	5000	43	2444	3650	67	3329	4410	75	3470	5350	65
Canada	1343	8100	17	1354	10020	14	1540	12030	13	1558	11000	14
Australia	1279	8690	15	275	11000	3	873	11910	7	1114	12610	9
Russia	532	1700	31	1413	4180	34	2331	5410	43	1990	6360	31
Total	94911	209430	45	100828	233140	43	126669	269550	47	114141	286440	40

The Indian share in markets of The Netherlands, United Kingdom, France and Russia may be taken away by Vietnam and Brazil.

Role of USA in global kernels import

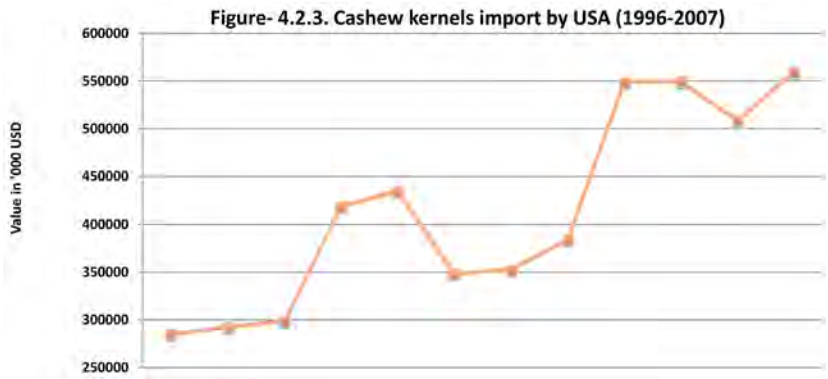
The global cashew kernel import market is highly dominated by USA. Hence, it is worthwhile to look into the USA imports over the years. The quantity of kernels imported by USA is given in the Figure- 4.2.2. It is clear from the figure that the imports of kernels have been increasing and shown a growth of 7.85% during 1996 to 2007.



Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics

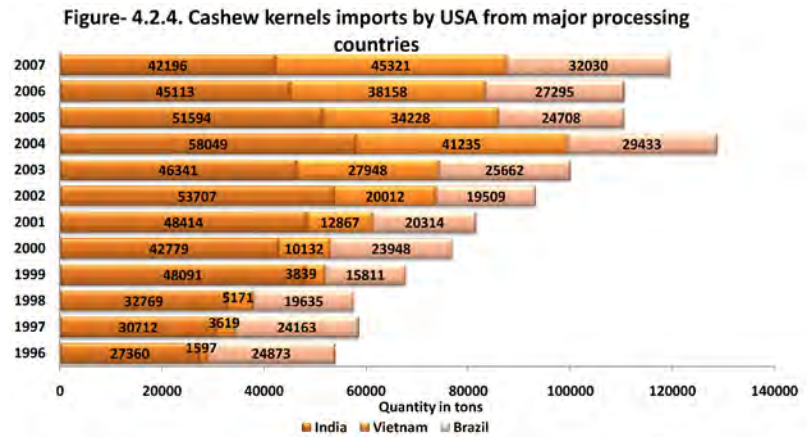
Value of cashew kernels import by USA

The cashew kernels import of USA in value terms has also shown an increasing trend over the years with an annual growth of 6.37%.



Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics

USA kernels imports from major processing countries



Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics

The kernel imports by USA have witnessed a clear upward trend from 1996 to 2007, which is evident from the Figure- 4.2.4. USA imports from India have been increasing from 1996-2007 with an annual growth of 4.53% in quantity terms and 3.19% by value terms. Kernels imports from Brazil also increasing with an annual growth of 3.11% by volume and 1.95% by value terms.

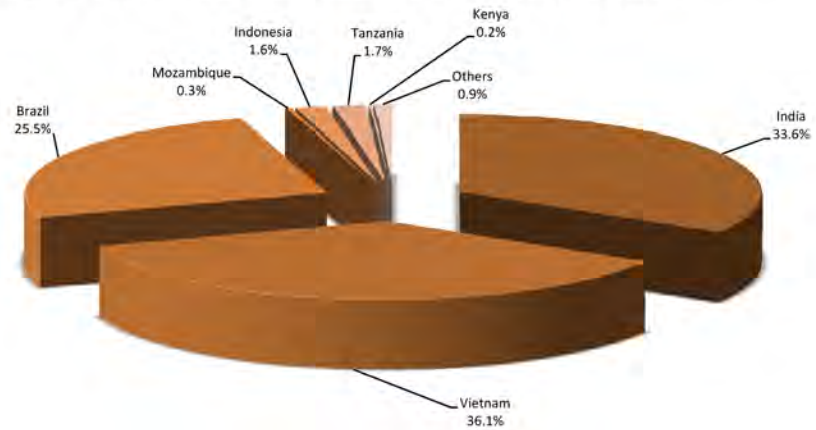
Meanwhile, USA imports from Vietnam have shown an inverted pyramid structure in growth with a remarkable growth of 35.36% in volume terms and 33.23% in value terms as witnessed from Table- 4.2.3.

Table- 4.2.3. CAGR of cashew kernels import by USA from major countries (1996-2007)

Countries	CAGR of quantity imports	CAGR of value imports
India	4.53	3.19
Vietnam	35.36	33.23
Brazil	3.11	1.95
Mozambique	-30.32	-30.54
Indonesia	7.7	7.08
Kenya	10.17	10.12
Others	1.71	0.52

Share of cashew processing countries in USA imports (Quantity)

Figure- 4.2.5. Quantity of cashew kernels import by USA in 2007

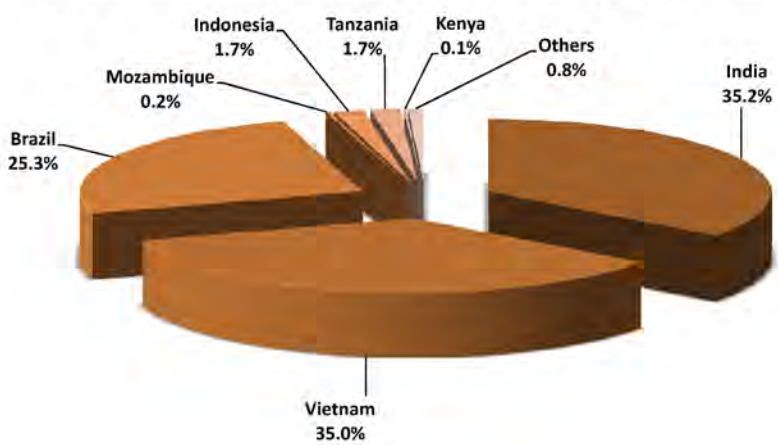


The kernels import figures for 2007 clearly indicates that the import from Vietnam was highest followed by India and Brazil.

In terms of quantity of cashew kernel imported by USA in 2007, Vietnam taken the prime position with a share of 36%, followed by India with 33.6% and Brazil with 25.5%. Tanzania (1.7%), Indonesia (1.6%), Mozambique (0.3%) and Kenya (0.2%).

Share of important cashew processing countries in USA imports (Value)

Figure- 4.2.6. Value of cashew kernels import by USA in 2007



Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics

The kernels import by value terms was highest from India with a share of 35.2% followed by Vietnam with 35% and Brazil with 25.3% share.

Table- 4.2.4. Share of major cashew kernel suppliers to USA (In%)

Year	India	Vietnam	Brazil	Total
1996	46.98	2.74	42.71	92.44
1997	48.48	5.71	38.14	92.33
1998	50.88	8.03	30.49	89.39
1999	67.21	5.37	22.10	94.68
2000	52.48	12.43	29.38	94.28
2001	57.83	15.37	24.26	97.46
2002	56.36	21.00	20.47	97.83
2003	45.53	27.46	25.21	98.20
2004	44.37	31.52	22.50	98.39
2005	45.25	30.02	21.67	96.95
2006	39.20	33.16	23.72	96.08
2007	33.64	36.14	25.54	95.32

From the above Table-4.2.4, the following inference can be drawn.

- Top three suppliers of cashew kernel have been able to maintain their share above 94% most of the times.
- However, the share among the top three suppliers has seen dramatic change with the emergence of Vietnam as a large supplier.

Table- 4.2.5. Share of African and other suppliers to US (In%)

Mozambique	Tanzania	Kenya	African total	Others	Total
5.21	0.00	0.70	5.91	1.65	7.56
4.89	0.00	0.45	5.35	2.33	7.67
5.65	0.00	0.03	5.68	4.92	10.61
2.57	0.00	0.07	2.65	2.68	5.32
3.45	0.00	0.04	3.49	2.23	5.72
0.44	0.22	0.09	0.75	1.79	2.54
0.39	0.27	0.15	0.81	1.36	2.17
0.03	0.47	0.14	0.64	1.16	1.80
0.06	0.25	0.23	0.54	1.07	1.61
0.08	0.72	0.28	1.09	1.96	3.05
0.16	1.55	0.35	2.06	1.85	3.92
0.28	1.70	0.15	2.13	2.56	4.68

The share of African countries supplies in USA kernels import has been fluctuating over the years (as given in Table-4.2.5). The reasons could be financial constraint, technology constraint, and availability of skilled manpower, poor marketing infrastructure support.

The other countries, which were exporting cashew kernels to USA were Indonesia, Sri Lanka, China, Kenya, Ivory Coast, South Africa, Thailand and Singapore.

Drivers of cashew kernel exports by major processing countries

It is well known that endogenous factors such as raw cashew availability and skilled manpower are the major drivers that drive competitiveness of suppliers. However, in the recent times, exogenous factors such as exchange rate (value of domestic currency against US Dollar), crude oil price are influencing competitiveness of suppliers. Exchange rates and its impact on trade are elaborated below.

1. It is very apparent from the Table-4.2.6 that the Vietnam currency (Dong) has depreciated steadily against the US Dollar over the years from 1996 to 2007. However, the value of Indian Rupee and Brazilian Real has been fluctuating over the years.
2. For Vietnam and India, quantity exported to USA is highly positively correlated with the currency value to an extent of over 80%. However, the influence of currency value on exports from Brazil is found to be relatively insignificant. Probably, factors such as proximity, favourable trade treaties and so on could drive trade between US and Brazil.
3. Since 2002, the value of Indian Rupee has appreciated gradually, while the value of Dong has mildly depreciated. All other conditions remaining same, this could have positively influenced exports from Vietnam to USA as evidenced by the data.

Table- 4.2.6. Cashew kernel supply by India, Vietnam and Brazil with exchange rate

Year	India			Vietnam			Brazil		
	Quantity	Value	Exchange rate	Quantity	Value	Exchange rate	Quantity	Value	Exchange rate
1996	27359.6	140148	35.44	1596.6	7585	11036	24873.3	118512	1.005
1997	30712.1	150227	36.34	3618.6	15386	11705	24162.9	108327	1.078
1998	32768.5	158159	41.29	5170.9	22481	13267	19635.2	90255	1.16
1999	48090.8	284030	43.06	3838.8	22718	13945	15811.0	93867	1.816
2000	42779.3	239058	44.95	10132.0	50403	14177	23947.8	123193	1.83
2001	48414.1	213539	47.27	12867.4	47545	15031	20314.0	79030	2.379
2002	53707.0	206875	48.68	20011.5	69086	15934	19509.4	70058	2.967
2003	46340.7	182467	46.66	27948.1	97143	16068	25662.4	97703	3.117
2004	58049.2	249704	45.34	41235.3	167267	16175	29432.5	123410	2.926
2005	51593.7	261029	44.11	34228.3	152207	15968	24707.8	119079	2.435
2006	45112.8	214787	45.32	38157.5	151124	16436	27295.1	121963	2.18
2007	42196.4	197133	41.36	45321.0	196204	16421	32030.1	141605	1.952

Note: Exchange rate for India is in Rupees, for Vietnam it is Dong and for Brazil it is Real. All exchange rate quotation is per one US dollar.

The regression result of India's export quantity against the Indian exchange (Against US dollar) has indicated that one% increase in Rupee against USD will increase the kernels export by 1944 tons. Likewise for Vietnam, a% increase in Vietnam Dong against USD will increase the kernels export from Vietnam by 7.5 tons.

USA's direction of cashew kernels import

Table- 4.2.7. Change in direction of trade of cashew kernels import by USA

Countries	India	Vietnam	Brazil	Mozambique	Indonesia	Tanzania	Kenya
India	0.45022	0.11729	0.40921	0.00000	0.01261	0.00000	0.00007
Vietnam	0.00000	0.92084	0.05470	0.00000	0.00000	0.01524	0.00825
Brazil	0.92336	0.00000	0.07164	0.00000	0.00000	0.00000	0.00000
Mozambique	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Indonesia	0.29162	0.00000	0.00000	0.33846	0.27575	0.00000	0.00000
Tanzania	0.00000	0.29022	0.70978	0.00000	0.00000	0.00000	0.00000
Kenya	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000	0.00000
Others	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

The result of transitional probability matrix formed by Markov chain analysis to analyze the change in direction of cashew kernels imports by USA is given in the Table- 4.2.7. The higher probability retention of 0.92 for Vietnam has indicated that it was a stable and a dominant supplier of kernels to USA and able to retain 92% of its share. In the meantime, it has lost very meagre quantity to countries like Brazil, Tanzania and Kenya and gained 29% of Tanzania's share and nearly 12% of India's share.

The probability retention of India was 0.45, so it can be inferred that India can retained 45% of its share in kernels import by USA and lost 40% of its share to Brazil, 12% to Vietnam and minimum quantity to Indonesia and Kenya over the years from 1996-2007. At the same time, India has gained the entire share of Mozambique and "other countries" and 92% of Brazil share and 29% of Indonesian share. Though Brazil has gained 71% of Tanzania's share and 41% of India's share over the period of 1996-2007, it can retains only 7% of its own share in kernels supply to USA.

The African countries were supplying only little quantity to USA; hence whatever they gained from their neighbouring countries has not reflected much in USA imports. For example, though Tanzania has gained 100% of Kenya's share, it doesn't reflect much on USA kernels imports. In brief, it can be inferred that India and Vietnam were the stable suppliers for cashew kernels to USA. Brazil was a less stable supplier; whereas exports from countries like Mozambique, Tanzania and Kenya were unstable during 1996-2007.

Annexure- 4.2.1. Global cashew kernels import (in tons)

Countries	1999	2000	2001	2002	2003	2004	2005
Australia	5630	5260	6820	8690	11000	11910	12610
Canada	3740	4830	5610	8100	10020	12030	11000
France	4640	4470	5080	5000	3650	4410	5350
Germany	4970	6080	7610	7390	8800	9360	12390
Japan	4890	5660	5750	6670	5340	6860	5920
Netherlands	19320	20490	19000	20600	25410	24100	36180
UK	7910	8040	9500	10360	10890	14990	21350
USA	71570	81510	83710	95420	101770	130870	114200
UAE	3260	4010	3460	4790	5700	6260	9820
China	2550	2040	10760	12580	7410	3210	4590
Russia	820	970	1470	1700	4180	5410	6360
Others	27550	19650	21270	28130	38970	40140	46670
Total	156850	163010	180040	209430	233140	269550	286440

Source: FAO Stat

Annexure- 4.2.2. Quantity of cashew kernels imports by USA (in tons)

Year	India	Vietnam	Brazil	Mozambique	Indonesia	Tanzania	Kenya	Others	Total
1996	27359.6	1596.6	24873.3	3033.2	222.5	0	407	739.5	58231.7
1997	30712.1	3618.6	24162.9	3099.8	676.4	0	286.8	797.4	63354
1998	32768.5	5170.9	19635.2	3639.9	2332.3	0	20.2	838.3	64405.3
1999	48090.8	3838.8	15811	1841.8	1170.1	0	52.5	744.1	71549.1
2000	42779.3	10132	23947.8	2809.7	1062.2	0	32.4	759	81522.4
2001	48414.1	12867.4	20314	367.7	810	185	79.3	684.9	83722.4
2002	53707	20011.5	19509.4	373.1	492.8	254.9	140.6	805.1	95294.4
2003	46340.7	27948.1	25662.4	32.9	503.3	480.1	139	681.3	101787.8
2004	58049.2	41235.3	29432.5	81.4	649.9	328.7	294.7	756.2	130827.9
2005	51593.7	34228.3	24707.8	96.8	1487.9	826	318	749.6	114008.1
2006	45112.8	38157.5	27295.1	189.8	1274.6	1778.5	406.9	856.3	115071.5
2007	42196.4	45321	32030.1	346	2032.5	2130.2	191.4	1172.4	125420

Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics

Annexure- 4.2.3. Value of cashew kernels imports by USA (in '000 USD)

Year	India	Vietnam	Brazil	Mozambique	Indonesia	Tanzania	Kenya	Others	Total
1996	140148	7585	118512	12389	1132	0	1945	3252	284963
1997	150227	15386	108327	10899	3100	0	1289	3335	292563
1998	158159	22481	90255	13994	10235	0	77	3545	298746
1999	284030	22718	93867	8204	6285	0	179	3869	419152
2000	239058	50403	123193	12771	5494	0	164	3543	434626
2001	213539	47545	79030	1090	3168	673	319	2925	348289
2002	206875	69086	70058	834	1934	942	470	2592	352791
2003	182467	97143	97703	100	2020	1757	491	2356	384037
2004	249704	167267	123410	291	2835	1418	1339	2761	549025
2005	261029	152207	119079	379	7421	4044	1518	3499	549176
2006	214787	151124	121963	877	5950	8075	1724	3579	508079
2007	197133	196204	141605	1303	9528	9383	809	4662	560627

Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics

CHAPTER 4.3.

Nutritional Aspects of Cashew Nuts

The tree nuts such as cashew, almond, pistachio, walnut, hazelnut, Brazil nut and macadamia nut are rich in nutrition. Understanding the nutritional aspects and promoting their benefits to the consumers facilitates consumption growth of these nuts. Here an attempt has been made to focus the nutrients relished from cashew nut against the other major tree nuts.

Calorific requirement (in Kilo calories)

The calorific requirements of different work groups in different categories as given by the National Institute of Nutrition in India are given in the Table-4.3.1.

Table- 4.3.1. Calorific requirement of different categories of work groups (in kcal)

Activity level	Adult Man	Adult Woman
Sedentary	2425	1875
Moderate	2875	2225
Heavy	3800	2925

Source: National Institute of Nutrition

In general the calorific requirement varies with the age, gender, and physical activity. The calorific requirements of different age groups were discussed in the following Table-4.3.2.

Table- 4.3.2. Calorific requirement of different age groups

Group	Kilocalories
Pregnant women	300*
Lactating women (0-06 months)	550*
(6-12 months)	400*
Infants 0-6 months	118 /kg body weight
6-12 months	98 /kg body weight
Children 1-3 years	1240
Children 4-6 years	1690
Children 7-9 years	1950
Boys 10-12 years	2190
13-15 years	2450
16-18 years	2640
Girls 10-12 years	1970
13-15 years	2060
16-18 years	2060

Note: * indicates in addition to the normal requirements

Source: National Institute of Nutrition

Since energy and nutrients are derived from carbohydrates, proteins, fats, vitamins and minerals, the requirement for the same by each should be known well before to have balanced food.

Carbohydrates: 60 to 70% of the total calorie requirement should be obtained from carbohydrates; within this greater importance should be given to complex carbohydrates than simple carbohydrates. They break down quickly during digestion and provide an immediate source of energy to the bloodstream.

Proteins: 0.8 - 1 gm protein per kg of ideal body weight should be taken. For e.g. a person with 65 kg should intake 52 - 65 grams of protein. The proteins requirement should be made from various sources.

Fat: This should not exceed 20 to 30% of total calorie requirement. The fat requirement should be met largely from vegetable sources and less from animal sources (butter, ghee).

The supporting points for intake of cashew nut

According to a study conducted by Kerala State Cashew Development Corporation (KSCDC), the cashew kernels, being a plant food, are cholesterol-free. Cashew kernels contain fat but the general misunderstanding is that fat is cholesterol. Cashew fat in does not possess a nutritional risk and is safe, healthy and trouble free. KSCDC also came out with a result of a study saying that consuming 28 grams of cashew kernels five days a week resulted in a 27% lower risk of developing diabetes. This is attributed to the high content of chromium and certain antioxidants present in the nuts, which help in delaying degenerative diseases such as diabetes. The report also revealed that the cashew kernels are nature's vitamin pills for children. The kernels are a good source of at least six forms of vitamin. Nuts and seeds don't contain cholesterol and are a good source of dietary fibre. About 85% of the fat content is essential fatty acids, which are needed by every cell in our bodies. Nuts have a high calorie count. The nut eaters live longer and 30 grams per day is generally considered a healthy amount.

Glycemic Index

The glycemic index or GI is an index to know the relative glycemic response to dietary carbohydrates. Not all carbohydrate foods are created equal; in fact they behave quite differently in our bodies. It describes this difference by ranking carbohydrates according to their effect on our blood glucose

levels. By definition, the consumption of high-glycemic index foods results in higher and more rapid increases in blood glucose levels than the consumption of low-glycemic index foods. In contrast, the consumption of low-glycemic index foods results in lower but more sustained increases in blood glucose and lower insulin demands on pancreatic beta-cells. Dietary glycemic load is the sum of the glycemic loads for all foods consumed in the diet. The concept of glycemic load was developed by scientists to simultaneously describe the quality (glycemic index) and quantity of carbohydrate in a meal or diet.

The benefits of low glycemic index foods are,

- Helps people lose and control weight
- Increase the body's sensitivity to insulin
- Improve diabetes control
- Reduce the risk of heart disease
- Reduce blood cholesterol levels
- Reduce hunger and keep you fuller for longer
- Prolong physical endurance
- Help re-fuel carbohydrate stores after exercise

Some strategies for lowering dietary glycemic load include:

- Increasing the consumption ofhz whole grains, nuts, legumes, fruits and nonstarchy vegetables
- Decreasing the consumption of starchy high-glycemic index foods like potatoes, white rice and white bread
- Decreasing the consumption of sugary foods like cookies, cakes, candy and soft-drinks.

See the Table-4.3.3 for the glycemic index and glycemic load values of selected foods relative to glucose. Foods with higher glycemic index values are at the top of the table, while foods with lower glycemic index values are at the bottom of the table.

Table- 4.3.3. Glycemic index and glycemic load values of selected foods

Food	Glycemic Index	Serving size	Carbohydrate per serving (g)	Glycemic Load per serving
Dates, dried	103	2 oz	40	42
Cornflakes	81	1 cup	26	21
Jelly beans	78	1 oz	28	22
Puffed rice cakes	78	3 cakes	21	17
Doughnut	76	1 medium	23	17
Food	**Glycemic Index**	**Serving size**	**Carbohydrate per serving (g)**	**Glycemic Load per serving**
Soda crackers	74	4 crackers	17	12
White bread	73	1 large slice	14	10
Table sugar (sucrose)	68	2 tsp	10	7
Pancake	67	6" diameter	58	39
White rice (boiled)	64	1 cup	36	23
Brown rice (boiled)	55	1 cup	33	18
Oranges, raw	42	1 medium	11	5
Pears, raw	38	1 medium	11	4
Apples, raw	38	1 medium	15	6
All-Bran cereal	38	1 cup	23	9
Skim milk	32	8 fl oz	13	4
Lentils, dried; boiled	29	1 cup	18	5
Kidney beans, dried; boiled	28	1 cup	25	7
Pearled barley; boiled	25	1 cup	42	11
Cashew nuts	22	1 oz	9	2
Peanuts	14	1 oz	6	1

Note: 1 oz= 1 ounce = 31.1 grams
1 tsp= 1 teaspoon
Source: Linus Pauling Institute, Oregon State University

It is clearly evident from the table that cashew nuts are having less glycemic index value of 22 compared with the food items prepared by cereals and pulses. Therefore, cashew nuts are good for health and also a rich calorific food. Those countries with higher production of nuts (take the advantage of cashew nuts availability with lower cost) can meet out their nutrient requirement by consuming proportionate quantity of cashew nuts along with other cereals and pulses.

Table- 4.3.4. Comparison of nutrients in different food items (per 100 gms)

Nutrients	Cashew	Rice	Ragi	Wheat	Sorghum	Maize	Green gram	Chick pea	Peanut	Red gram
Proteins (gm)	18.22	6.79	7.3	13.68	11.3	9.42	23.86	19.3	25.8	21.7
Fat (gm)	43.85	0.56	1.3	2.47	3.3	4.74	1.15	6.04	49.24	1.49
Carbohydrate (gm)	30.19	81.72	72	71.13	74.63	74.26	62.62	60.66	16.14	62.78
Fibre Content (gm)	3.3	1.7	3.6	2.7	6.3	7.3	16.3	17.4	8.5	15
Calorie value (kcal)	553	371	328	339	339	365	347	364	567	343
Sodium (mg)	12	0	11	2	6	35	15	24	18	17
Potassium (mg)	660	120	408	431	350	287	1246	875	705	1392
Calcium (mg)	37	60	344	34	28	7	132	105	92	130
Phosphorus (mg)	593	136	283	508	287	210	367	366	376	367
Nutrients	**Cashew**	**Rice**	**Ragi**	**Wheat**	**Sorghum**	**Maize**	**Green gram**	**Chick pea**	**Peanut**	**Red gram**
Magnesium (mg)	292	31		144		127	189	115	168	183
Iron (mg)	6.68	1.5	3.9	3.9	4.4	2.71	6.74	6.24	4.58	5.23
Zinc (mg)	5.78	0.96		4.16		2.21	2.68	3.43	3.27	2.76
Thiamine (mg)	0.423	0.1	0.42	0.42	0.237	0.385	0.621	0.477	0.64	0.643
Riboflavin (mg)	0.058	0.07	0.19	0.121	0.142	0.201	0.233	0.212	0.135	0.187
Niacin (mg)	1.062	3.632	1.1	6.738	2.927	3.627	2.251	1.541	12.066	2.965
Vitamin B6 (mg)	0.417	0.445		0.044		0.622	0.382	0.535	0.348	0.283

Source: USDA National Nutrient Database for Standard Reference, Release 20 (2007)

It can be seen from the Table-4.3.4 that cashew nut has high calorific value of 553 kilocalories when compared to other cereals and pulses taken here for comparison. Though it contains lower carbohydrates, the protein and fat content are very significant in cashew nut. Apart from proteins and fat, the nuts are also a good source of minerals like potassium, phosphorus, magnesium, sodium, calcium and iron.

Studies by KSCDC have showed that the fatty acid content in cashew is not harmful; besides it is cholesterol free safe, healthy and trouble free. Nearly 80% of the fat content in cashew nut is essential fatty acids ie., rich in mono-unsaturated fat which may help to protect the heart.

In terms of protein content, the cashew nuts contain significant amount of proteins next to major pulses. They are also having considerable amount of minerals like potassium, phosphorus and sodium when compared to other food grains. Apart from these minerals, the cashew nuts are also a source of considerable amount of minerals like calcium and iron.

The cashew nuts are also a good source of vitamins such as thiamin, riboflavin and niacin. According to the study conducted by KSCDC, cashew nuts are a good source of dietary fibres. Almost all-important nutritional contents are there in cashew nuts. Hence, there will be a scope for increasing the consumption habit of cashew nut.

Table- 4.3.5. Current prices of important food items

Food Items	Recent prices (in US$/kg)	Source from
Cashew	4.09	June issue, Cashew bulletin, India for LWP grade
Rice	0.80	Reuters
Ragi	0.36	Reuters
Wheat	0.45	Reuters
Maize	0.30	Reuters
Green gram	0.60	APEDA, India
Chick pea	0.75	APEDA, India
Peanut	0.50	Freshplaza.com
Red gram	0.72	News sources

The current prices of important food items have given in the Table-4.3.5. Though the price of cashew is higher, the mineral contents are more compared with other food items.

Nutrient realization per Rupee of each food items has been given in Table-4.3.6. It can be seen from the table that the price of cashew kernels are higher by four times when compared to other staple food items. Even though the price was very high in case of cashew kernels, the nutrient contents are in significant level. Among the staple food items, ragi and maize are cheaper in prices and hence the nutrient realization i.e., calorie level, protein, fat, some minerals like potassium and phosphorus are high in case of cereals.

Table- 4.3.6. Nutrient realization per dollar value of major food items

Food crops	Calorie (Kcal)	Protein (gm)	Fat (gm)	Potassium (mg)	Phosphorus (mg)	Sodium (mg)
Cashew	1351.42	44.53	107.16	1612.90	1449.17	29.33
Rice	4637.50	84.88	7.00	1500.00	1700.00	0.00
Ragi	9111.11	202.78	36.11	11333.33	7861.11	305.56
Wheat	7533.33	304.00	54.89	9577.78	11288.89	44.44
Maize	12166.67	314.00	158.00	9566.67	7000.00	1166.67
Green gram	5783.33	397.67	19.17	20766.67	6116.67	250.00
Chick pea	4853.33	257.33	80.53	11666.67	4880.00	320.00
Peanut	11340.00	516.00	984.80	14100.00	7520.00	360.00
Red gram	4763.89	301.39	20.69	19333.33	5097.22	236.11

When considering the nutrient content of cashew nut, the mineral and protein content are in significant level in cashew kernels. The sodium realization per Rupee of cashew is higher than other staple foods. Likewise potassium, sodium and fat content are high in cashew kernels against the major staple food rice. Since the fat in cashew kernel is essential fatty acids, it will be a best substitute in a place where other staple foods availability is scarce.

Since potassium is needed to regulate blood pH, keep the water balance; ensure the acidification of the urine and helps for nerve conduction and muscle contractions. It is worth note that the cashew kernels are good source of potassium. Sodium is also an important nutrient for nerve conduction. The National Academy of Sciences also considers 1,500 mg / day of sodium an adequate intake. So, almost all nutrients are present in cashew kernels. The important fact to notice here is we have to take only adequate quantity of cashew kernels as substitute to combat the excess intake of nutrients by means of other food items and avoid the adverse effect of that excess intake.

Nutritional comparison between important tree nuts

The major nuts consumed by people across the world are cashew nuts, almond, pistachio, walnuts, hazel nuts, Brazil nuts and Macadamia nuts.

Table- 4.3.7. Nutrient comparison between major nuts (per 100 gms)

Nuts	Protein (g)	Calories (kcal)	Total Fat (g)	Vit E (mg)	Iron (mg)	Fiber (g)	Calcium (mg)	Mg. (mg)	K (mg)
Almonds	21.22	575	49.42	26.22	3.72	12.2	264	268	705
Brazil nuts	14.3	656	66.43	5.73	2.43	7.5	160	376	659
Cashews	18.22	553	43.85	1.458	6.68	3.3	37	292	660
Hazelnuts	14.95	628	60.75	15.03	4.7	9.7	114	163	680
Macadamias	7.91	718	75.77	0.54	3.69	8.6	85	130	368
Pistachios	20.61	557	44.44	2.3	4.15	10.3	107	121	1025
Walnuts	14.3	642	53.9	2.5	2.4	4.8	94	-	-

Source: USDA National Nutrient Database for Standard Reference, Release 20 (2007)

Table-4.3.7 indicates that in terms of calorific value of important tree nuts, macadamia nuts having higher calorific value followed by brazil nuts, walnuts, hazel nuts, almonds, pistachio and cashew nuts. Meanwhile, iron content is very high in cashew nuts when compared with other nuts.

Table- 4.3.8. Current prices for important tree nuts

Nuts	Recent prices (in US$ / kg)	Variety specification
Almonds	5.19	US Non-pareil
Brazil nuts	5.50	Medium nuts
Cashews	4.09	LWP (Rotterdom)
Hazelnuts	13.53	Turkish standard 2
Macadamias	7.70	Australian variety
Pistachios	13.20	Iranian pistachio
Walnuts	14.00	Light amber brokens

Note: Prices for cashew, Almond, Brazil nut, Hazelnut and Walnut from June issue of cashew bulletin and pistachio and macadamia prices from news sources.

Even though the other nuts possess high nutrient content when compared to cashew nuts, the prices of those nuts are costly when compared to cashew nuts as stated in the Table-4.3.8. Hence, the nutrient realization per dollar is higher in case of cashew nuts compared with other nuts. It is evident from the Table-4.3.9.

Table- 4.3.9. Nutrient realization per dollar value of major tree nuts

Nuts	Protein (g)	Calories (kcal)	Total Fat (g)	Vit E (mg)	Iron (mg)	Fiber (g)	Calcium (mg)	Mg. (mg)	K (mg)
Almonds	40.87	1107.47	95.18	50.50	7.16	23.50	508.47	516.18	1357.86
Brazil nuts	26.00	1192.73	120.78	10.42	4.42	13.64	290.91	683.64	1198.18
Cashews	44.53	1351.42	107.16	3.56	16.32	8.06	90.42	713.59	1612.90
Hazelnuts	11.05	464.17	44.90	11.11	3.47	7.17	84.26	120.48	502.60
Macadamias	10.27	932.47	98.40	0.70	4.79	11.17	110.39	168.83	477.92
Pistachios	15.61	421.97	33.67	1.74	3.14	7.80	81.06	91.67	776.52
Walnuts	10.21	458.60	38.50	1.79	1.71	3.43	67.15	-	-

Note: Mg. – Magnesium and K – Potassium

The energy realization per dollar is higher in cashew at 1352 kilocalories against other tree nuts. Likewise per dollar realization of protein, minerals like iron, magnesium and potassium are highest in cashew when compared to other tree nuts.

The higher global production of cashew nut has indirectly indicated that most of the global consumers are fond of these nuts because of their taste. From this nutrient analysis also it is evident that cashew nuts are found to be better option to meet out the nutrient requirements compared with other nuts, if we take prices of nuts into consideration.

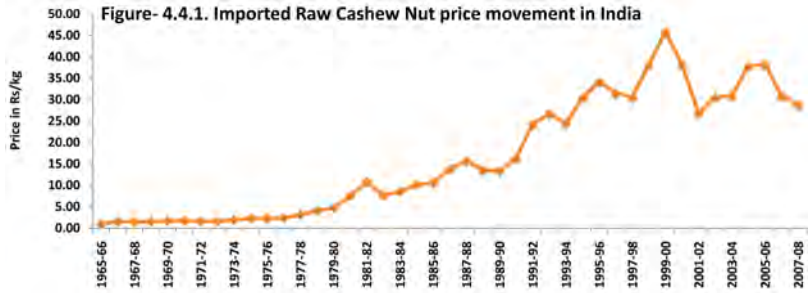
CHAPTER 4.4.

RCN and Kernels Price Movement in India

Raw cashew nut price movement in India

The imported raw nut price movement in India over the years from 1965-66 to 2007-08 is given in the Figure- 4.4.1. It could be inferred from the figure that the raw nut prices have attained its peak in 1999-2000 i.e., the price of RCN during that period was Rs.45/kg. Due to crop shortage in major cashew producing countries like Vietnam, Indonesia and Brazil, RCN prices in 2008-09 are likely to reach higher than this level.

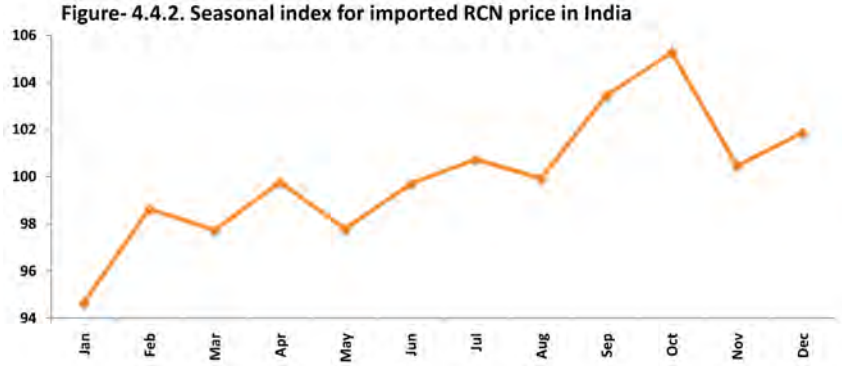
Figure- 4.4.1. Imported Raw Cashew Nut price movement in India



Source: DGCI & S, Custom House

Seasonality of imported RCN prices in India

Figure- 4.4.2. Seasonal index for imported RCN price in India

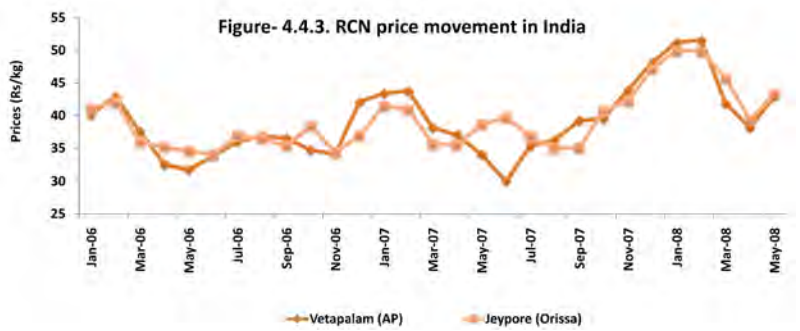


The seasonal index of imported raw nut prices in India has shown (Figure- 4.2.2) that the prices peak during September and October. Meanwhile, the prices are heading to trough in January month. When we look into the arrivals pattern from different producing countries, it is obvious that the raw nuts availability

will be more during November to May from countries like Brazil, Tanzania, Indonesia, Benin, Mozambique, Kenya, Nigeria and Ivory Coast. In September and October, arrivals will be limited, which will besmall and from Guinea Bissau, Indonesia and Tanzania.

Domestic RCN price movement

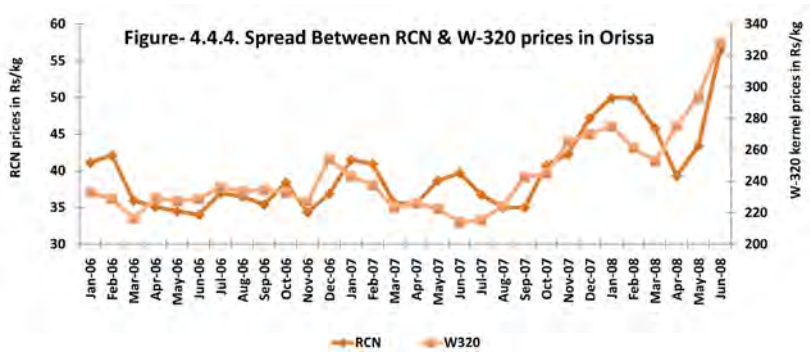
The raw cashew nut prices shown in the Figure- 4.4.3 have increased much in the current year starting from October 2007 to till date due to lower supply from both domestic and international crop. Usually prices slide during the peak arrivals season from April to May, but this year the unavailability of RCN caused prices to move up. Average price of RCN during 2006 in India was Rs.36.70/kg, while it has increased to Rs.39/kg in 2007. Average prices of RCN from January to May 2008 were higher at of Rs.45.70/kg. Lower crop arrivals from important countries such as Ivory Coast, Guinea Bissau and Indonesia has kept RCN prices at peak levels in the current year.



Source: Domestic Trade sources, India

In India, the raw cashew nut prices well be lower during the second quarter of every year due to the higher supply from domestic as well as international producing centres. However, the prices will peak at first as well as in the fourth quarter of every year due to limited supply.

Spread between RCN and W-320 prices in Orissa, India



Source: Domestic trade sources, India

It could be inferred from the Figure- 4.4.4 that the prices of raw cashew nut and W-320 were moving together, i.e., whenever the W-320 cashew kernels prices up the RCN prices move also moving up. Hence, we can get an indication from kernel prices, which decides the RCN prices. The present kernels price also indicates tight supply situation in the market and kept raw nut prices at higher levels.

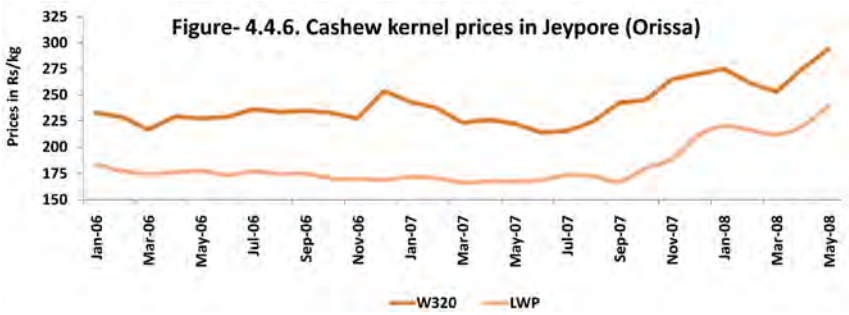
Comparison of W-320 prices in domestic and export market

Source: Domestic Trade sources, India

In cashew grade, W-320 (Whole white) is considered as a reference grade because of its higher consumption and preference around the world. Here an attempt has been made to compare the prices in domestic as well as in export market for Indian origin cashews.

It is clear from the Figure- 4.4.5 that the domestic price of W-320 was higher when compared to its export price. On an average the domestic W-320 prices have premium of Rs.30/kg over export market. The reason behind this price trend is the domestic buyers are not preferred to have whole grade kernels instead they used to consume pieces, butts and other lower grade kernels only. Moreover, W-320 has more enquiries from international buyers particularly from EU and US. Hence, the domestic availability restricted to some extent and mostly consumed by high-income group consumers thus the tight supplies could be seen in the local market. This keep the prices at higher levels. But in the recent days higer inquiries are thus narrowing down the price difference in the domestic and international markets.

Cashew kernel price movement in Jeypore (Orissa)

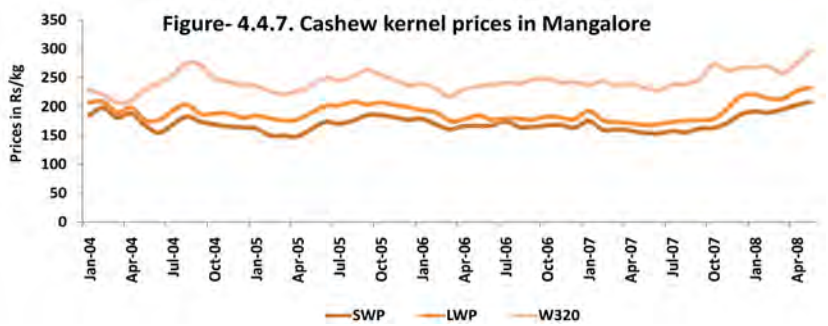


The kernel prices of grades like W-320 and LWP in Jeypore (Orissa, India) have shown a similar price trend from the year 2006 to till date (Figure-4.4.6). The prices of these grades have been in increasing trend from October 2007 to till date.

A positive correlation of 86% has been seen between the prices of W-320 and LWP in Jeypore market of Orissa from the year 2006 to till date. The average price premium of W-320 over LWP grade in Jeypore market of Orissa from 2006 to till date was Rs.59/kg.

Cashew kernel price movement in Mangalore, Karnataka

The cashew kernel price movement in Mangalore (Karnataka, India) has given in the Figure- 4.4.7. The positive correlation between prices of LWP and SWP grade kernels has indicated that they are highly influenced by each other movements.



Likewise, the correlation between SWP and W-320 has shown that they have 48% of correlation in Mangalore market over the years 2004 to till date. Meanwhile, the strength of association between the prices of LWP and W-320 is 57% as evident from Table- 4.4.1.

The average price difference between the higher grade W-320 and SWP in Mangalore was Rs.72/kg over the period of 2004 to till date. Likewise the average price difference between W-320 and LWP was Rs.53/kg for the same period. The difference in prices between LWP and SWP over the same period has been Rs.18/kg.

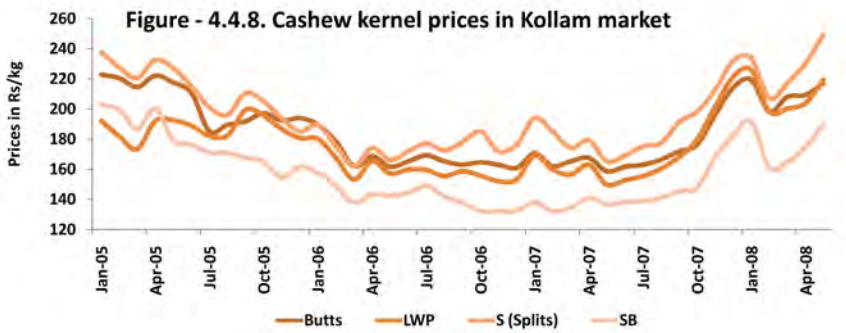
Table- 4.4.1. Correlation matrix between grades in Mangalore

Grades	SWP	LWP	W-320
SWP	1.00	0.91	0.48
LWP	0.91	1.00	0.57
W-320	0.48	0.57	1.00

Cashew kernel price movement in Kollam market, Kerala

In Kollam market (of Kerala), prices have been moving in the similar pattern. The prices of a kernel grade will influence the prices of other grades in the same direction as shown in the Figure- 4.4.8.

The average price difference between split grade and butts in Kollam market was Rs.10.90/kg for the period of 2005 to till date and the difference between Splits and LWP is Rs.19/kg. Meanwhile, the difference between Split and scorched butts prices were higher at Rs.38.50/kg for the same period of time.



It can be seen from the Table- 4.4.2 that the prices of butts and scorched butts are highly correlated with 96% of correlation. Likewise, the prices of butts and splits grads also shown a higher correlation of 94%. The prices of splits and scorched butts have witnessed 91% of correlation and so on.

Table- 4.4.2. Correlation matrix between grades in Kollam

Grades	Butts	LWP	S (Splits)	SB
Butts	1.00	0.87	0.94	0.96
LWP	0.87	1.00	0.89	0.81
S (Splits)	0.94	0.89	1.00	0.91
SB	0.96	0.81	0.91	1.00

The cashew kernel prices will be higher during the fourth quarter of every year as it coincides with festive season in India. Prices start moving up from the third quarter onwards.

Annexure- 4.4.1. Per kg imported RCN prices in India (1965-66 to 2007-08)

Year	RCN prices in Rs/ kg	Year	RCN prices in Rs/ kg
1965-66	0.94	1987-88	15.72
1966-67	1.56	1988-89	13.47
1967-68	1.48	1989-90	13.36
1968-69	1.56	1990-91	16.29
1969-70	1.69	1991-92	24.24
1970-71	1.74	1992-93	26.70
1971-72	1.63	1993-94	24.41
1972-73	1.57	1994-95	30.45
1973-74	1.91	1995-96	34.20
1974-75	2.29	1996-97	31.59
1975-76	2.30	1997-98	30.60
1976-77	2.40	1998-99	38.22
1977-78	3.08	1999-00	45.80
1978-79	4.10	2000-01	38.23
1979-80	4.71	2001-02	26.80
1980-81	7.41	2002-03	30.58
1981-82	10.78	2003-04	30.93
1982-83	7.54	2004-05	37.85
1983-84	8.52	2005-06	38.26
1984-85	10.15	2006-07	30.91
1985-86	10.57	2007-08	28.83
1986-87	13.74		

Source: DGCI & S, Custom House

Annexure- 4.4.2. Domestic RCN prices in India from 1996- till date (in Rs/kg)

Month (Year)	Vetapalam (AP)	Jeypore (Orissa)	Month (Year)	Vetapalam (AP)	Jeypore (Orissa)
Jan-06	40.16	41.13	Apr-07	37.00	35.50
Feb-06	42.91	42.09	May-07	33.99	38.64
Mar-06	37.50	35.94	Jun-07	30.00	39.69
Apr-06	32.50	35.10	Jul-07	35.31	36.75
May-06	31.73	34.50	Aug-07	36.25	35.00
Jun-06	33.75	34.00	Sep-07	39.23	35.00
Jul-06	36.00	36.98	Oct-07	39.54	40.73
Aug-06	36.88	36.50	Nov-07	43.94	42.25
Sep-06	36.50	35.38	Dec-07	48.13	47.20
Oct-06	34.69	38.38	Jan-08	51.25	50.00
Nov-06	34.06	34.34	Feb-08	51.56	49.88
Dec-06	42.09	36.88	Mar-08	41.88	45.75
Jan-07	43.44	41.50	Apr-08	38.13	39.34
Feb-07	43.75	40.94	May-08	43.00	43.40
Mar-07	38.13	35.63			

Source: Domestic Trade Sources, India

Annexure- 4.4.3. Cashew kernel prices in Jeypore (Orissa) from 2006 to till date (in Rs/kg)

Month (Year)	W320	LWP	Month (Year)	W320	LWP
Jan-06	232.75	183.75	Apr-07	226.00	167.50
Feb-06	228.75	177.50	May-07	222.50	167.50
Mar-06	216.50	175.00	Jun-07	214.00	168.75
Apr-06	229.25	176.25	Jul-07	215.33	173.33
May-06	227.50	177.50	Aug-07	224.50	172.50
Jun-06	228.75	173.75	Sep-07	242.50	167.50
Jul-06	236.20	177.00	Oct-07	245.00	180.00
Aug-06	233.50	175.00	Nov-07	265.00	188.75
Sep-06	234.67	175.00	Dec-07	270.00	211.00
Oct-06	232.75	170.00	Jan-08	275.00	220.00
Nov-06	227.33	170.00	Feb-08	261.25	216.25
Dec-06	254.00	169.00	Mar-08	253.00	212.00
Jan-07	243.33	171.67	Apr-08	275.33	220.00
Feb-07	237.75	170.50	May-08	294.20	240.00
Mar-07	223.33	166.67			

Source: Domestic Trade Sources, India

Annexure- 4.4.4. Cashew kernel prices in Kollam market of Kerala from 2005 to till date

(in Rs/kg)

Month (Year)	Butts	LWP	S (Splits)	SB
Jan-05	222.88	192.24	237.65	203.04
Feb-05	220.46	181.88	227.62	199.51
Mar-05	214.58	173.43	220.46	186.65
Apr-05	222.22	192.24	232.80	200.18
May-05	217.52	192.53	227.07	179.31
Jun-05	210.54	189.04	214.95	176.37
Jul-05	185.19	182.10	201.06	171.08
Aug-05	189.59	182.43	196.21	170.86
Sep-05	191.80	199.51	210.54	167.55
Oct-05	197.31	195.66	205.03	165.34
Nov-05	192.53	186.65	194.00	154.32
Dec-05	194.00	180.78	185.19	161.67
Jan-06	189.59	180.22	189.59	157.63
Feb-06	178.57	167.55	175.26	148.81
Mar-06	162.04	153.22	162.04	137.79
Apr-06	168.65	165.34	174.16	143.30
May-06	161.67	157.26	166.08	142.56
Jun-06	165.34	159.83	171.96	144.40
Jul-06	169.31	159.61	177.25	149.03
Aug-06	165.34	155.42	172.51	142.20
Sep-06	163.14	158.73	178.02	137.79
Oct-06	164.61	155.79	185.19	132.28
Nov-06	163.14	152.12	171.96	132.28
Dec-06	160.93	153.22	176.37	132.28
Jan-07	170.49	169.02	194.00	138.15
Feb-07	162.04	159.83	185.19	132.28
Mar-07	165.34	156.53	174.16	134.48
Apr-07	167.55	163.14	179.31	141.09
May-07	158.73	149.91	165.34	136.68
Jun-07	161.67	152.85	169.02	138.15
Jul-07	163.14	155.42	175.26	138.89
Aug-07	166.45	160.38	177.47	141.09
Sep-07	171.96	168.10	191.19	145.50
Oct-07	176.37	179.67	198.41	147.71
Nov-07	196.21	201.72	212.74	168.65
Dec-07	214.29	221.34	231.92	182.54
Jan-08	219.36	225.97	233.69	191.80
Feb-08	198.41	198.41	207.23	160.93
Mar-08	208.11	200.18	216.93	164.90
Apr-08	209.44	203.92	230.38	175.26
May-08	216.93	219.58	249.56	189.59

Source: Domestic Trade Sources, India

Annexure- 4.4.5. Cashew kernel prices in Mangalore, Karnataka from '04 to till date (in Rs/kg)

Month (Year)	SWP	LWP	W320
Jan-04	185.19	207.23	229.28
Feb-04	198.41	208.33	220.46
Mar-04	180.78	189.59	207.23
Apr-04	188.22	198.41	209.77
May-04	167.55	176.92	229.28
Jun-04	155.06	176.59	240.30
Jul-04	168.87	192.68	254.41
Aug-04	182.98	203.92	275.02
Sep-04	174.16	186.84	272.82
Oct-04	168.96	188.01	249.21
Nov-04	166.01	188.27	243.61
Dec-04	163.80	180.78	236.99
Jan-05	162.29	184.34	235.94
Feb-05	150.02	179.67	227.18
Mar-05	149.69	176.04	221.78
Apr-05	148.50	177.30	227.44
May-05	161.38	189.42	236.86
Jun-05	173.43	201.35	251.32
Jul-05	170.63	201.71	244.71
Aug-05	175.82	208.33	252.98
Sep-05	185.17	203.70	263.00
Oct-05	185.19	207.34	255.73
Nov-05	181.88	202.82	245.81
Dec-05	177.25	198.85	237.21
Jan-06	179.01	193.56	239.42
Feb-06	168.65	189.59	230.38
Mar-06	160.93	175.26	217.15
Apr-06	166.45	177.47	230.38
May-06	166.45	184.63	234.79
Jun-06	167.55	177.47	238.1
Jul-06	174.51	179.67	241.4
Aug-06	164.79	179.12	240.30
Sep-06	164.90	177.25	246.91
Oct-06	167.55	182.98	249.12
Nov-06	168.10	180.78	241.40
Dec-06	163.58	178.13	242.50
Jan-07	175.63	192.90	237.73
Feb-07	159.83	176.37	244.16
Mar-07	160.38	173.06	235.89
Apr-07	158.73	170.86	240.3
May-07	154.32	168.10	232.58
Jun-07	153.22	169.75	228.17
Jul-07	157.63	173.06	238.10
Aug-07	155.42	175.82	238.65
Sep-07	162.04	176.37	248.02
Oct-07	163.14	178.57	273.37
Nov-07	171.96	196.76	262.35
Dec-07	187.13	218.69	268.08
Jan-08	191.36	220.46	268.22
Feb-08	189.59	213.84	268.96
Mar-08	195.77	213.40	257.50
Apr-08	202.82	227.07	275.57
May-08	208.11	232.80	297.18

Source: Domestic Trade Sources, India

CHAPTER 4.5.

Analysis on Indian W-320 FOB Prices

W-320 cashew grade is the reference grade in the international market, as it is produced in larger quantity. W-320 refers to white wholes and the colour of the kernels is white or pale ivory or light ash with characteristic shape. In general the kernels count per pound (lb) of W-320 is 300-320.

Seasonal index for W-320 FOB prices

Note: FOB prices for W-320 in USD/lb, which was exported through Cochin / Tuticorin. Source: Samsons Trading Co, Mumbai

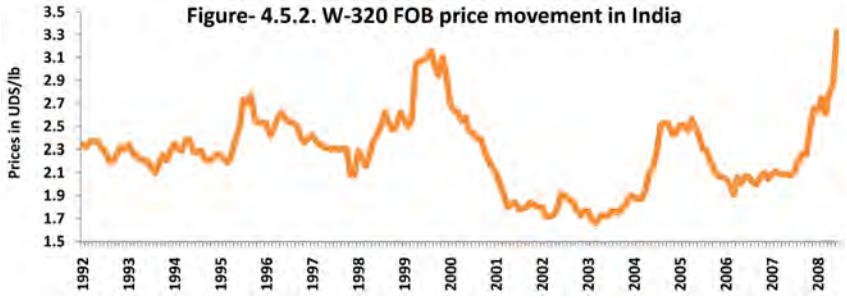
The seasonality for W-320 FOB prices from India has shown in Figure-4.5.1. It could be inferred from the figure that the prices remain higher during June to August and bottom out during February and March of every year.

Cyclical trend in W-320 prices

If we closely look into the W-320 price movement given in Figure- 4.5.2, it shows that the current prices are peaking at USD 3.33/lb, as like 1999 levels peak of USD 3.16/lb. Likewise, the price in 1995 was USD2.74/lb, the nearer value of this level has been reached in 2004 at USD2.55/lb. Moreover, the prices in 1996 peak of USD 2.62/lb has been revisited again in 2005 at USD 2.54/lb. Hence, we could get a clue that the W-320 prices have shown a cyclical trend once in ten years.

The W-320 prices hit the highest level during August 1999 at USD3.16/lb. The prices have increased sharply from 2.56/lb in March 1999 to USD3.04/lb in April and attained a peak of USD3.16/lb in August 1999. These higher price ranges stayed for nearly six months from April to September 1999.

Figure- 4.5.2. W-320 FOB price movement in India



The factors triggered higher price levels in 1999:

1. The area under cashew cultivation in the year 1999 was 0.71 million hectares with 0.52 million tons of production. Both area and production were higher in 1999 against its previous year levels.
2. Despite the increased area and production, good domestic and export demand from India has kept the prices at peak in 1999.
3. The domestic consumption and exports of cashew kernel were at higher levels in 1999 at 0.59 million tons and 92,461 tons respectively.

Overall, the price has been remained largely in between USD1.85 and 2.52/lb since 1992 to 2007.

W-320 cashew prices forecast

Figure- 4.5.3. Forecasted W-320 prices till December '08

The current price movement has shown in the Figure- 4.5.3 has indicated that W-320 cashew prices have started replicating its 1999 level. Hence, the prices are expected to move up further and likely to stay above USD3.00/lb for at least 6 months period starting from April this year. The current price is USD3.33/lb (June, 2008) and the forecasted (based on ARIMA analysis) price levels were given in the Figure- 4.5.3. The figures have clearly given an indication that the prices will move up till the end of this year.

When we look into the fundamentals of 2008, the area under cashew cultivation has increased by 4.2% to 850,000 hectares in 2007-08 against the last year. The production of cashew has also registered an increase of 8% to 620,000 tons compared the production a year ago. I.e., the area in the year 2007-08 has increased by 150,000 hectares compared to cultivated cashew area in the year 1999. This increase in area has led to rise in production by 100,000 tons in 2007-08 from 1999 production.

On the processing front, the import of raw cashew nut during this year was reported to be 605,000 tons and the kernel exports stood at 114,000 tons. The domestic consumption has also expected to be higher this year as in 1999 on account of increase in health awareness and disposable income.

The factors, which found to influence the current hike in cashew kernel prices at international markets are,

- Shortage in Indonesian and Brazilian crops
- Lower output from Vietnam
- Increased cashew consumption around the world especially in USA. The cashew kernels import by USA has witnessed an annual growth of 7.9% from 1996 to 2007
- Crop damage in the major cashew producing regions of India like Kerala and Mangalore due to incessant rains
- Higher domestic consumption in India and
- The prices of RCN from African origin (Ivory Coast and Guinea Bissau) have increased much this year.

Annexure - 4.5.1 FOB prices of cashew nut in USD/lb (Cochin/Tuticorin)

Year	Price
Jan-92	2.34
Feb-92	2.32
Mar-92	2.37
Apr-92	2.37
May-92	2.37
Jun-92	2.31
Jul-92	2.28
Aug-92	2.20
Sep-92	2.20
Oct-92	2.26
Nov-92	2.32
Dec-92	2.30
Jan-93	2.34
Feb-93	2.28
Mar-93	2.24
Apr-93	2.23
May-93	2.20
Jun-93	2.20
Jul-93	2.15
Aug-93	2.10
Sep-93	2.18
Oct-93	2.25
Nov-93	2.21
Dec-93	2.29
Jan-94	2.35
Feb-94	2.30
Mar-94	2.29
Apr-94	2.38
May-94	2.38
Jun-94	2.28
Jul-94	2.28
Aug-94	2.29
Sep-94	2.22
Oct-94	2.20
Nov-94	2.23
Dec-94	2.25
Jan-95	2.25
Feb-95	2.22
Mar-95	2.19
Apr-95	2.26
May-95	2.39
Jun-95	2.48
Jul-95	2.73
Aug-95	2.70
Sep-95	2.77
Oct-95	2.56
Nov-95	2.53
Dec-95	2.53
Jan-96	2.53
Feb-96	2.42

Year	Price
Mar-96	2.48
Apr-96	2.58
May-96	2.62
Jun-96	2.56
Jul-96	2.54
Aug-96	2.53
Sep-96	2.50
Oct-96	2.41
Nov-96	2.36
Dec-96	2.40
Jan-97	2.42
Feb-97	2.37
Mar-97	2.34
Apr-97	2.32
May-97	2.31
Jun-97	2.30
Jul-97	2.31
Aug-97	2.30
Sep-97	2.30
Oct-97	2.31
Nov-97	2.08
Dec-97	2.08
Jan-98	2.28
Feb-98	2.23
Mar-98	2.16
Apr-98	2.25
May-98	2.38
Jun-98	2.43
Jul-98	2.52
Aug-98	2.62
Sep-98	2.53
Oct-98	2.47
Nov-98	2.51
Dec-98	2.62
Jan-99	2.56
Feb-99	2.50
Mar-99	2.56
Apr-99	3.04
May-99	3.07
Jun-99	3.08
Jul-99	3.10
Aug-99	3.16
Sep-99	3.03
Oct-99	2.95
Nov-99	3.10
Dec-99	2.95
Jan-00	2.70
Feb-00	2.64
Mar-00	2.62
Apr-00	2.55

Year	Price
May-00	2.58
Jun-00	2.46
Jul-00	2.44
Aug-00	2.40
Sep-00	2.39
Oct-00	2.29
Nov-00	2.21
Dec-00	2.15
Jan-01	2.10
Feb-01	2.00
Mar-01	1.91
Apr-01	1.80
May-01	1.83
Jun-01	1.84
Jul-01	1.78
Aug-01	1.79
Sep-01	1.80
Oct-01	1.84
Nov-01	1.82
Dec-01	1.80
Jan-02	1.80
Feb-02	1.72
Mar-02	1.72
Apr-02	1.73
May-02	1.79
Jun-02	1.92
Jul-02	1.89
Aug-02	1.87
Sep-02	1.85
Oct-02	1.78
Nov-02	1.73
Dec-02	1.76
Jan-03	1.76
Feb-03	1.69
Mar-03	1.66
Apr-03	1.71
May-03	1.73
Jun-03	1.72
Jul-03	1.76
Aug-03	1.76
Sep-03	1.75
Oct-03	1.79
Nov-03	1.83
Dec-03	1.90
Jan-04	1.89
Feb-04	1.87
Mar-04	1.87
Apr-04	1.95
May-04	2.11
Jun-04	2.15

Year	Price
Jul-04	2.29
Aug-04	2.51
Sep-04	2.53
Oct-04	2.52
Nov-04	2.43
Dec-04	2.44
Jan-05	2.51
Feb-05	2.51
Mar-05	2.46
Apr-05	2.56
May-05	2.50
Jun-05	2.42
Jul-05	2.30
Aug-05	2.29
Sep-05	2.20
Oct-05	2.12
Nov-05	2.07
Dec-05	2.06
Jan-06	2.05
Feb-06	2.00
Mar-06	1.91
Apr-06	2.06
May-06	2.01
Jun-06	2.07
Jul-06	2.06
Aug-06	2.02
Sep-06	2.00
Oct-06	2.06
Nov-06	2.10
Dec-06	2.05
Jan-07	2.09
Feb-07	2.11
Mar-07	2.09
Apr-07	2.09
May-07	2.08
Jun-07	2.08
Jul-07	2.12
Aug-07	2.21
Sep-07	2.26
Oct-07	2.26
Nov-07	2.49
Dec-07	2.66
Jan-08	2.64
Feb-08	2.75
Mar-08	2.61
Apr-08	2.79
May-08	2.87
Jun-08	3.33

Source: Samson's trading Co., Mumbai

Experts Views

Organic Cashew Cultivation - Methods and Economics

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1.Introduction

Cashew nut (*Anacardium occidentale* L.) belongs to family *Anacardiaceae*. From its original home in North-East Brazil, it has spread through out the tropics. Its cultivation is distributed from 27° North to 27° South latitude. Cashew kernels are used in confectionery and dessert. The shells contain oil known as Cashew Nut Shell Liquid (CNSL) used in industry. Cashew nut is widely consumed in rich countries and gives valuable foreign exchange to the producer countries. Today consumers are ready to pay premium price to organically grown products. Further, organic cultivation is economically and ecologically sustainable. So, organic farming is healthy both for the producer and the consumer.

2.Climate

Cashew can be grown from sea level to an elevation up to 700 m. It has been cultivated at places receiving 600 to 4500 mm rainfall and temperature ranging from 20-36°C (av. minimum of coldest month and av. maximum of hottest month).

3.High yielding varieties of India

Various research centres in India have released about 40 high yielding cashew varieties. These varieties are reported to yield 8-20 kg nut per plant per year. They could be classified as early, mid and late season flowering varieties.

3.1. Varieties recommended for organic farming

Only mid and late season varieties are better suited for organic farming. The reason being that in early season varieties the crops flush early and this early flowering attracts maximum infestation of Tea Mosquito Bug (TMB). It is during this period (Nov-Jan) that the weather is cool and the dew fall during early morning followed by cloudy environment results in mass multiplication of TMB, which causes maximum spoilage of flowers. Mid and late season (Feb-Apr) varieties escape this menace. Due to increased

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temperature during flowering and fruiting in mid and late varieties, TMB population comes down thereby the crop damage by the pest is minimum or nil. However, under extreme changed weather conditions favorable to sudden outbreak of TMB, its control even with chemical means is difficult. Some of the most promising mid and late flowering varieties released are given below.

3.2. Mid season flowering varieties

i) Bhaskara		ii)	VTH 174
iii) Dhana (H1608)		iv)	Dharashree
v) Amrutha (H1597)		vi)	Priyanka (H1591)
vii) BPP-8		viii)	V-4
ix) V-7			

3.3. Late season flowering varieties

i)Ullal-1 ii) Chinthamani-1 iii) Madakkatara-2

4.Land preparation

Wild growth particularly forest tree growth should be cleared from the site selected for cashew cultivation. The roots of the weeds and bushes should be completely uprooted around 2-meter radius of the planting pit. This ensures competition-free environment for the newly planted cashew grafts. In the absence of inter crops or cover crops the space in between the plants could be cleared in phased manner in the subsequent years. Cashew is a sun loving plant, there should not be shade over the plants.

5.Digging of pits

Pits of 1 m x 1 m x 1 m dimension should be dug. A spacing of 7 m x 7 m or 8 m x 8 m or 10 m x 5 m is ideal depending upon the variety and type of land used. In case of vigorous growing varieties, spacing can be 8 m x 8 m and in case of less vigorous varieties, it can be 7 m x 7 m or 10 m x 5 m. If the soil is more fertile, spacing adopted should be more. If there is a hard pan, the bigger pits should be opened of size 1.2 m x 1.2 m x 1.2 m. Hedge row system of planting with a spacing of 10 m x 5 m will be beneficial for growing intercrops during the initial period. The pits should be dug out 15 to 20 days before planting and exposed to sunlight so as to get rid of soil borne pests. Later two third portions of the pits are to be filled with a mixture of topsoil, 6 kg of compost, 20 g bio fertilizers (N fixers and P solubilizers or Varanashi Composter) and 200 g rock phosphate.

6. Planting

Since cashew is a rain fed crop, planting is usually done during monsoon season. However, in heavy rainfall areas the planting may be done once the heavy rains are over. Plants multiplied by vegetative methods (air layers or grafts) are preferred because these plants give higher yields. The grafts prepared using scion sticks of high yielding mother trees behave like the mother plants. While establishing cashew garden, instead of a single variety it is preferable to go for two to four varieties having middle and late flower bearing habits. To prevent pest problems, it is better to avoid early season flowering varieties as explained earlier. Healthy plants should be planted after carefully removing the polythene bags without disturbing the rhizosphere soil. Soil at the center of the pit should be scooped out for planting. After placing the plant into the pit, the soil around it should be pressed gently. In case of grafts, care should be taken to see that the graft joint is at least 5 cm above the ground level. This clearance will help to locate and remove the sprouts on the rootstock below the graft joint (Fig. 1 and 2). The remaining one-third portion of the pit should be gradually filled up to the ground level within 2 years.

6.1. Staking and mulching

After planting the graft, a stake should be provided to support the plant and loosely tied to plant with a jute thread (Fig. 1). This prevents damage to the graft joint due to wind blow. The soil around the plant should be covered with thick mulch of green or dry leaves for better soil and moisture conservation.

7. After care, training and pruning

Side shoot growth below the graft joint should be removed periodically. Emerging side shoots above graft joint should be removed by secateure up to 50-75 cm height of the stem. There should be a clear single stem up to 50-75 cm height. This should be attained by removing the lower branches in stages so that the tree gets enough strength to withstand heavy wind. Single stem at base facilitates easy cultural operations, nut collection, and surveillance of Cashew Stem and Root Borer (CSRB) infestation. New and longer stakes should be provided after removing old and weaker ones during the second and third year after planting. De-blossoming should be carried out for the first two years after planting. Further, regular pruning of weaker branches in the initial years of growth helps to encourage the establishment of good framework (Fig. 3). Third year onwards flower

panicles need not be removed. After 3-5 years, the main branch, which is growing vertically should be beheaded at a height of 2.5 m to 3.5 m. This would reduce over shading effect of higher branches on the lower branches, which encourages better spread of the canopy as well as uniform distribution of light on all the branches.

The ideal period for pruning would be after nut harvesting and before the onset of new shoots. This could be taken up at the end of May or beginning of June. When large sized shoots are pruned, care should be taken to see that the cut surface is as smooth as possible and hence sharp blades should be used. Cut portion should be swabbed with 10% bordeaux paste.

8.Soil and water conservation methods

Cashew being mostly unirrigated crop, requires proper soil and moisture conservation measures. In slope area, terracing should be taken up around each plant within second year (Fig. 4 and 5). Initially terrace with inward slope should be made and a catch pit of 2 m x 0.3 m x 0.45 m (l x b x h) at a distance of 1.8 m-2 m away from the base of the plant on the upper side of the slope should be dug. The terrace and trench could be also constructed in semicircular pattern. On a level land, square circular or staggered trench of 0.3 m depth should be dug and the soil should be spread around plant basin (Fig. 6 and 7). After the earthwork, the soil around should be mulched with organic matter. This prevents erosion during rainy season and avoids direct exposure to sunlight there by efficiently conserving soil moisture in summer (Fig. 8).

9. Manuring

In organic farming system, nutrient should be given in organic way. A grown up cashew tree produces about 20 kg of biomass waste per year (cashew leaf litter, prunings, waste cashew apples etc.). This should be returned to the soil. In addition, 33 kg compost or 50 kg FYM or 20 kg poultry manure with 50 g bio-fertilizers should be applied when there is optimum soil moisture. Manure application should be taken up in the beginning of monsoon (June) at low rainfall areas and in mid monsoon (August) in high rainfall areas. Addition of bio-fertilizers namely N-fixers and P-solubilisers also gives benefits. If Varanashi composting method is used, additional dosage of bio-fertilizers is not required. For young plants, the dosage starts from one fifth of recommendation and increases year after year till fifth year. After the application of organic manure around the trees, it should be covered by a thin layer of soil and properly mulched.

Periodic spray of cow's urine (1:10 dilution) or compost tea (1: 40 dilution) facilitates better growth. They also prevent pest and disease attack.

When there are plants of more than 20 years age in an orchard, pits of 0.5 m length, breadth and depth are dug at the centre of trees and cashew biomass with fruits are incorporated into the pits along with organic manure and bio-fertilizers. Cow dung slurry of 20% should be added into it and covered by a thin layer of soil. May is the ideal month for carrying out this operation. Some of the roots of old trees may get exposed and are prone to CSRB attack hence, these roots are covered by thin layer of soil.

9.1.Alternate manures

In view of rising demand for organically grown cashew, strategies need to be developed for organic farming for different agro-ecological zones because organic manure availability may vary according to different locations.Some of the commonly available organic manures like poultry manure, Farm Yard Manure (FYM), vermicompost, oil cakes, coir pith, organic manure mixtures etc. hold promise in organic farming in cashew as per the results obtained at NRCC. There is high potentiality to utilize cow dung slurry in major cattle rearing areas. In addition to the above manures, poultry litter and oil cakes are also available in huge quantities in most of the states.Green leaf is in abundance in Kerala, coastal Karnataka and Maharashtra, where cashew is mostly grown. The green leaf can serve as good organic manure to cashew. Green manure crops like gliricidia and pongamia can be grown very well under rain fed conditions on the border or inside cashew plantations to produce green manure.

While considering the quantity of nutrients available in soil, the approximate quantity of organic manure required to meet the recommended dose of Nitrogen of 500 g per tree is presented in Table 2. The recommended dose of Nitrogen has been arrived at, based on the trials conducted in various research stations. In organic manure, availability of nutrients normally stretches for a longer period and in addition the loss of nutrients through leaching is least.

If the nutrients are applied through chemical fertilisers hardly 50% of nitrogen and 75% of the applied potash (K_2O) will be made available to the plants due to nutrient loss through seepage, runoff and de-nitrification.

Such nutrient loss is negligible in the case of organic manures. Detailed study on this aspect needs to be taken up for suggesting options to farmers like, the exact quantity of different organic manures to be applied per tree depending upon the availability of these manures in the respective locality.

The quantity of organic manures mentioned in Table 2 will meet the full requirement of Phosphorous (P_2O_5) and Potash (K_2O) in all cases except in green manure and groundnut cake.When these are used, bone meal and wood ash may be suggested to supplement P_2O_5 and K_2O requirements for producing cashew organically.

Table 2: Quantity of organic manures required for adult cashew tree

Manure	Quantity (kg/tree)
Poultry manure	17.4
Farm yard manure (FYM)	62.5
Vermicompost	31.3
Green manure gliricidia (dry weight)	12.5
Biogas slurry	27.8
Water hyacinth compost	25.0
Castor cake	8.6
Groundnut cake	6.4
Pongamia cake	14.7
Cashew waste compost	33.0
Neem cake	9.61

Note: Calculated based on nutrient concentration in each type of manure as worked out at NRCC.

10. Cover cropping

Leguminous crops such as *Pueraria javanica*, *Calopogonium mucunoides* and *Centrosema pubescens* enrich the soil nutrients, add organic matter, prevent soil erosion and conserve soil moisture. Seeds of these cover crops can be sown in the beginning of rainy season at the rate of 12 kg per ha in the inter space of cashew orchard. Beds of 30 cm x 30 cm are prepared in sloppy degraded soils by loosening the soil and mixing compost or cow dung. Then the seeds are sown in the beds and covered by a thin layer of soil. Presoaking of the seeds in water for six hours ensures better germination. Fencing is necessary to avoid cattle grazing. *Gliricidia maculata* can be grown in the interspace between two rows of cashew or all along the border (Fig. 9). If it is grown in the interspace it may be spaced at one meter distance. Three rows of gliricidia can be grown in the interspace of two rows of cashew. Gliricidia may be grown by sowing seeds or planting

stem cuttings of one meter length during rainy season. Nearly 60 kg leaf and tender branches can be collected to apply to each cashew plant from this green manure crop (Fig. 10).

11.Intercropping

Leguminous crops like horse gram, cowpea, and other crops such as ground nut, tapioca, vegetable and fodder crops, elephant-foot yam(Fig. 11 and 12) are grown as intercrops in cashew plantations. Among the various annuals, biennials, fruit crops and tree species, pineapple has been found to be the best when grown as inter or mixed crop (Fig. 13). In cashew garden for the first 7 years, pineapple could be grown in the inter-space between two rows of cashew. Three trenches could be opened in between the rows across the slope. Size of trench should be of one m width, 0.5 m depth and of any convenient length. In each trench two rows of pineapple suckers should be planted at 60 cm between rows and 40 cm between two suckers within the row. For one meter length, half basket of compost should be added and mixed with soil before planting suckers. One hectare cashew orchard can accommodate 15,000 suckers. Pineapple starts yielding from second year and after fourth year, it should be replanted in a new trench dug out by the side of existing trench or the same could be retained till seventh year of cashew plantation.

After seven years, because of heavy shade of cashew tree over the pineapple and due to difficulty in picking raw cashew nuts fallen over pineapple plants, it may not be feasible to grow this intercrop economically. Nearly 40 tons of pineapple fruits can be expected for seven years with a gross return of about US $ 4518.70. Expenditure would be US $ 2259.37 and hence net profit from pineapple alone will be US $ 2259.37 per ha of cashew garden. Apart from giving an additional income, 30% increase in cashew nut production was also observed mainly due to better soil and water conservation in the trenches, where pineapple is planted across the slope between two rows of cashew.

Other crops like turmeric, ginger and elephant foot yams can be grown as intercrops organically for the first 5 years of planting cashew. The profit realized from these crops may range from US$ 451.87 to US$ 1129.68 per ha.

12. Mixed cropping

It is not possible to achieve sustainability by growing only one particular type of crop. Whatever is the size of holding, growing a variety of crops within the

available land contributes to the ecological balance. While selecting mixed crops its compatibility with the main crop, spacing, and availability of light, manure and water requirement should be properly studied.Mango, sapota, kokum, amla, jack fruit etc. could be grown as mixed crops in cashew orchards (Fig. 14). In countries like Malaysia, Indonesia and Cambodia, rambutan, longon, dwarf bamboos are grown with cashew by providing proper spacing for each crop according to canopy coverage. Considering various mixed crops grown in different cashew growing areas and from the experiments conducted at NRCC Puttur, some of the promising combinations of crops are listed below. Nevertheless, farmers are advised to study carefully various aspects of cultivating mixed crops in their locations namely suitability, irrigational requirements, marketing avenues etc. before adopting them in their orchards. Some of the crop combinations along with spacing recommended for each crop in high-density multispecies situations are given below.

1. Between two rows of cashew, the spacing maintained is 30 m. In the middle of two rows planting mango, tamarind, silk cotton, jack, sapota, amla etc. at a uniform distance of 10 m (as shown in Fig. 15) would give additional income. These crops do not require irrigation. But timely pruning of these trees would be highly beneficial after seven years of planting. Catch pits will benefit in conserving soil and water.

2. Between the rows of cashew the spacing maintained is 21 m. In the middle, two rows of planting with guava or longon and rambutan or breadfruit at 7 m distance between rows and 6 m between plants would be economical (Fig. 16). These crops require light irrigation and are not suitable for dry areas.

3. Between two rows of cashew the spacing maintained is 10 m. In the middle, planting acacia or casuarinas along with wild mango to the borders at 12 m distance would give ecological sustainability (Fig. 17). Acacia and casuarinas should be regularly pruned after 2-3 years and leaves may be incorporated into cashew basins. After 5-6 years these trees are cut and sold. For planting in the borders some of the wild mango could be selected and multiplied by softwood grafting and may fetch much more price in the domestic market itself when compared to the popular varieties.

4. The other combination would be cashew, dwarf bamboo and kokum as in Fig. 18. Bamboo is gaining more importance for its suitability for fabrication of cheap and beautiful furniture and handicraft materials. Due to flowering, there is decline in bamboo crop over the years and abrupt shortfall of supply may increase the price in the future. Kokum is a fruit of various medicinal uses. From rind of the kokum fruit, juice and

beverages are prepared. The chemical content hydroxy citric acid is known to have the properties of anti-obese effect. The juice prepared from the rind has natural cooling effect on body and is widely used in Maharastra and Karnataka. The fat content extracted from the seeds of kokum is having special properties of melting at higher temperature there by it can be blended with cocoa, milk and sugar and chocolate thus made can be kept stable at room temperature, unlike other cocoa chocolates prepared purely from cocoa butter. At NRCC, kokum is grown as mixed crop in cashew garden accommodating 200 trees each in one-hectare area. About 20-30 kg fruit from single tree (400-600 kg per ha) can be expected. The return from a kokum tree will be about US $ 2.25-3.38 and US $ 451.8 - 677.81 per ha.The cost of cultivation is US $ 0.67 per plant (US $ 135.5 per ha.) and net profit will be US $ 1.58-2.71 per plant or US $ 361.5 - 542.2 per ha.

13. Irrigation and drainage

Cashew is grown under rain fed conditions. However, it is preferable to give supplementary irrigation during summer months, especially during January-March at fortnightly intervals at the rate of 200 liters per plant, which is proved to double the yield. This is evident from the research results obtained at NRCC. Cashew responds well for drip irrigation at the rate of 60-80 liters of water per tree once in four days after the initiation of flower panicles till fruit set and development (January-March). However, cashew cannot withstand water stagnation. In high rainfall, areas plantations located in low-lying areas should have trenches to drain out excess water.

14. Weed management

Generally weeding in cashew can be done twice a year. One weeding is recommended in the month of August before manure application and another just before the start of flushing and flowering (October or November). The weed biomass can be effectively recycled as mulch cum green manure by applying around plant basin.

15. Plant protection

In India about 60 insect pest species are identified to affect cashew. Major pests are Tea Mosquito Bug (TMB), Cashew Stem and Root Borer (CSRB), Leaf Miner, Leaf and Blossom Webber and Flower Thrips as well as Cashew Apple and Nut borer. So far, there is no major disease causing economic loss in cashew.

15.1.Management of Tea Mosquito Bug (TMB) – *Helopeltis antonii* Sign. (Heteroptera; Miridae)

Tea mosquito bug can cause yield reduction to the tune of 30-40% by damaging tender shoots, inflorescences and nuts. Both adults and nymphs (Fig 19 and 20) of TMB suck the sap from tender shoots, panicles and immature nuts and apples resulting in the formation of black lesions. These lesions on shoots and panicles coalesce causing shoot blight or blossom blight (Fig. 21). The plants can escape TMB attack if the new flush is delayed. Planting mid season or late season flowering varieties would be the right strategy to escape TMB.Even early flowering varieties also flower 10-15 days late if the plants are grown organically compared to chemical fertilizer applied ones. The delay in flowering naturally minimizes the incidence by escaping multiplication of TMB population. The pest could be repelled by smoking the garden by burning organic residues three times each during flushing, flowering and fruiting.Care must be taken to see that small heaps of organic wastes in several places on the ground below the canopy of the tree is burnt slowly. This can be achieved by putting a thin layer of soil on the heaps and setting fire. At any chance the burning should not produce too much of heat lest flowers and shoots get affected. Clean cultivation is another method to check multiplication of TMB considerably. All weeds should be removed and heaped as mulch. Encouraging multiplication of weaver ants (*Oecoyphylla smaragdina*) checks the TMB (Fig. 22). These ants feed on the eggs and nymphs of the TMB. In the initial stages the colonies of weaver ants may be brought from near by forest.

At NRCC Puttur, a plot of 2.5 hectares is maintained for the last four years and though initially the TMB damage was noticed in small pockets, no economic loss on yield was observed. Here the organic insecticides like Servo-agro-spray oil (Petroleum by-product),Phalada III C1 and Phytozeal were sprayed during flushing, flowering and fruiting periods. All of these were found effective. Though little damage was noticed due to TMB initially in certain mid varieties (V-4), later it did not spread indicating that the pest can be brought under check with these organic pesticides.

15.2. Management of Cashew Stem and Root Borer (CSRB) - *Plocaederus ferrugineus L.* (*Coleoptera; cerambycidae*)

Older cashew trees are more prone to infestation by CSRB (Fig. 23). Adult female beetles (Fig. 24) lay eggs in the bark crevices of the stem (near to the collar region) or on the exposed roots. After hatching, the young

grubs (Fig. 25 and 25-a) tunnel immediately into the trunk or root regions. Due to extensive feeding by irregular tunneling in the bark, the translocation of the nutrients is hampered leading to drying of leaves and twigs. In the infested portions the gum and frass (chewed fibres and excreta pellets) start oozing out from the tree, which is the initial symptom of pest attack. Curative measures given below should be taken up immediately.

The infested portion having frass below the bark on either the main stem or root portion after suitably digging the soil should be carefully chiseled to inflict minimum damage to the bark. Tunnels should be tracked (Fig. 26) towards the fresher frass to locate the CSRB grubs, which should then be removed and killed. In case white powdery fibers are seen it indicates that the grubs have entered the heartwood for pupation. In such cases a pliable wire (for example automobile gear wire) should be inserted deep into the pupation hole and pushed in till a slushy sound is heard or milky white fluid flows out indicating damage to the grub or pupa. Later chiseled portion of the bark should be swabbed with 10% bordeaux paste. When a paste of cow dung and ash is applied to the injured portion of the bark, it helps in curing of wounds. Swabbing neem oil is also quite effective.

Trees having more than 50% of the bark circumference damage with yellowing of the canopy hardly ever recover. However, the pest stages in such trees will act as inoculum for the next season. Hence phyto-sanitation should be adopted by uprooting such trees, which are beyond recovery and disposed off immediately, along with removal of pest stages in other infested trees. Such operations prevent build up of pest inoculum. As the pest incidence occurs during the period of nut collection (Feb-May), the infested trees can be marked and curative measures could be adopted immediately, so that the grubs do not inflict more damage. As preventive measure, brushing waste motor oil once or twice a year to the lower trunk region discourages egg laying (Fig. 26).

Minor pests like Cashew Apple and Nut Borer (Fig. 27 and 28), leaf miner, leaf and blossom webber could be mechanically controlled at younger stages of plant growth or with organic sprays suggested for TMB. As the plant grows older, the loss is insignificant.

16. Harvesting

Only the fallen nuts should be collected from the base of the tree to avoid damaging of the flowers and unripe nuts (Fig. 29). The fruits should not be harvested from the tree. The nuts, after separating from the fruits, should be washed with water, sun dried for 2-3 days (Fig. 30) and stored in gunny bags at a height of at least 4 inches above the ground by placing them over a wooden plank. Nuts should be sold in the same year and should not be stored for the future.

17. Nut yield

All the varieties recommended have a yield potential of over 8 kg per tree or 1 to 1.5 tons per hectare. Though cashews yield starts from the fourth year, its full potential (about 8 kg per tree) will be realized after 8-10 years depending on the level of management (Fig. 31).

18. Cost and returns

The cost and returns of cashew grown on a hectare of the land in India is shown in the tables 3 – 6. The returns from inter or mixed cropping is not taken into consideration. Cashew as a single crop block has been taken into account. From this table, one can analyze the cost and returns from cashew alone in different phases of growth. In the first year, the cost involved per tree is US $ 2.28, but over the years one can notice a decrease in it. Cashew starts yielding from the fourth year. The yield goes on increasing from one kilo in fourth year to 7 kilos in tenth year. The economical return starts from the fifth year, where it is US $ 51.72 per ha and at the end of the tenth year it will be US $ 656.06 per ha. But, if one takes the cumulative returns for the ten years, it will be US $1346.61 per ha (or US $ 8.63 per tree). By growing the inter crop, returns can be expected in the very first year of planting. The economical sustainability could be achieved by inter and mixed cropping even during the time of fluctuations in prices of the main crop output.

Cost and returns

Cost of cultivation per hectare of cashew Spacing: 8 m x 8m (156 plants)

Table 1: From 1st to 3rd year

Particulars	1st year		2nd year		3rd year		Total	
	Man day	Cost US $	Man day	Cost US $	Man day	Cost US $	Man day	Cost US $.
A. Labour cost (US $ 1.69/day)								
1. Fencing material/ labour		79.07						79.07
2. Land preparation	60	101.67	5	8.47	14	23.72	79	133.86
3. Soil conservation			30	50.83			30	50.83
4. Digging of pits	30	50.83					30	50.83
5. Planting	10	16.94	2	3.39	2	3.39	14	23.72
6. Application of organic manure	3	5.08	6	10.16	8	13.55	17	28.79
7. Weeding			5	8.47	10	16.94	15	25.41
8. Training & pruning			2	3.39	2	3.39	4	6.78
9. Organic spray	2	3.39	4	6.77	5	8.47	11	18.63
Total A	**105**	**256.98**	**54**	**91.48**	**41**	**69.46**	**200**	**417.92**
Per plant (US $)		**1.65**		**0.59**		**0.42**		**2.68**
B. Cost of inputs								
1. Grafted plants (US $ 0.33/plant)	156 pl.	52.86	16 pl.	5.42	8 pl.	2.71	180 pl.	60.99
2. Compost manure 6-18 kg /plant (US $ 0.02033/kilo)	936 kg	19.02	1871 kg	38.04	2808 kg	57.09	5615 kg	114.15
3. Biofertilizers (50g/ plant at US $ 0.1355)		21.14		21.14		21.14		63.42
4. Organic certification		5.64		5.64		5.64		16.92
Total B		**98.66**		**70.24**		**86. 58**		**255.48**
Per plant (US $)		**0.63**		**0.45**		**0.56**		**1.64**
C. Total cost of cultivation (A+B)		**355.64**		**161.72**		**156.04**		**673.40**
Per plant (US $)		**2.28**		**1.03**		**1.00**		**4.31**
D. Economics								
1. Nut yield kilo/ tree								
2. Kilo/ ha.								
3. Price/ kilo (US $)								
4. Returns/ ha (US $)								
5. Net returns (US $)		**-355.64**		**-161.72**		**-156.04**		**-673.40**
6. Net returns per plant (US $)		**-2.28**		**-1.03**		**-1.00**		**-4.31**

Table 2: From 4th to 7th year

Particulars	4th year		5th year		6th year		7th year		Total	
	Man day	Cost US $	Man day	Cost US $	Man day	Cost US $	Man day	Cost US $	Man day	Cost US $
A. Labour cost (US $ 1.69/day)										
1.Watching(part time)	15	25.41	15	25.41	15	25.41	15	25.41	60	101.64
2. Application of organic manure	8	13.55	8	13.55	8	13.55	8	13.55	32	54.20
3. Weeding	10	16.94	10	16.94	10	16.94	10	16.94	40	67.76
4. Training & pruning	2	3.39	2	3.39	2	3.39	2	3.39	8	13.56
5. Organic spray	5	8.47	5	8.47	5	8.47	5	8.47	20	33.88
6. Harvesting	2	3.39	3	5.08	5	8.47	5	8.47	15	25.41
Total A	**42**	**71.15**	**43**	**72.84**	**45**	**76.23**	**45**	**76.23**	**175**	**296.45**
Per plant (US $)		**0.45**		**0.47**		**0.49**		**0.49**		**1.90**
B. Cost of inputs										
1. Compost manure 24-30 kg/ plant(US $ 0.02/ kilo)	3744	76.12	4680	95.14	4680	95.14	4680	95.14	17784	361.54
2. Biofertilizers (50g/ plant at US $ 0.13)		21.14		21.14		21.14		21.14		84.56
3. Organic certification		5.64		5.64		5.64		5.64		22.56
Total B		**102.90**		**121.92**		**121.92**		**121.92**		**468.66**
Per plant (US $)		**0.65**		**0.79**		**0.79**		**0.79**		**3.00**
C. Total cost of cultivation (A+B)		**174.05**		**194.76**		**198.15**		**198.15**		**765.11**
Per plant (US $)		**1.11**		**1.24**		**1.27**		**1.27**		**4.90**
D. Economics										
1. Nut yield kilo/ tree		1		2		3		4		10
2. Kilo/ ha.		156		312		468		624		1560
3. Price/ kilo (US $)		0.79		0.79		0.79		0.79		0.79
4. Returns/ ha (US $)		123.24		246.48		369.72		492.96		1232.40
5. Net returns (US $)		-50.81		51.72		171.57		294.81		467.29
6. Net returns per plant (US $)		**-0.32**		**0.33**		**1.10**		**1.88**		**2.99**

Table 3: From 8th to 10th year

Particulars	8th year		9th year		10th year		Total	
	Man day	Cost US $	Man day	Cost US $	Man day	Cost US $	Man day	Cost US $
A. Labour cost (US $ 1.69/day)								
1. Watching (part time)	15	25.41	15	25.41	15	25.41	45	76.23
2. Application of organic manure	8	13.55	8	13.55	8	13.55	24	40.65
3. Weeding	10	16.94	10	16.94	10	16.94	30	50.82
4. Training & pruning	2	3.39	2	3.39	2	3.39	6	10.17
5. Soil conservation	30	50.82					30	50.82
6. Harvesting	7	11.86	10	16.94	10	16.94	27	45.74
7. Organic spray	5	8.47	5	8.47	5	8.47	15	25.41
Total A	**77**	**130.44**	**50**	**84.70**	**50**	**84.70**	**177**	**299.84**
Per plant (US $)		**0.83**		**0.54**		**0.54**		**1.92**
B. Cost of inputs								
1. Compost manure 30 kg/plant@ US $ 0.02/kg	4680 kg	95.14	4680 kg	95.14	4680 kg	95.14	14040 kg	285.43
2. Biofertilizers (50g/ plant@ US $ 0.13)		21.14		21.14		21.14		63.42
3. Organic certification		5.64		5.64		5.64		16.92
Total B		**121.92**		**121.92**		**121.92**		**365.77**
Per plant (US $)		**0.78**		**0.78**		**0.78**		**2.34**
C. Total cost of cultivation (A+B)		**252.36**		**206.62**		**206.62**		**665.60**
Per plant (US $)		**1.61**		**1.32**		**1.32**		**4.25**
D. Economics								
1. Nut yield kilo/ tree		5		6		7		18
2. Kilo/ ha.		780		936		1092		2808
3. Price/ kilo (US $)		0.79		0.79		0.79		
4. Returns/ ha (US $)		616.20		739.44		862.68		2218.32
5. Net returns (US $)		**363.84**		**532.82**		**656.06**		**1552.72**
6. Net returns per plant (US $)		**2.33**		**3.41**		**4.20**		**9.95**

Table 4: From 1st to 10th year

Particulars	1-3 year		4-7 year		8-10 year		Total	
	Man day	Cost US $	Man day	Cost US $	Man day	Cost US $	Man day	Cost US $
A. Labour cost (US $ 1.69/day)								
1.Fencing/Watching (part time)	-	79.07	60	101.64	45	76.23	105	256.96
2. Land preparation	79	133.86					79	133.86
3. Soil conservation	30	50.83			30	50.83	60	101.67
4. Digging of pits	30	50.83					30	50.83
5. Planting	14	23.72					14	23.72
6. Application of organic manure	17	28.79	32	54.20	24	40.65	73	123.65
7. Weeding	15	25.41	40	67.76	30	50.82	85	144.00
8. Training & pruning	4	6.78	8	13.56	6	10.17	18	30.51
9. Organic spray	11	18.63	20	33.88	15	25.41	46	77.92
10. Harvesting	0	0	15	25.41	27	45.74	42	71.16
Total A	**200**	**417.92**	**175**	**296. 45**	**177**	**299.84**	**552**	**1014.28**
Per plant (US $)		**2.68**		**1.90**		**1.92**		**6.50**
B. Cost of inputs								
1. Grafted plants US $ 0.3388/plant	180	60.99					180	60.99
2. Compost manure		114.15		361.54		285.43		761.12
3. Biofertilizers		63.42		84.56		63.42		211.40
4. Organic certification		16.92		22.56		16.92		56.40
Total B		**255.48**		**468.66**		**365.77**		**1089.91**
Per plant (US $)		**1.64**		**3.00**		**2.34**		**6.98**
C. Total cost of cultivation (A+B)		**673.40**		**765.11**		**665.60**		**2104.11**
Per plant (US $)		**4.31**		**4.90**		**4.26**		**13.48**
D. Economics								
1. Nut yield kg/ tree				10		18		28
2. Kilo/ ha.				1560		2808		4368
3. Price/ kg (US $)				0.79		0.79		0.79
4. Returns/ ha (US $)				1232.40		2218.32		3450.72
5. Net returns/ha (US $)		**-673.40**		**467.29**		**1552.72**		**1346.61**
6. Net returns per plant (US $)		**-4.31**		**2.99**		**9.95**		**8.63**

Note: Costs worked out in Indian rupee and converted to US Dollars. One US$=44.26 Rupees in 2006.

19.Significance of organic cultivation and its potentiality

Cashew is grown in most of the places as a naturally grown crop with less attention hence the expected returns are not achieved. For organic cultivation, Leaf litter, dried twigs, branches, fruits etc. should be utilized as organic inputs for the cashew tree. There is growing demand for organic food grains, fruits, vegetables and other products, which would fetch premium

price in the international market. Since dairying and rearing of animals are a part and parcel of most of the farming systems, the availability of organic materials in plenty determines the scope for organic cultivation of most of the crops, apart from converting a large number of smaller cashew holdings into organic.

In organic farming, most important aspect is maintaining the soil fertility status. When organic materials are added to the soil, the soil microbes work on them and convert them into readily available nutrients for the plants apart from improving the soil structure. Earthworms, millipedes, centipedes and many soil macro fauna also play major role in improving the properties of soil.

Annexure – 1
Organic sprays which could be utilized in cashew cultivation:

1. Sprays providing nutrition and imparting protection from insects/ diseases.
a. Cattle urine: For every one liter of cattle urine, 8-10 liter of water should be added and sprayed.

b. Compost tea: One kg of well-degraded compost powder is mixed in 40 liter of water, filtered and sprayed. Varanashi Bio spray is one such formulation, which is readily available in the market.

c. Jeevamrutha: 10 kg fresh cow dung, 5-10 liter of cattle urine, 2 kg of black Jaggary (or palm sugar), 1 kg legume seed powder (black gram/ Bengal gram/ green gram), one handful soil from the bunds of the field should be mixed in 200 liters water. All these constituents are mixed in a barrel, kept in shade for 2 days stirring three times a day. The mouth of the barrel should be kept closed with a wet gunny bag. The solution is to be used for spraying within 7 days of its preparation. Filter before use.

d. Beejamrutha : 5 kg fresh cow dung, 5 liter cattle urine, 50 g CaO (lime), one handful of soil from the bunds of field should be mixed in 20 literwater. All these constituents have to be thoroughly mixed and used for the seed treatment. Treated seeds have to be shade dried and sown. The treatment enhances germination. Cashew nuts can be soaked for a day in this solution before sowing.

2. Organic sprays for control of pests.
a. Strychnos nux-vomicaL: Seeds, bark, leaves and roots of this plant are used. Two kg of the plant part is crushed and boiled in 30 liter of water. The solution should be filtered andsprayed in 1 : 2 proportion with water. It proves useful in avoiding TMB to certain extent. Spraying once in 15 days during the flushing period is suggested.

b. Neem seed concoction: One kg of pounded neem seeds are soaked in 10 liter of water for 10-12 h then 20 liter of water and 1 ml of liquid soap are added, filtered and sprayed. It is useful against some insect pests.

c. Tobacco concoction: 200 g tobacco should be tied in a piece of cloth and boiled in 2 liter of water and allowed to soak for 24h and filtered. 100 ml of neem oil with 20 ml of liquid soap are added and diluted in 5 liter of water and sprayed.

d. Neem oil/ Castor oil: 200 ml of neem / castor oil is mixed with 40 ml of liquid soap and diluted in 10 liter water and sprayed. This is effective against TMB if sprayed frequently.

e. Lantana: One kg lantana (*Lantana camera* L.) leaves are finely crushed and diluted in 10 litre of water and sprayed, which is effective against leaf miner.

f. Fish: One kg of fresh fish is crushed and mixed with one kg of black jaggary or palm sugar and allowed to ferment for 15 days. This preparation may be used at 15 ml per one liter of water for spraying. This is effective against bacterial diseases.

g. Annona (Custard apple- *Annona squamosa*L.) + **Chilli** + **Neem seed:** Two kg of Annona leaves should be shredded and made into paste by adding some water. 500 g of dry chillies have to be soaked for 8-10 h in water. Neem seed should be powdered and soaked for 8-10 h in water. All the ingredients are mixed and water is added to prepare a solution. Then diluted to 50 liter with water and sprayed, controls thrips and caterpillars.

h. Chilly + Garlic: One kg of green chilly along with 3 garlic bulbs is crushed to make a paste and soaked in five liter of water for 8-10 h. This solution is dissolved in 18 liter water and sprayed. Effective against leaf hoppers and grass hoppers.

Note: All the sprays are to be carried out during either morning or evening hours.

Before the arrival of chemical pesticides, there were several traditional methods of insect and disease control, which slowly disappeared. Off late, they are gaining importance once again. Such organic control measures have been collected from various sources and listed here for the benefit of the organic farmers. Some of them have been tried in cashew cultivation. Hence, farmers are suggested to try appropriate combinations on a small scale and extend the successful results to other plants in the orchard.

Annexure – 2

Organic inputs and their conditions of use

To market products with organic label, it has to be certified by appropriate certification agency. There are several certifying agencies in India. The names and address of the recognized certifying agencies operating in India is listed in APEDA website (Annexure-4). A Few are internationally recognized.

The organic inputs, which could be used in a certified organic farm, are listed in the tables below. Organic wastes available in certified plantations are permitted to be used as inputs in organic cultivation. Certain other products are allowed for use in organic agriculture for the control of pests and diseases (plant protection). Such products should only be used in absolute necessity and should be chosen after taking the environmental impact into consideration.

Many of these products are restricted for use in organic production. In the table "restricted" means that the conditions and the procedure for use shall be set by the certification programme.

1.Substances of plant and animal origin

Particulars	Conditions of use
Cow dung, slurry, cattle urine	Should be used as composts or used by adding water
Human excrement	Should not be directly used on edible portion of the plant. - Restricted
Vermi compost/ vermi tea	✓
Bone meal, Meat meal, Blood meal, Feather meal	Restricted
Crop residues, green manures, straw, other mulches	✓
Saw dust, wood shavings, Ash, Coal (without coating of chemicals)	✓
Extraction from different plant parts	✓
Organic composts (animal waste, poultry waste etc.)	Restricted
The items produced outside the organic farm unit - Animal excrement, poultry manure etc.	Restricted
Fish meal	Restricted
Sea weed and its products	Restricted
Town and house hold waste compost	Restricted
Plant waste compost	✓

2.Minerals

Particulars	Conditions of use
Calcium carbonate of natural origin (chalk, lime stone, gypsum, phosphate)	Restricted
Megnesium sulphate	Restricted
Potassium (mineral), sulphate of potash etc.	Should not have undergone chemical treatments
Gypsum (calcium sulphate)	Restricted
Rock phosphate	Restricted
Sodium chloride (table salt), calcium chloride	Restricted
Micro nutrients (Bo, Cu, Fe, Mn, Md, Zn etc.)	Restricted
Sulphur	Restricted
Vermiculite	Restricted

3.Others

Particulars	Conditions of use
Microbiological preparations	✓
Bio fertilizers	✓
Biodynamic preparations	✓
Byproducts of sugarcane industry	Restricted
Byproducts from oil palm, coconut and cocoa (including empty fruit bunch, palm oil mill effluent (pome), coco peat and empty cocoa pods	Restricted
Byproducts of industries, processing ingredients from organic agriculture	Restricted

I.Plant based or animal based products in organic plant protection

Particulars	Conditions of use
Neem oil	Restricted
Gelatin	✓
Pesticide of plant origin (including neem)	Restricted
Pyrithrins (of chrysanthemum origin)	Restricted
Tobacco Tea (apart from pure nicotine)	✓
Casin (milk protein)	✓
Sea algae, sea weeds/ sea salt/ products derived from salt water	Restricted
Mushroom based products	✓
Products of chlorella	✓
Products from fermentation of Aspergillus	Restricted
Natural acids (vinegar)	Restricted
Decoction of plant origin (neem, garlic, pongamia)	✓
Predators	Restricted

II. Products of mineral origin

Particulars	Conditions of use
Lime or sodium chloride	Restricted
Burgundy mixture	Restricted
Clay (Perlite, vermiculite, zeolite)	Restricted
Cu salts/ inorganic salts (bordeaux mixture, copper hydroxide, copper oxychloride)	Restricted
Light mineral oils	Restricted
Potassium permanganate	Restricted
Lime sulphur (calcium polysulphide)	Restricted
Silicates	Restricted
Sodium bicarbonate	✓
Sulphur (fungicide, miticide or acaricide)	Restricted

III.Microbes for biocontrol of pests

Particulars	Conditions of use
From virus, fungal or bacterial preparations (bio control agents like Trichoderma, Bacillus thuringiensis, Granulosis virus etc.	✓

IV.Others

Particulars	Conditions of use
Sterilized insects	✓
Carbon dioxide and nitrogenous gas	Restricted
Soft soap (potassium soap)	✓
Homeopathic and Ayurvedic preparations	✓
Herbal and Biological/Biodynamic preparations	✓

V.Traps

Particulars	Conditions of use
Nets, Traps	Restricted
Pheromones, light traps	✓

Note: ✓ Indicates permitted to use

The procedure for getting organic certification is quite complex. To obtain certificate, the organic growers should maintain necessary documents and follow strict guidelines and have to undergo periodical inspections from the certifying agencies. In a way it makes the farmers disciplined and handle their produce as per the international standard. If there is no assured market with premium price, certification is of no value. This requires a lot of patience and hard work. The main objective of this book is to make the farmers take up organic and sustainable agriculture. Regarding organic certification only introduction is given in this book and there are still a lot of things left uncovered.

Annexure – 3

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Annexure – 4

Websites

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8. APEDA-National programme for organic farming
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Annexure – 5

Our gratitudes

The Authors wish to extend their heartfelt thanks to those people who have contributed in providing relevent informations, by giving published articles or photographs and also those who have helped us indirectly. The names of the persons are listed below.

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NOTE: This Article is prepared by condensing Hand book on organic Cashew Cultivation (2007) Published by Varanashi Research Foundation, Adyanadka, 574 260, India. Hard copy of the same is available for sale with the Publisher.

Varanashi Publications
Handbook on organic Cashew Cultivation

Authors: Dr. Varanashi Krishna Moorthy
Dr. Yadukumar. N
Mr. Shankar Raj. N.S

Handbook on organic cashew nut cultivation, the most informative book on production of cashew is published by Varanashi Research Foundation, a well known institution working for the promotion of eco friendly organic agriculture. The book is indemi 1/8 size with 71 pages.The highlight of the book is simple narration about the sequences of events in the cultivationof cashew. It is a modified package of practices for cashew with a new outlook. The beautiful color photographs and neat drawings totaling 48, perfectly match the illustrations. Mixed crops and inter crops have been explained with layout plans. Utilisation of organic inputs in the place of chemical inputs and the resultant benefits have been explained. The authors have takenpains in gathering information on every minute aspect of organic cashew production. Facts regarding soil and water conservation and organic plant protection means have been effectively discussed. The Book has many tips to boost the cashew production and to achieve sustainability. It intends to create awareness among the farmers, students, Scientiests and public about the eco friendly organic agriculture. The book is the outcome of an advisory project at Cambodia financed by GTZ, Germany. four editions have came out in a short period of1½ years !!

Price:
1. English Indian versionRs. 150/- (for Indian buyers)
US $ 35/- (for International buyers)
2. English International version US $ 35/-
3 KannadaRs.75/-

Contact Address : Varanashi Research Foundation
P.O Adyanadka - 574260
D.K, Karnataka
Tel : (08255) 270254 / 270686
e-mail: info@varanashi.com
web: www.varanashi.com

Figures

Fig.1: Planting cashew grafts

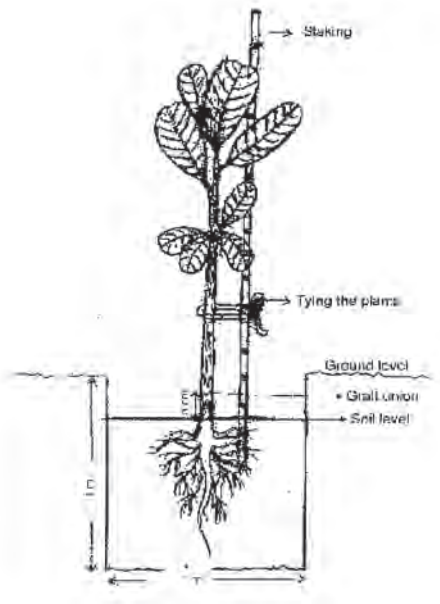

Fig.2: A properly planted cashew graft with staking

Fig.3: Pruned young cashew plant

Fig.4: Providing catchpits for young cashew on sloping land (drawing)

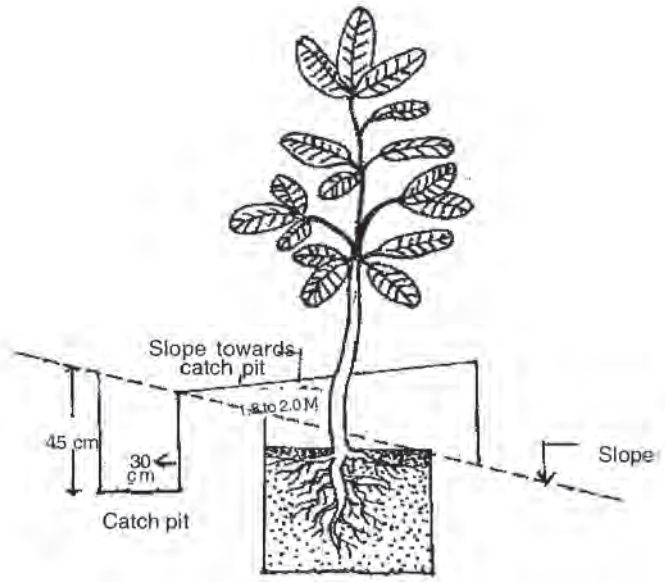

Fig.5: Providing catchpits for young cashew on sloping land (photograph)

Fig.6: Circular catch pit at a distance of 3 m from the trunk of an old tree

Fig.7: Circular catch pit for old cashew tree on level land

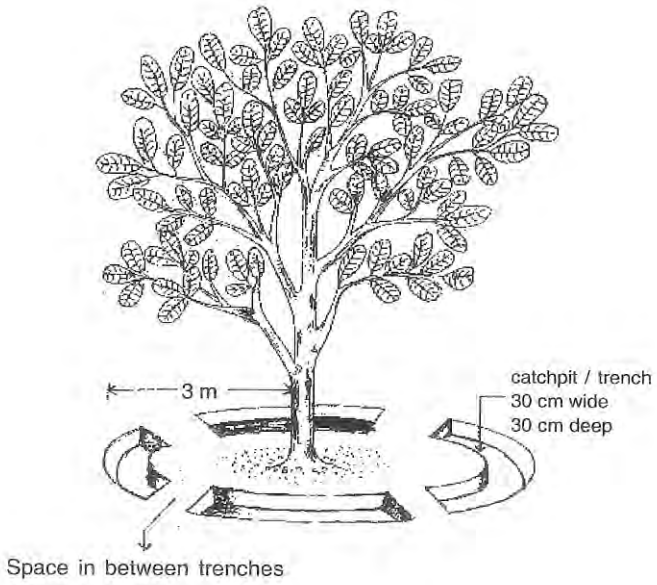

Fig.8: Mulching of cashew tree with dry leaves

Fig. 9: Gliricidia in between cashew plants as a green manure crop

Fig.10: Application of Gliricidia branches and leaves as green manure to the cashew plants

Fig.11: Tapioca intercrop with cashew

Fig.12: Elephant foot yam in between cashew plants

Fig.13: Inter cropping pineapple in cashew orchard

Fig.14: Mixed cropping of sapota, mango and cashew

Fig.15: Mixed cropping of cashew with mango/tamarind/cotton/jack fruit and sapota/phyllanthus

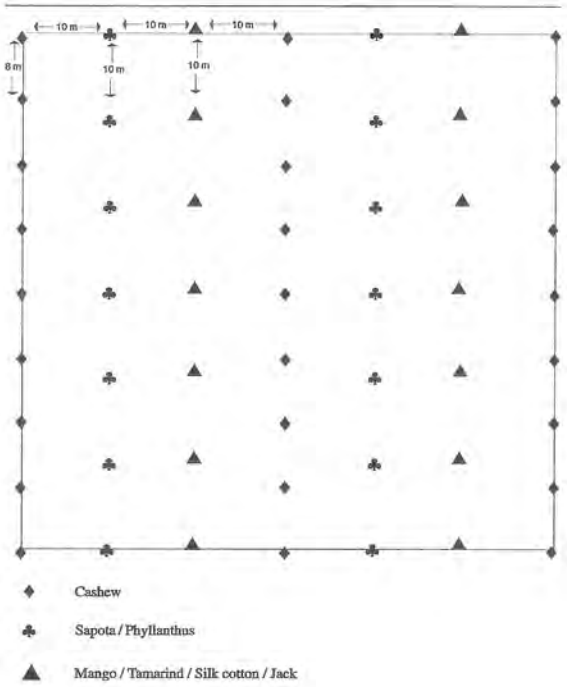

Fig.16: Mixed cropping of cashew with guava/longon and bread fruit/ rambutan

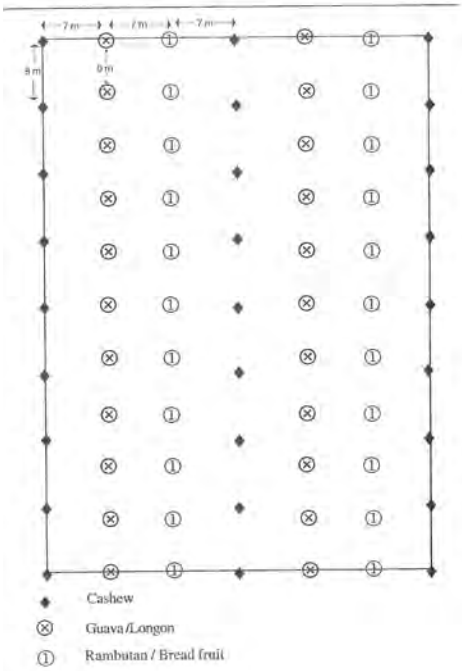

Fig.17: Mixed cropping of cashew with acacia, casuarinas and wild mango

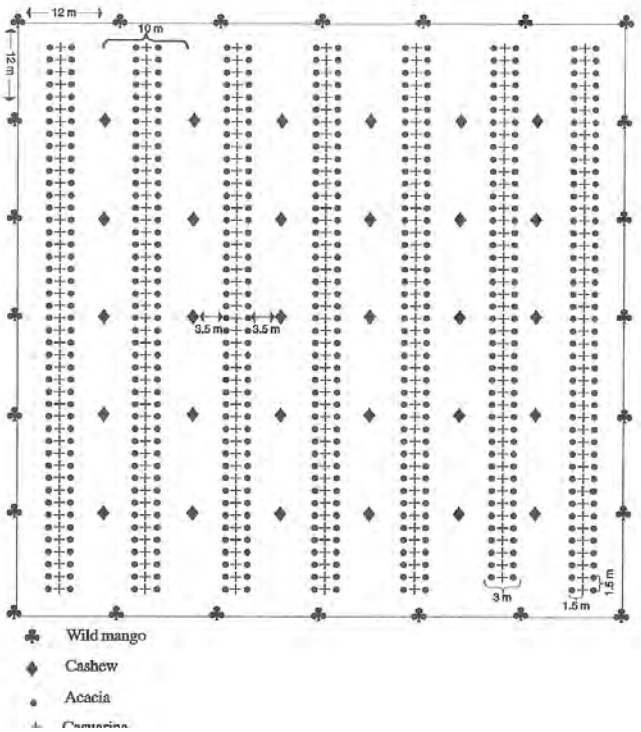

Fig.18: Mixed cropping of cashew with dwarf bamboo and garcinia (kokum)

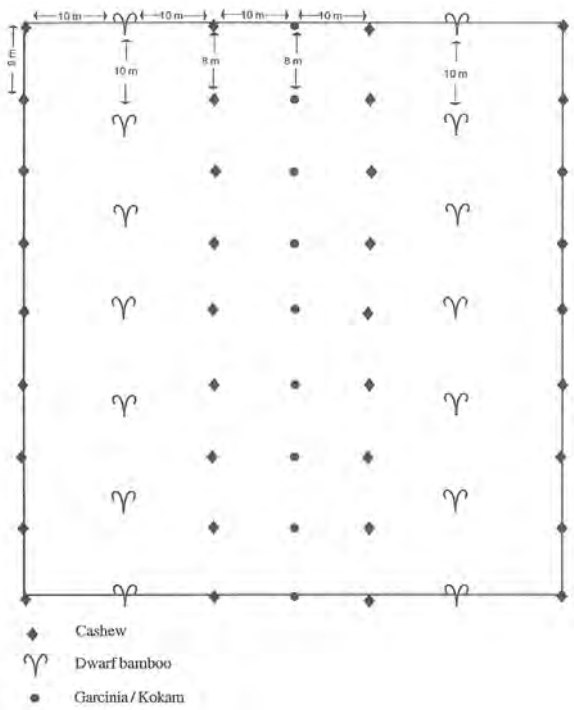

Fig.19: An adult TMB

Fig.20: TMB nymph

Fig.21: TMB damage in cashew

Fig.22: Weaver ants – natural enemy for TMB

Fig.23: CSRB infested cashew tree

Fig.24: CSRB adults

Fig.25: CSRB adults

Fig.25-a: CSRB adults

Fig.26: CSRB grubs being removed from the infested trunk of a cashew tree

Fig.27: Cashew nut damaged by cashew apple and nut borer

Fig.28: Cashew apple damaged by cashew apple and nut borer

Fig.29: Cashew fruit along with immature nuts

Fig.30: Drying of cashew nut under the open sun in a drying yard

Fig.31: A heavy bearing cashew tree

Value Addition in Cashew Nut Through Improved Technology - Perspectives and Recent Developments

Dr.K.A.Retheesh
MD, Kerala State Cashew Development Corporation Ltd., Kerala.

Though India is exporting to more than 60 countries of the world, over 99.5% of India's cashews go in bulk packaging and as plain cashew kernels in 4-gallon prime tins or plastic containers with a net weight of 25 lbs or 11.34 kg flushed with carbon dioxide or nitrogen. It is quite unfortunate that even after 7 decades of experience in international trade in cashew kernels, exports of the commodity in value added forms/ consumer packs constitute less than 0.5% of total exports per annum or in value terms less than US$.1 million. Most cashews are either oil or dry roasted. They are marketed to the consumers in a mixture with other nuts, as 100% nuts and also in confectionery products. Raw cashews are also sold in health food and dry fruits stores. India currently has different varieties of cashew kernels including roasted and salted, sugar coated, spiced and masala fried. However no serious efforts have been taken by Indian exporters to market these types of products in branded consumer packs in foreign markets.

Value addition in the cashew industry can be evolved in three forms:

A. Incremental value addition to the commodity in its existing form itself
B. Finding new uses: Programmes to promote cashew as a healthy, friendly nut, ideal as a snack food, with high calories and polyunsaturated fat contents have been initiated. Expanding the use of cashew kernel in sweets, biscuits and confectionary preparations is also being attempted.
C. Innovative value added products.

Kerala State Cashew Development Corporation (KSCDC) being the biggest processor of cashew in the world is taking initiative to produce value added products from cashew. Now KSCDC has introduced 4 value added products from cashew.

1. **Cashew Soup**: It is in powder form. It can be added to boiled water, delicious soup is ready. No other ingredient is necessary to make soup.
2. **Cashew Powder**: This is targeted to housewives. This powder can be used as thickener in dishes and will add taste to food items.
3. **Cashew Vita**: Is a health drink targeted to growing children. It can be added to boiled milk.
4. **Cashew Bitz**: As everybody knows cashew is a good combination with hot drinks. This is a mixture of masala with cashew bitz.

These products are research outcome of Central Food Technological Research Institute (CFTRI), Mysore the premier institute in food technology in India. The brand name of these products is "CDC Cashews."

These products are true value added products. The global launch of the product was done at Dubai on 22nd April 2008. The market response is very good. KSCDC envisages to lead Indian Cashews in the global market as value added product.

High Yielding Varieties of Cashew

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India is the pioneer in cashew research and development. They have a history of five decades in cashew research. Indian researchers have developed a large number of varieties and technologies capable of increasing the production and productivity of the crop.

Crop improvement work undertaken under the Indian Council of Agricultural Research at National Research Center for Cashew, Puttur (NRCC) and eight State Agricultural Universities {Kerala Agricultural University (KAU), Konkan Krishi Vidyapeeth (KKV), Acharya N.G. Ranga Agricultural University (ANGRAU), Tamil Nadu Agricultural University (TNAU), University of Agricultural Sciences (UAS), Bidhan Chandra Krishi Vishwavidyalaya (BCKVV), Orissa University of Agriculture & Technology (OUAT)} during the past five decades led to the development of 40 high yielding varieties capable of yielding 2 to 4 tons of raw nuts per hectare (Table-1). Of these 40 varieties, 14 are hybrids and 26 are selections. These varieties possess desirable attributes like medium to bold nuts, high shelling percentage, high kernel weight and preferred export grades. The important characteristics of the 40 high yielding cashew varieties are summarized in the Table-1.

Selection of appropriate varieties and adoption of suitable agronomic practices are of utmost importance to realize better out put from cashew plantations. Care should be taken to choose good quality planting materials (soft wood grafts) of high yielding varieties suited to the specific location, planting grafts at recommended spacing and management in scientific lines, in order to exploit the best potential.

Cashew- an effective bio-agent for eco-restoration

Cashew is a very hardy and drought tolerant crop with deep and prolific root system. It can well tolerate moisture stressed and nutrient stressed environments compared to other similar species. The abilities of cashew roots to penetrate through the hard pans of the soil profile, permitting more water infiltration, promoting biological activity in the soil and

converting a less productive soil to a more productive one, are very well known. In many areas, cashew is effectively used as a potential bio-agent for CO_2 sequestration, establishing green belts and eco-restoration purposes. While promoting cashew for eco-restoration utilization of wastelands and less endowed environments, seedlings can be used as a planting material rather than grafts. The planting density can also be high. In such efforts, there is an incidental bonus in the form of cashew nuts as well.

The salient characteristics of few high yielding varieties of cashew are given below.

Madakkathara –1

Year of release	**1990**
Centre	CRS, Madakkathara
Hybrid / Selection	Selection
Canopy type	Compact
Branching habit	Intensive
Flowering	November
Fruiting	January – March
Special character	Early
Apple colour	Yellow
Juice percentage	72
Nut weight	6.2 g
No. of nuts / kg	61
Kernel weight	64 g
Shelling percentage	26.8
Export grade	W280
Mean nut yield / tree	13.8 kg

Priyanka (H-1591)

Year of release	**1995**
Center	CRS, Madakkathara
Hybrid / Selection	Hybridization
Parentage	BLA-139-1 x K-30-1
Canopy type	Open
Branching habit	Intensive
Flowering	December - February
Fruiting	February - May
Special character	Bold nut variety, mid season, and drought tolerant
Apple colour	Yellowish red
Juice percentage	67
Nut weight	10.8 g
No. of nuts / kg	93
Kernel weight	2.87 g
Shelling percentage	26.57
Export grade	W180
Mean nut yield / tree	17.03 kg

Dhana (H 1608)

Year of release	1993
Centre	CRS, Madakkathara
Hybrid / Selection	Hybridization
Parentage	ALGD-1-1 x K-30-1
Canopy type	Compact
Branching habit	Intensive
Flowering	December - January
Fruiting	January- March
Special character	Mid season
Apple colour	Yellow
Juice percentage	72
Nut weight	8.2 g
No. of nuts / kg	122
Kernel weight	2.44 g
Shelling percentage	29.8
Export grade	W210
Mean nut yield / tree	10.66 kg

H 1600

A high yielding cashew hybrid from Kerala Agricultural University

Table -1. Salient characters of cashew varieties released in India

Name of the variety	Parentage	Institution	Release	Yield (kg/tree)	Nut wt. (gm)	Kernel wt. (gm)	Shelling%	Export grade
Anakkayam-1	T.No. 139 of Bapatla	KAU, Anakayam	1982	12	5.95	1.67	27.99	W 280
Madda kkathara-1	T.No. 39 of Bapatla	KAU, Madakkathara	1990	13.8	6.2	1.64	26.8	W 280
Kanaka (H 1598)	BLA 139 x H3-13	KAU, Madakkathara	1993	12.8	6.8	2.08	30.58	W 280
Dhana (H 1608)	ALGD - 1 x K 30-1	KAU, Madakkathara	1993	10.66	8.2	2.44	29.8	W 210
Dharasree (H3-17)	T-30 x Brazil - 18	KAU, Anakayam	1996	15.02	7.8	2.4	30.5	W 240
Amrutha (H 1597)	BLA 139 x H3 - 13	KAU, Makakkathara	1998	18.35	7.18	2.24	31.58	W 210
Akshaya (H7 - 6)	H - 4 -7 x K - 30 - 1	KAU, Anakayam	1998	11.78	11	3.12	28.36	W 180
Anagha (H - 8 - 1)	T - 20 x K- 30 - 1	KAU, Anakayam	1998	13.73	10	2.9	29	W 180
Sulabha (K - 10 - 2)	Selection	KAU, Madakkathara	1996	21.9	9.8	2.88	29.4	W 210
Priyanka (H - 1591)	BLA-139-1 x K-30-1	KAU, Madakkathara	1995	17.03	10.8	2.87	26.57	W 180
Makakkathara -2	(NDR-2-1)Neduvellur Material	KAU, Madakkathara	1990	17	7.25	1.88	26.2	W 210
K 22-1	Selection	KAU, Madakkathara	1987	13.2	6.2	1.6	26.5	W 280
Vengurla 1	Ansur - 1	KKV, Vengurla	1974	19	6.2	1.39	31	W 240
Vengurla 2	WBDC-VI(V-37/3)	KKV, Vengurla	1979	24	4.3	1	32	W 320
Vengurla 3	Ansur - 1x Vettore 56	KKV, Vengurla	1981	14.4	9.1	2.09	27	W 210
Vengurla 4	Midnapur Red x vettore 56	KKV, Vengurla	1981	17.2	7.7	1.91	31	W 210
Vengurla 5	Ansur Early x Mysore Kotekar	KKV, Vengurla	1984	16.6	4.5	1	30	W 400
Vengurla 6	Vettore 56x Ansur 1	KKV, Vengurla	1991	13.8	8	1.91	28	W 210
Vengurla 7	Vengurla 3x M-10/4	KKV, Vengurla	1997	18.5	10	2.9	30.5	W 180
BPP 1	T1xT273	Angrau	1980	10	5	1.35	27.5	W 400
BPP 2	T1xT273	Angrau	1980	11	4	1.04	25.7	W 450
BPP 3	3/3 Simhachalam	Angrau	1980	11	4.8	1.34	28.1	W 400
BPP 4	9/8 Epurupalam	Angrau	1980	10.5	6	1.15	23	W 400
BPP 5	TNo. 1	Angrau	1980	11	5.2	1.25	24	W 400
BPP 6	TNo. 56	Angrau	1980	10.5	5.2	1.44	24	W 400
BPP 8 (H2/16)	T1 x T39	Angrau	1993	14.5	8.2	1.89	29	W 210
Vridhachalam - 1	Vazhisodani palayam	TNAU, Vridhachalam	1981	7.2	5	1.4	28	W 320
Vridhachalam - 2 (M 44/3)	T 1668 of Katterpalli	TNAU, Vridhachalam	1985	7.4	5.1	1.45	28.3	W 320
Vridhachalam - 3 (M 26/2)	Edaya nchavadi	TNAU, Vridhachalam	1991	11.68	7.18	2.16	29.1	W 210
Ullal 1	8/46 Thaliparamba	UAS, Ullal	1984	16	6.7	2.05	30.7	W 210
Ullal 2	3/67 Guntur	UAS, Ullal	1984	9	6	1.83	30.5	W 320
Ullal 3	5/37 Manjeri	UAS, Ullal	1993	14.7	7	2.1	30	W 210
Ullal 4	2/77 Tuni	UAS, Ullal	1994	9.5	7.2	2.15	31	W 210
Chinthamani 1	8/46 Thaliparamba	UAS, Chintamani	1993	7.2	6.9	2.1	31	W 210
UN 50	2/27 Nileswar	UAS, Ullal	1995	10.5	9	2.24	32.8	W 180
NRCC - 1	3/8 Simhachalam	NRCC, Puttur	1989	10	7.6	2.1	28.2	W 210
NRCC - 2	2/9 Dicherla	NRCC, Puttur	1989	9	9.2	2.15	28.6	W 210
Jhargram - 1	T. No. 16 of Bapatla	BCKVV, Jhargram	1989	8.5	5	1.5	30	W 320
Bhubaneswar - 1	WBDC - 5(V-36/3)	OUAT, Bhubaneswar	1989	10.5	4.6	1.47	32	W 320
Goa - 1	Balli - 1	ICAR R.C, Goa	1999	7	7.6	2.2	30	W 210

Note: NRCC - National Research Center for Cashew, KAU - Kerala Agricultural University, KKV - Konkan Krishi Vidyapeeth, ANGRAU - Acharya N.G Ranga Agricultural University, TNAU - Tamil Nadu Agricultural University UAS - University of Agricultural Sciences, BCKVV - Bidhan Chandra Krishi Vishwavidyalaya, OUAT - Orissa University of Agriculture & Technology

Cashew Apple Products

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Cashew apple is highly nutritious and is a valuable source of sugars, minerals and vitamins. The chemical composition of cashew apple is: moisture 87.8%, protein 0.2%, fat 0.1%, carbohydrate 11.6%, crude fibre 0.9%, calcium 10.0 mg/100g, phosphorous 10.0 mg/100g, iron 0.2 mg/100g, vit C 261.0 mg/100g, minerals 200.0 mg/100g, thiamin 0.02 mg/100g, riboflavin 0.5 mg/100g, nicotinic acid 0.4 mg/100g and vitamin A 39.0 IU. Thus cashew apple is compared with several other fruits in the content of most of the nutrients but superior in vitamin C and riboflavin.

However it is quite unfortunate that such an excellent fruit is currently wasted completely, causing economic loss to cashew farmers and the country. Large numbers of technologies are available at present for the economic utilization of cashew apple for various purposes. Cashew apple processing can generate substantial employment opportunities, especially to women and can contribute appreciably towards income enhancement of cashew farmers.

Uses of cashew apple

An overview of the uses of cashew apple is given hereunder.

I. Fresh consumption

Cashew apple is widely eaten raw as fresh fruit.

II. Uses in food processing

1. Beverages

a. Fresh apple beverages: Several nutritious and refreshing beverages like clarified and cloudy juice, juice concentrate, syrup, squash and ready- to-serve can be made from the unfermented juice of cashew apple.

b. Fermented beverages: Wine, vinegar, liquor and alcohol are the fermented products that can be manufactured from cashew apple.

2. Pulp products: Jam, mixed jam, fruit bar, leather and sweet are some of the pulp products prepared with cashew apple.

3. Confectioneries: Candy and tutty fruitty are the important products. Frozen deserts and dairy confectionary items like milk shakes, ice creams and ice candy could be prepared from cashew apple juice by optimization of juice concentration and spray drying. Dehydrated cashew apple powder can be used for preparation of various value added products like biscuits, doughnuts, cake, soup, chocolates and breads.

4. Culinary preparations: Pickle can be prepared from matured but green cashew apple. Chutney can be prepared from ripe cashew apple.

5. Canned products: Canned cashew apple

III. Medicinal uses
Extensively used for traditional preparations for several ailments. It is used as a curative against scurvy and stomach ailments like dysentery and diarrhoea.

IV. Uses in neutraceutical extractions
Cashew apple contains ascorbic acid, fibre, carotenord pigments, minerals and host of other elements, which are of significance to human health and hence can be used in neutraceutical extractions.

V. Agricultural uses
The cashew apple as well as its residue can be utilized as animal feed and for the preparation of vermin-compost. Cashew apple extract can be used in pest management as bait for catching crustaceans.

VI. Energy productions and industrial uses
Cashew apple can be used for the production of biofuel, biogas and tannin.

Commercial cashew apple products
Cashew Research Station, Madakkathara under Kerala Agricultural University, Thrissur, India have done commendable works on the utilization of cashew apple and development of several products like squash, syrup, pickle, candy, chutney, jam, wine, liquor and vinegar. An FPO licensed

cashew apple processing unit has been established at Cashew Research Station, Madakkathara during 1997 for the manufacture of cashew apple products. It is the first ever unit established in India for cashew apple processing. The unit has been producing cashew apple syrup and cashew drink for the past few years. These are sold through various sales centres of the university. It has recently started commercial production and sale of three new products viz., mixed cashew apple- mango jam, cashew apple pickle and candy.

1. Cashew apple syrup and drink

Selected cashew apples are cleaned thoroughly, juice extracted and clarifying agent, preservative and citric acid are added immediately. The clarified juice is siphoned out and this serves as the raw material for the preparation of syrup and drink. Sugar and citric acid are added to the clarified juice in required quantity to produce syrup and drink as per demand.

The nutrients, Vitamin C and riboflavin, which are high in cashew apple, are preserved in these beverages also. Cashew apple syrup contains 276 mg Vitamin C and drink contains 140 mg vitamin C/ 100g. These are natural products and price is comparatively less. Taste is better if served chilled. Syrup has a storage life of one year.

Cashew apple drink, which is the second commercial product from Cashew Research Station, Madakkathara, is an RTS (Ready – To -Serve) beverage. Drink is marketed both in glass bottles and in attractive food grade pouches. Pasteurized drink in glass bottles has a storage life of three months under ambient storage conditions.

2. Cashew apple- mango mixed jam

The ripe apples are collected from the farm, selected, cleaned and soaked in salt solution for three days to remove tannin. Apples are again washed in water, cooked, made into pulp and mixed with equal quantity of mango pulp. Pulp is mixed with sugar and citric acid to prepare jam. Vitamin C content of the product is 18 g/ 100g.It is marketed under the trade name *Cashewman* mixed jam.

3. Cashew candy

It is a sweet product. For preparation of this candy, quality apples with good shape are selected. As like jam preparation, tannin is removed

from apples, cooked, pierced using fork and dipped in sugar solution. Concentration of sugar solution is gradually increased so as to reach 70^0 brix. After two weeks of soaking, sugar solution is drained out and candy is dried in shade. It takes about 2-3 weeks for making the final product. About 745 g candy can be obtained from one kilogram of cashew apple. Vitamin c content of the product is 28.4 mg/100g.

4. Cashew pickle

Mature but unripe cashew apples are collected directly from plant carefully without disturbing the flowers and tender nuts. After cleaning, the fruits are cut into small pieces and astringency is removed by immersing in salt water. After removing from salt water, it is again washed and the pickle is prepared using oil, chilli powder, fenugreek powder, turmeric powder, chilli and ginger garlic paste.

Transfer of technology on cashew apple processing

The Cashew Research Station, Madakkathara is organising national and internationalprogrammes to popularize and transfer the technologies for cashew apple processing. The stakeholders include scientists from universities and central institutes, development officials, farmers, unemployed youth, member of Self Help Groups and women. The persistent transfer of technology initiatives of the Madakkathara centre for the economic utilization of cashew apple, which is currently wasted, totally causing huge national loss, has started bearing fruits. A trainee who got preliminary training on cashew apple utilization at this centre has started the first ever cashew apple processing unit in private sector at Iritty, Kannur, Kerala under the trade name "TOMCO PRODUCTS". He is using the technology developed by the Madakkathara centre for the production of cashew apple syrup and cashew apple drink. The KVK, Kannur under KAU gave him vocational training and post training assistance and guidance in the establishment of the unit starting from project preparation and obtaining FPO license up to marketing. Few more units are in the initial stages of establishment with the technical assistance of Madakkathara Centre.

Benchmark Price for Cashew Kernels

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The increase in merchandise trade around the world has resulted in various tools for measuring value of the produce traded. The division of labour and specialisation that induced increase in global production and consumption is due to the introduction of economic efficiency. All factors of production are priced in such a way that the economic gains are derived upto the stage of consumption.

The development of knowledge has contributed to increasingly arithmetic and econometric tools where producers, traders and consumers can measure the value. These are called as benchmark prices.

The most popular and known benchmark is the Brent Crude and WTIwhich is a reference for and discussion of cost and/or pricing of petroleum.

The term benchmark originates from the chiseled horizontal marks that surveyors made, into which an angle-iron could be placed to bracket ("bench") a leveling rod, thus ensuring that the leveling rod can be repositioned in exactly the same place in the future (Wikipedia)

Purpose of benchmark price

Benchmark price is a reference price for an entire industry for a particular unit of produce. It will serve producers, manufacturers, traders and consumers to arrive at cost and pricing of various units and classification of produce.

Arriving at benchmark price for Cashew kernels

The time has come to create a benchmark price for cashew kernels. The trade is increasingly internationalized and now is ready to be exposed to more economic inputs and managerial competencies. Cashew kernels are derived from raw cashew nuts (*anacardium occidentale*). Currently, global consumption is concentrated in OECD countries but increasingly shifting to middle-income countries as well as countries of production.

Cashew kernels are classified into grades, which have increasing and decreasing value depending on colour, size, shape, wholes and brokens and other distinguishing characteristics. There are 25 grades in cashews, which are in published standards, and there are derivatives from these grades based on customer preferences and distinction made by producers on quality and value.

Global trade in Cashews is now bilateral. Manufacturers and traders enter into contracts through intermediaries. The characteristics of the produce are understood on given standard and regulated by common trade practices. Third parties are unusual in Cashew now.

Cashew trade was pioneered and developed by US importers in the 1920s to date and therefore globally it is a standard developed which offers convenience of trade.

Trade is conducted universally in US Dollars per lb. This is based on the American standard.

How can we define a benchmark prices?
It must be global: A benchmark price must be global in nature. The benchmark prices need to be arrived at scientifically based on costs and value.

It must be accessible to all: Benchmark prices must be made available at a definite time and accessible to all traders.

Definite in Terms: The benchmark price must be in an internationally accepted currency and designated for a unit of produce and a fixed point.
It must be easy to refer in a way that will enable participants in physical trade to measure the following:

- **Time differences** - e.g. present to forward price reflecting storage and interest cost

- **Place differences** - e.g. the cost of transportation from place of reference to the destination

- **Quality differences** - e.g. to establish the differential of a superior grade over the reference price and a inferior grade to the reference price

- **Value Differences** - When there is a perception of value by the customer, which needs to be referred to against the standard, grade e.g. specialty, organic, taste, value added etc.

- **Classification** - Enable participants to reduce or increase value based on nature and classification of produce. When there is a perception of value by the customer, which needs to be referred to against the standard grade, e.g. specialty etc., this can be referred to as a premium over the benchmark prices. Similarly, when there is a value reduction, it will be at a discount to the benchmark price.

The evolution of a benchmark price requires understanding and cooperation amongst all members of the cashew value chain and stakeholders. It has to evolve and then accepted. The world is increasingly dominated by the market economy and economic efficiency will be a rule than an exception. Sufficient resources must be devoted to develop a mechanism for benchmark pricing and it will be hugely positive for the cashew economy, which can be considered as a "growth" industry.

Benchmark price Cashew commodity India/ ggp /26.5.2008

Value Chain in Cashew Trade

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A value chain is a concept developed in modern business management, which describes the flow of a product from the producer to consumer. The conversion of agricultural produce from primary stage of production of raw cashew and delivery to the secondary stage of manufacture involves purchasing, processing, logistics, manufacture, trading and preparation for selling to final consumer.

Each operator who handles the product needs an intermediary and a stakeholder who provides the needed service. Intermediaries are traders, brokers and handlers who buy, hold and sell the produce till it reaches the final consumer. The produce is transformed at each stage of handling.

Cashew in its raw form is a tropical produce. It is produced in three prominent nations India, Vietnam and Brazil. About 20 other countries, mostly tropical produce the rest of raw cashew production. Further process is required to make it fit for consumption and is valued across the world. It is consumed in almost all nations, but heavily in OECD countries and now recently, in India and China.

Brief History of Intermediation

India was a prominent exporter (99% of world production) and USA was a prominent consumer till the late 1960s. Therefore, world market was dominated by Indian and US interests. There was sufficient rivalry and information to ensure a semblance of "perfect competition".

Cashew exporter was a manufacturer exporter in India. A broker was called an agent who was an intermediary in USA who acted as an exclusive agent for the Indian exporter and sold the cashews to importers in USA. Importers were traders who imported and paid for the cashews, stored them in warehouses and in turn sold it "users". Users, were companies who engaged in roasting, salting, canning and distributing the cashews into chains for consumption. The business flourished through the cable. It was direct or coded depending on the intricacy of the trade and how it needed to be conveyed.Telephone was not in vogue at all as international calls commenced from Quilon and Mangalore only in the late 70s.

The agents used to visit India once in a year to renew their ties and make assessments and if the exporter could afford it, he would make trips to New York. It was sufficient to have an introduction to a good broker and the good broker introduced you to the range of importers.

An important fact to note is that the brokerage system was exclusive by agreement.

This enabled the relationship to develop with all the importers. The competition amongst brokers was sufficiently good enough to support the large number of shippers. Before the Brazilian industry emerged, India was the sole supplier to the USA. There were sufficient numbers of large and small cashew factories to provide a stream of cashews.

Price fluctuations were also the order of the day as much as they are now but they were neater and orderly.

The market for all grades was established in hierarchy. The law of contracts operated. Prices were on the basis of offers and acceptance. When market for buying was overactive, buyers issued bids, which were a good basis for the sellers to make their decisions.

The standard of trading developed was in US Cents per lb or US D per lb. Eg., 270 indicated in cents and 2.7 indicated in Dollar. The standard of packing was two tins of 50 lbs each. Initially wooden crates were used and sent in break bulk in steamers. Containers became the vogue in the 1980s and then standard since then.

Whenever a person in the trade, refers to what's the market? It was always the pivotal grade W-320 and the rate was mentioned as 260 it means 2.6 USD per lb.

The trade became universal in that currency as any trader anywhere in the world would prefer to trade in the same currency as the USA. This system has been in vogue since then.

The American system worked in a very simple way. The business itself was hard though. If you had cashew to sell for any month from today to the 10th month, you could offer it. It could be at the same price or the variable

price. The Agent issued a telegram confirmation, which was as good as a valid contract. The Contract followed. Agents, importers and users were members of the Association of Food Importers (AFI), and followed the AFI standard Contract and rules.

The invoice showed a deduction of 5% from invoice value. Two and half% was paid on acceptance of the cargo and two and half% was the deduction of commission paid for by the seller but remitted by the buyer from the proceeds of the invoice.

The prices fluctuations were on 5-cent ticks. For instance if the price today is 270 then the price declined it was in the range of 265, 260, 250 and so on. Rarely business took place on decimals if there was a fight between buyer and seller. The payment stipulation was LC to be opened one day prior to the beginning of the month.

The cashew economy till the late 1970s was dominated by USA and interrupted by bilateral trade with Russia. Eventually, Brazil came into the picture and USA had another source along with Mozambique and Tanzania who became processors. In 1980s manufacturing in Africa declined and India began to grow in world supplies. This was due to the emergence of around 24 nations who began to cultivate cashews and India became the world's dominant buyer. Today the number of players in cashew globally has multiplied.

Currently intermediation is done in different ways. It serves bilateral interests but also generates problems, which affect standardization andhomogeneity. A new order in intermediation is called for. This has to be done by all stakeholders communicating effectively.

Intermediation:
Intermediation takes place in the following ways – trader, broker, manufacturer, logistics provider, value added process and final outlet to consumer. The trader, brokers and logistics provider may be multiple in the chain and usually manufacturer, value added process and final outlet remain in the chain for the produce.

Traders:
Traders buy and sell. They buy produce from agriculturists and sell to

the manufacturer. Another group buys cashew kernels and sells to the merchandiser or retailer as the case may be. Traders perform time and place functions. The trader earns the margin (or may lose it) when there is a transaction of selling and buying. A trader physically handles the merchandise or has a third party who handle it. Traders take their place between:

- Agricultural producer and another trader or manufacturer
- Manufacturer to processor
- Manufacturer to another trader or retailer

Brokers:

Brokers are individuals or firms who act as intermediaries between two firms and arrange the information prior to a sale. Brokers take a fee called brokerage, which usually is a percentage of sale value. Brokers can have a role in any transaction between buyer and seller in the entire value chain. There can be a minimum of two brokers from agricultural produce stage to final consumer or more.

Manufacturers:

Making cashew kernels out of raw cashew is manufacture. Many believe it's merely a "process". Manufacturers buy raw cashew nuts and convert it into cashew kernels in an elaborate process. They are the key intermediaries between agricultural producers to final consumer. Manufacturers incur the highest cost in terms of value added at the secondary stage.

Processors:

Processors are intermediaries who handle the produce of kernels and add value. Adding value can be in the form of roasting and other forms of value addition, which make it acceptable to the end consumer. They can be as small as 2 kgs a day to 150 tons per day.

Retailers:

Retailers buy from traders or processors and are the last point to the consumer. In OECD countries the highest value is in retailing which takes off up to 45 to 50% of the shelf price of a cashew pack.

Factors in intermediation:

"One can eliminate the middleman but not his functions" is a commercial saying. How crucial is the value of intermediation at each point in the

cashew value chain needs to be determined. Currently, it looks minimal in terms of intermediation costs, as net margins at each stage of process are not very high, as it seems.

Cashew is a high value product. Currently, the wholesale value of cashew is Rs.350,000 per metric ton and retail value is any where between Rs.700,000 to Rs.900,000 per metric ton. Therefore, liquidity is easier in cashew as it is a sought after material. There is a long way to go to generate sufficient surpluses in cashew that can lead to marketing. We therefore need to go into all aspects of the Cashew Value Chain.

Conclusions:

Cashew is a paradox where we can say that bilateral trade is highly efficient but inefficiencies exist in the value chain apparently when one looks holistically. The justification at each level of intermediation and handling makes reasoning that at the bilateral level trading is highly efficient and cost effective. We need to reconcile both and bring in effectiveness.

- Gains will accrue from consolidation in an industry which is fragmented in origin.
- Information flow, encouraged from producer to consumer and vice versa will improve value to all stakeholders in the cashew value chain
- Cashew value chain stakeholders need to make a holistic understanding of the product, its nature and the behaviour of participants in various contexts.
- There will be a drastic change in the way cashew is handled three years from now.

Marketing Initiatives from the Government for the Development of Indian Cashew Trade

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Cashew is an important agricultural commodity in India, earning about Rs. 2500 crores (US $ 570 Million) of foreign exchange per annum. This amounts to 0.35% of the total foreign exchange earnings of the country through exports.

The industry provides employment to more than 10 lakh workers in the trading, processing and the farming sectors. India is the largest producer, processor, exporter and consumer of cashew kernels in the world. Our cashew kernels are exported to more than 60 countries in the world, mainly to USA, Netherlands, UK, Germany, Japan, Australia, UAE, etc.

The total world exports of cashew kernels was 2,93,077 tons during 2007, of which India's share was 1,15,265 tons constituting 39.33% of the total. Until a decade back, India and Brazil were the major players in the world cashew market. Of late, Vietnam has also entered into the fray. The percentage share of Indian cashew in the international market has come down from 44% in 2003 to 39% in 2007.

The main factors affecting our market share and export performance are insufficient production of domestic raw cashew nuts and competition from other cashew producing countries mainly Vietnam. The entry of Vietnam has caused a fall in international prices. Competition from other nuts like almonds, macadamias, pistachios, etc., which are promoted on the basis of health claims, un-remunerative international prices, high cost of production etc., are the other reasons for the decline in export performance.

The Directorate of Cashew nut and Cocoa Development (DCCD) under the Ministry of Agriculture is the organization looking after the production development of raw cashew nut in India.

The Cashew Export Promotion Council of India (CEPCI) was established by the Govt. of India in 1955, with the active co-operation of the cashew industry, with the object of promoting exports of cashew and allied products from India. The Council provides the necessary institutional framework for performing the different functions that serve to intensify and promote India's exports of cashew and allied products.

At present, the CEPCI has 162 cashew exporters as its members from various parts of India. The Registration-Cum-Membership Certificate (RCMC) given by the Council enables the members to avail all eligible assistances/incentives provided by the GOI from time to time.

CEPCI acts as a nodal agency for implementation of Government supported schemes for development and promotion of export of Indian Cashews. The Govt. of India has recognized the economic and social importance of this traditional and labour intensive industry. It has been extending financial assistance to undertake various promotional activities for the upgradation and modernization of the cashew processing units and improving the quality of the product. There by generating more demand for our cashew kernels and increased price realization for Indian cashews in the world markets.

The CEPCI undertakes various programmes / activities like participation in the international food fairs, international conventions and seminars, sponsoring trade delegations, market surveys, disseminating trade enquiries, market information, publishing statistics, journals, etc., organizing buyer seller meets, implementing schemes for assisting exporters to improve quality of cashew kernels exported etc., under the Marketing Development Assistance (MDA), Market Access Initiative (MAI), Assistance to State for Infrastracture Development of Exports (ASIDE) and Five Year plan schemes of the GOI. These programmes help the Indian cashew exporters to be more competitive in international markets.

Since raw cashew nut production in the processing states is not adequate, raw nuts are being sourced from other cashew growing states. The raw nuts so purchased attract a CST @ 3%. In order to enable our cashew processing/exporting industry compete with low priced kernels from other countries, the Govt. of India could consider exempting raw cashew nuts from the levy of CST. Walnuts have been exempted from VAT in

order to help the farmers in Jammu and Kashmir. Removal of CST and VAT for cashews would help thousands of farmers and processors in more than 10 states and also lakhs of workers in the farm and factories.

There has hardly been any incentives/ special benefit from the Govt. of India for export of cashew kernels as compared to most of the other similar agro products in India. Domestic prices for cashew kernels are generally higher as compared to the international prices. Though the raw material cost and cost of production has increased considerably in the recent years, processors are persisting with exports mainly because they don't get buyers for large quantities and higher-grade varieties in the domestic market. As the margins are very thin, they have to do huge volumes and for this they have to depend on exports. The industry is highly labour intensive and provides direct employment in the factories to more than 5 lakhs workers, mostly women from the economically and socially backward sectors.

The cashew processing industry in India thus deserves encouragement from the Govt. of India in the form of sufficient export incentives in view of its huge employment generating potential. One ton of Cashew kernels exports would roughly generate 400 man-hours of work.

The incentives currently available to cashew exporters are:

1. DEPB @1.5% or Drawback @ 1% of FOB value of exports of Cashew Kernel
2. VKGUY @5% of FOB value of exports of Cashew Kernel, CNSL and Cardanol.

The export of cashew kernels from India during 2007-08 was 1,14,430 tons valued at Rs.2288.90 crores as against an export of 1,18,540 tons valued at Rs.2455.15 crores during 2006-07. There was a decrease in the export price of cashew kernels during the year. The average unit export price realized during the year was Rs.200.18 per kg compared to Rs.207.12 per kg during 2006-07 recording a decrease of 3.35%.

The processing facilities in India being relatively old and lack the modern technology. Due to restrictive guidelines and rules for MDA from the Government, the Council was not able to undertake much promotion activities during the period 2003-06. The continued fall in the value of US

$ during the last one year or so has affected Indian cashew exports very severely, leading to drop in exports.

The Foreign Trade Policy (FTP) 2005-09 has announced important export promotion schemes like the 'Focus Product' scheme with a view to incentivise export of products which have high employment intensity in rural and semi urban areas. This offsets the inherent infrastructure inefficiencies and other associated costs involved in marketing these products. VKGUY is to promote export of fruits, vegetables, flowers, minor forest produce, etc. and their value added products by incentivising exporters of such products. Even though cashew qualifies for both the schemes in all aspects, it was left out from both these schemes. The Council had taken up this at all levels and the Government has been kind enough to allow VKGUY for cashew for the period 2004-05 and from 01-04-2007.

As an initiative to develop exports, the Govt. has abolished the export cess. This has come as a relief to the cashew industry.

To create more demand and make Indian cashews more competitive in the International markets, the Council implements various programmes under the MDA and MAI schemes of the Ministry of Commerce, Government of India.The programmes include sponsoring trade delegations, participating in international fairs, conducting market studies, creating awareness through advertisements on the health and nutritional aspects of cashews and free sampling of the products in trade fairs, etc.The Council participates in major international food exhibitions in selected destinations to retain our existing buyers, to explore new markets, to identify potential buyers and to project India as the worlds largest and reliable supplier of cashews who can supply any grade, any quantity at any time of the year, irrespective of the fact that cashew is a seasonal crop.

During 2007-08, the Council participated in three international fairs viz. Fancy Food Show, New York, USA; World Food, Moscow, Russia and Anuga fair, Cologne, Germany utilizing the MDA assistance of the Govt. of India. Member exporters participated in these fairs through the Council stall and generated good business for their products.

Under the MAI scheme the Council conducted has two market studies, one in USA and the other in Japan during the year 2002-2003. These studies were conducted by top consultancy agencies viz. M/s. Tata Consultancy Services and M/s. KPMG respectively at a combined cost of Rs.107 lakhs. The study results were circulated among the members of the Council and to the Govt. of India for approval to conduct health and nutrition studies.

The Govt. had extended assistance, under the MAI scheme to conduct buyer seller meets in India/abroad which facilitated renewal of existing contacts, building new ones, generation of new business and dissemination of our products, quality etc. During 2001, the Council had organized world's first ever "World Cashew Congress" in Kochi bringing all the cashew related countries, producers, processors and buyers in one place. In September 2006, the Council organized KAJU INDIA 2006, the first buyer seller meet at Kovalam, Trivandrum. 245 delegates including 45 foreign delegates participated in the meet.

The CEPCI along with national associations of other major cashew producing countries viz. VINACAS of Vietnam and SINDICAJU of Brazil is in the process of formation of the Global Cashew Alliance to promote cashew in the global markets based on the nutrition and health advantages of cashew.

Another initiative from the Govt. is to encourage manufacture and export of value added products, which would increase the value realization as well as job opportunities in the country. A proposal to provide financial assistance to exporters of cashew kernels in value added consumer packs for undertaking intensive marketing campaign in UAE market has been submitted by the CEPCI for Govt. approval under the MAI scheme. Once this proves successful, the proposal can be extended to other potential markets.

The Five Year Plan schemes of the Govt. of India extending assistance to cashew exporters for upgrading and modernizing their processing and packaging facilities, for acquiring latest packaging facilities, for acquiring internationally accepted quality certification like ISO/HACCP etc. This has proved very effective in empowering the exporters to improve their productivity, quality standards and preparedness to face the emerging

challenges in the international marketing. The Council has been preparing and operating the Five Year Plan schemes for the benefit of the cashew industry and during the IX and X plan period, 180 units have upgraded their facilities availing a total grant of Rs.5.93 Crores.

For the XI plan, the 'Modernisation and Diversification Scheme' is available for modernization of cashew processing factories. The scheme has a total outlay of Rs.19.36 crores for 2008-09 to 2011-12. It has the following four components:

i) Process upgradation/ modernization of Cashew processing units
ii) Setting up facilities for value addition / consumer packing of cashewkernels
iii) Adoption of new packaging systems
iv) Implementation of internationally accepted quality systems like ISO, HACCP, Organic, etc.

Quality has emerged as the key factor deciding whether a product gets into the mainstream global market or falls by the wayside. Only with long-term commitment to quality can exporters survive and grow into today's intensely competitive environment. Understanding the need of the hour, the Govt. of India has extended full support to the CEPCI's move to establish the CEPCI laboratory and technical division at Kollam in 1997. The Govt. has provided financial assistance under the Five Year Plan Schemes for establishing the laboratory. Assistance under the ASIDE scheme was also granted for upgradation of the division and for construction of 'Cashew Bhavan' at Kollam for housing the CEPCI laboratory and R&D center.

India has been the largest producer, processor and exporter of cashew kernels in the world. Even though our share has come down considerably, we are still the largest in cashew trade. With the assistance of the Govt. of India, the industry has been trying to overcome the difficulties in developing our markets in the domestic as well as the international sectors. However, the industry needs more encouragement, assistance and support to survive and to retain its No. 1 position as a world leader in the cashew trade.

A Comparative Study of the Specifications of CEPCI and AFI for Cashew Kernels

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The cashew industry in India was started in a very small way in 1920s. A small consignment was shipped to U.S, which was packed in wooden containers lined with newspaper. From this stage the industry has grown in various sections like production, processing, packing, shipment etc. Quality was considered as the supreme point for the development of this industry. In 1995, under the Ministry of Commerce Government of India has formed 'The Cashew Export Promotion Council of India (CEPCI).The CEPCI has stipulated certain specifications for shipment of cashew kernels from India. In 1964 Govt. of India has formed "The Export Inspection Agency" (EIA) which took over the pre-shipment inspection and certification of cashew kernels from CEPCI and made it Mandatory with effect from 1st April 1966. In early 90's the compulsory pre-shipment inspection was revoked due to the liberalization policy of the Govt. of India; but the specification for cashew kernels meant for export remained the same. The Association of Food Industries (AFI) of U.S. had also stipulated certain standards for the imported raw cashew kernels to US. Both the standards are almost the same. Here is a comparative study on both the standards:

Nomenclature:

The nomenclature of different quality grade varies in the two standards. In CEPCI standard the terminologies used are white wholes, white broken, scorched wholes, scorched broken, dessert wholes and dessert broken. These broad quality grades have further been sub-divided.

AFI standard uses the following nomenclature: "First quality, second quality, spotted / scorched, third quality / special scorched, fourth quality, dessert, butts, splits, large pieces, small pieces, small Brazilian pieces and granules."

A comparative statement of different quality nomenclatures are given below:

AFI	CEPCI
Whole / First quality	First quality / Fancy
Extra-class/ Fancy	
Scorched / Second quality	Second quality
Class I	Scorched
Dessert/Third/Fourth quality	Third quality
Class II	Special Scorched
Third quality	Dessert
Fourth quality	
Dessert	

For the same quality different nomenclatures are recognized in all the two standards so that at least one nomenclature is common for the same main quality grade.

In the case of broken the nomenclature and the size of the pieces are same in all the two standards. In AFI standards, an optional grade viz., small Brazilian pieces also has been included in between small white pieces and baby bits, with the size of pieces as same.

Size Grade:

AFI			CEPCI		
Grade	Count/lb	Count/kg.	Grade	Count/lb	Count/kg.
W180	120-180	266-395	W180	120-180	Below 395
W210	180-210	395-465	W210	180-210	Below 465
W240	220-240	485-530	W240	220-240	485-530
W320	300-320	660-706	W320	300-320	660-706
W450	400-450	880-990	W450	400-450	880-990

The size grade and count ranges are same except in the case of W 180. There is one more grade viz. W150 in CEPC standard.
Size grade is compulsory in white wholes, in all the standards. In all the standards under scorched size grading is optional.

The tolerance for different defects is tabulated below (in percentage)

No	Type	Quality	AFI Tolerance	Type	CEPCI Tolerance`
1	Moisture		5%		5%
II	Brokens		5%		5%
III	Grade	1st Quality Fancy	2nd Quality – 5%	W180.W210	6% (NLSG + NLG)
			3rd Quality- 1.5%	W240, W320	
			4th Quality- 0.5%	W450, W500	
			Dessert Quality-0.5%	B.S, LWP, SWP	
			7.5%	BB	
					1% (Cashew Powder)
		2nd Quality	3rd Quality-5.0%	SW, SW180	NLSG + NL (7.5%)
			4th Quality-1.)%	SW210, SW240	
			Dessert Quality-2.5%	SW320, SW450	
			SW500, SB, SS, SP		
				SSP	DSP (5%)
		3rd Quality	4th Quality-1.0%	SSW	DW (7.5%)
			Dessert Quality-2.5%	SPS	DP+DSP (7.5%)
		4th Quality	2nd Quality-5.0%	-	-
			3rd Quality-2.0%	-	-
		Dessert Quality	-	DW	-
			-	DP	DSP (7.5%)
IV	Superficial Damage (Scrapes)		1st Quality -1.0%		Scraped kernels also permitted provided such scrapings does not affect the characteristic shape of the kernels
			2nd Quality -2.0%		
			3rd Quality-5.0%		
			4th Quality-1.0%		
			Dessert Quality-no limit	(For all grades)	
V	Adhering Testa		1st Quality-1.5%	Nil	
			2nd Quality-1.5%	Nil	
			3rd Quality-1.5%	Nil	
			4th Quality-1.5%	Nil	
			Dessert Quality-5.0%	Nil	
VI	Insect Damage		1st Quality-0.5%		Infestation not allowed.
			2nd Quality-1.0%		
			3rd Quality-1.0%		
			4th Quality-1.0%		
			Dessert Quality-1.0%		
VII	Mold Rancidity Decay		1st Quality-0.5%		Not allowed
			2nd Quality-1.0%		
			3rd Quality-1.0%		
			4th Quality-1.0%		
			Dessert Quality-1.0%		
VIII	Foreign Matters		FQ, SQ, TQ, FQ, Des Q (All grades) – 0.05%		Not allowed
IX	Speckled/ Spotted Kernels		1st Quality- not allowed		(WW, SW, B, S, LWP, SB, SS, SP, SSP) Not allowed
			2nd Quality – no limit		
			3rd Quality- no limit		
			4th Quality – no limit		(SSW, SPS, DW, DP) No limit
			Dessert Quality – no limit		

CEPC: For 'whole' kernels that have been size graded, the quantity of kernels of Nnext Lower Size Grade (NLSG) shall not exceed 5% by weight for white, scorched and dessert at the time of packing. For 'whole' kernels, the quantity of brokens and pieces together shall not exceed 5% by weight for white, scorched and dessert at the time of packing.

For 'butts' and 'splits', the quantity of pieces present shall not exceed 5% by weight for white, scorched and dessert at the time of packing. For 'pieces' grades, the quantity of the NLSG shall not exceed 5% by weight for white, scorched and dessert, at the time of packing.

In the standard formulated by CEPC, if 7/8 portion of the kernel is intact the same is considered as "wholes". In the case of splits also the same concept is being applied. There is no tolerance prescribed for this defect and even if the entire kernels are broken at the tip to the extent mentioned, such kernels are being considered as whole and splits as the case may be.
AFI: The quantity of broken kernels or pieces in "whole" kernels shall not exceed 10% by weight. The quantity of pieces present in "butts" and "splitted" shall not exceed 10% by weight. The quantity of the next lower size grade in "pieces" shall not exceed 5% by weight.

Broken:
AFI allows a tolerance of 10% in "whole" "butts" and "splits". In the case of pieces next lower grade is allowed up to 5%.
CEPC standards permit 5% tolerance uniformly.

Presentation:
AFI: New, clean, dry, leak proof, lead free containers with airtight seal. Packaging should be sufficiently strong. Outer container shall be new cardboard cartons free of infestation, visual mold and sealed without using staplers. The contents shall be uniform.

CEPC: Packed under inert gas or vacuum.
Either consumer pack specified by the buyer or bulk packs in 10 kg., 11.34 kg. (25 lbs. or 20 kg). In each package contents shall be uniform in quality and size.
Each package shall be marked with:

- Name of the product
- Grade or trade name or brand name

- Name and address of the packer
- Buyer's name or marks
- Net weight
- Origin of product
- Destination.

AFI standards specifically state to use only lead free containers. CEPC standard does not mention this specifically. Other details with regard to packaging, type of product and marking are practically same. AFI standards even though does not mention vacuum / inert gas, it is implied and states that the kernels have to be packed in hermetically sealed containers.

Others: AFI specification stipulates that all shipments should be inspected prior to loading and shall be carried on conveyances suitable for transporting food products in good condition i.e., free of odours, insect or mold damage, rodent activity and all other foreign materials.

Mozambique Cashew Industry Challenges for 2008

Mr. Carlos Costa
President Executive committee, African Cashew Alliance

Mozambique has a huge challenge ahead to catch up other African countries, particularly with the West African countries, which are the major cashew producers in Africa, in producing raw cashew nuts in greater quantities and better quality.

Unfortunately the efforts developed to reorganize the cashew sub-sector in Mozambique have been damaged by several natural calamities. This year the cyclone "Jokwe" that struck the Northern part of Mozambique in particular Nampula, the most important cashew producer province and Zambézia province, destroyed thousands of homes, several health posts, classrooms, and mosques, and knocked down electricity pylons, cutting of the power supply to the main villages in the coastal zones. The cyclonic winds has also destroyed partially two of the main cashew processing units from Miranda industrial and a farm of 150 ha, causing losses calculated to be about USD 250 thousands, besides the damages on the raw cashew nuts due to the heavy rains that followed the winds. So far it is not known the extension of the cashew orchard losses, but it is reported that in some areas most of the trees fell down and the farm plots were completely devastated, announcing difficult times ahead for the rural families.

In Mozambique, virtually there is no entrepreneurial cashew orchards. Therefore, this kind of disasters aggravate the already precariously position of the smallholders, the main cashew producers, within the cashew value chain. On the other hand, due to the geographical dispersion of the smallholders, normally possessing in average 0.5-2 hectares with some cashew trees, it has been difficult to implement programs that can have a positive impact on the income of the rural families involved in this activity, what drives to a very slow recovering of the raw cashew nut production.

In fact, presently productivity among farmers is still very poor and profits are low:

- Per tree cashew yields average 2.5-3 kilograms; this explains the low production volumes registered by Mozambique in the last decade, in average 60,000 tons.

- In average smallholder sells less than 100 kilograms per year. In average the price to the producer this season 2007/08 was around 55 US cents per kg.
- Farmers sell into commodity markets at US $0.35-0.60 per kilogram; average annual farmer income from cashew thus ranges from US $35-60.
- Outturn is one of the poorest in Africa 42-46 against 50-56 from India, Vietnam and some countries from West Africa.

To overcome this situation, it is necessary to take into account two issues that seem to be determinant in preventing the recovering of cashew production which are:

1. Farmers rely upon single export market (India) and since West African raw nut is available with better quality, demand for Mozambican production is declining.
2. Lack of buy-side investment in farmers' output because of Distance between Mozambican farmers and their primary market (Indian processors) prevents mutually beneficial relationships being developed. Limited incentive or ability for smallholders to invest in productivity and/or to improve the quality of their crop, and Labor-intensive shelling method suitable for small & medium-scale factories (1000-2500 tons) to mechanized shelling and peeling adjusted to small-scale processing more appropriate for larger units able to provide economies of scale with a minimum capacity of 5000 tons.
3. Lack of financial support for small and medium scale planting, bush fires etc.

First trials proved the efficiency of the new mechanized peeling equipment from Oltremare but for shelling the level of efficiency of mechanized equipment is still far from being acceptable when compared with the manual shelling in use. Efforts are now being done with Oltremare to improve the small medium scale mechanized shelling to achieve better performance, meanwhile most of the existing processing units will adopt the mechanized peeling equipment this year.

Besides the adoption of up-dated technology in a certain way dictated for the need to lower down the labor costs to accommodate the statutory minimum wage enforced by Government for 2008, processors in Mozambique are now discussing with the Government to approve

the payment by productivity, which provides important incentives to processing workers. On the other side processors will sign an agreement with the national cashew workers union to improve workers' welfare by numerous non-wage related measures, such as guaranteeing minimum safety and hygiene conditions and ensuring uniformity and transparency in factory operations. This measures together with the gradual introduction of quality systems such as HACCP, being done in a couple of factories will allow the international certification of the processing units, a crucial step to build industry reputation.

Before this picture, for 2008 Mozambican processors decided to place efforts together with other cashew stakeholders mainly the Government specialized institutions, in addressing the following key issues:

a) Restructuring of production base with export tax review and promotion of replanting within commercial and family sectors.
b) Defining the labor environment on the basis of productivity and competition with other countries. Improving infrastructures (roads, water, energy) and procedures on export
c) Investing on improved warehouses for raw material to be used in warehouse receipt scheme as bank guaranty.
d) Investing in quality systems, including hygiene and labour security.

Bio-Fuel Production Potential of Cashew Apple

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Bio-ethanol: Researchers all over the world are looking for alternative sources of energy, to meet the energy requirements of the population, as the renewable energy sources are depleting fast. USA and Brazil have already gone ahead in research and commercial production of bio-energy in a major way. In the recent years bio-ethanol is identified as an important renewable source of energy, which is clean and usable in combustion engines. Today bio ethanol is considered as the fuel of the future and United States is the world's biggest bio-ethanol manufacture. It is true that ethanol is more expensive than the fossil fuels. However, it is an uncontaminated fuel, producing only smaller quantity of air pollutants and safer and greener to the environment. Ethanol is an alcoholic fuel prepared from the sugars found in corn, sorghum, wheat, potato, cassava, rice, sugarcane, sugar beets etc.,

Utilization of food crops for the production of bio-fuel often invite severe criticisms as it may hamper the food security of billions of people. Today, the whole world is passing through a very critical phase as the human race as a community is facing serious threats of food security, drinking water security, energy and environmental security. The effect of global warming coupled with increase in water scarcity poses many challenges to food security of our planet. Hence, utilization of non-food crops and resources for the production of bio-fuel would be a more rational approach to address the energy issues. In this context, cashew apple, an important organic resource generated in cashew plantations and wasted in large quantities becomes a very attractive substrate to produce ethanol.

Cashew nut production: Cashew cultivation in the world is centered around the equator and spread over in 30 nations. Food and Agriculture Organization statistics indicate that the total world production of raw cashew nuts is 2.34 million tons from a global area of 3.09 million ha. The details regarding country wise cashew nut production is presented

in Table-1. Vietnam, Nigeria, India, Brazil, Indonesia, Philippines, Ivory cost, Tanzania, Guinea-Bissau and Mozambique are the first ten major cashew nut producing countries of the world. Vietnam produces 0.9 million tons of cashew followed by Nigeria (0.6 million tons) and then India (0.6 million tons).

In India, cashew is grown in an area of 0.84 million ha. mainly in the states of Andhra Pradesh, Maharashtra, Tamil Nadu, Orissa, Karnataka and Kerala. Cashew industry today uses only the raw nuts for the manufacture of cashew kernels and almost the entire quantity of the cashew apple remain wasted in the plantation itself, except in certain places like Goa.

Cashew apple production: Cashew is grown mainly for its highly nutritious and delicious kernel, which has got great demand in the international market. The cashew apple is a pseudo fruit containing sizable amount of starch and the same can be effectively used for the production of ethanol. In Goa, cashew apple is utilized for the production of *fenni*, which is a liquor containing 40 to 45% ethanol. A small quantity of cashew apple is also used for the production of various products like juice, jam, candy, pickle etc.,

The ratio of raw cashew to apple generally varies from 1:5 to 1:10. Taking a modest ratio of 1:7, it is estimated that the cashew plantations in the world can generate about 21.7 million tons of cashew apple. The estimated potential of cashew apple production in Vietnam is 6.59 million tons (Table-1), that of Nigeria is 4.45 million tons and that of India is 4.01 million tons.

Potential for bio-ethanol production from cashew apple: Fresh cashew apple contains 9.5 to 10% carbohydrates, in addition to varying quantities of fats, minerals and vitamins. It is estimated that cashew apple can yield 8 to 10% of ethanol. Every kilogram of raw nut generates apple equivalent to produce 500 to 600 ml of ethanol of about 70% purity. This indicates that there is a huge potential of generating ethanol from cashew apple. As such, the use of cashew apple for ethanol production assumes greater significance. Technology for the production of ethanol from cashew apple is available and the same can be utilized for ethanol production. However, it is necessary to take up further research to evolve an efficient technology for getting a better recovery of ethanol from cashew apple.

The estimated potential of ethanol production in 10 major cashew nut producing countries is shown in Table-1. It can be seen that the cashew apple produced in the world can generate about 1.7 million tons of ethanol. The ethanol production potential of Vietnam is estimated at 0.5 million tons, that of Nigeria is 0.4 million tons and that of India is 0.3 million tons. In India, Andhra Pradesh, Maharashtra, Tamil Nadu, Orissa, Karnataka, Kerala and Goa are the major cashew growing states with excellent potential for ethanol production (Table-2). Maharashtra has a potential to produce 1,02,000 tons of ethanol, followed by Andhra Pradesh (52,000 tons) and then Tamil Nadu (31,000 tons). It is quite possible to utilize at least 50% of the apple generated and as such cashew apple offers tremendous scope to meet the energy crisis without affecting the food security concerns.

The Government of India has already approved 10 to 20% mix of ethanol with petrol in the automobiles. Efforts are being made in the country for the large-scale production of bio-fuels from various organic sources like sorghum, wheat, maize, sugarcane etc. But attempts are meager or none to utilize the cashew apple for ethanol production, although technology is very much available for the same. Participation of private sector entrepreneurs must be encouraged for the production of ethanol and Governments must initiate appropriate action in this direction. In India, the main cashew growing states should initiate action to utilize cashew apple in a big way. Impediments if any exist in our way for the translation of this possibility to action, Governments must take suitable actions to eliminate such constraints so that large quantities of bio-fuel can be generated from bio-waste *namely* cashew apple.

Table-1. Cashew nut production and estimated potential of cashew apple and ethanol yield- country wise

Countries	Cashew nut (tons)	Apple (tons)*	Ethanol yield (tons)**
Vietnam	941600	6591200	527296
Nigeria	636000	4452000	356160
India	573000	4011000	320880
Brazil	236140	1652980	132238
Indonesia	122000	854000	68320
Philippines	113071	791497	63320
Côte d'Ivoire	93970	657790	52623
Tanzania	90400	632800	50624
Guinea-Bissau	85200	596400	47712
Mozambique	68328	478296	38264
Benin	41000	287000	22960
Thailand	25861	181027	14482
Ghana	16000	112000	8960
Malaysia	13910	97370	7790
Kenya	11225	78575	6286
Madagascar	6816	47712	3817
Sri Lanka	6810	47670	3814
Senegal	4500	31500	2520
Burkina Faso	3500	24500	1960
El Salvador	2810	19670	1574
Peru	2213	15491	1239
Belize	1931	13517	1081
Honduras	1800	12600	1008
Mexico	1165	8155	652
Angola	1076	7532	603
China	1000	7000	560
Dominican Republic	973	6811	545
Guinea	850	5950	476
Togo	300	2100	168
Bangladesh	1	7	1
Total	3103450	21724150	1737932

** Estimated Cashew apple production potential at 1:7 nuts: apple ratio*

*** Estimated ethanol production potential at 8%*

Table-2. Cashew area, raw nut production, and estimated cashew apple and alcohol yield in different states of India

State	Area (000ha)	Production (000 tons)	* Apple yield 1:7 ratio (000 tons)	**Ethanol yield (000 tons)
Andhra Pradesh	170	92	644	52
Maharashtra	160	183	1281	102
Tamil Nadu	121	56	392	31
Orissa	120	78	546	44
Karnataka	100	45	315	25
Kerala	80	67	469	38
Goa	55	27	189	15
NE States	14	10	70	6
West Bengal	10	10	70	6
Gujarat	4	4	28	2
Others	3	1	7	1
T O T A L	837	573	4011	321

** Estimated Cashew apple production potential at 1:7 nuts: apple ratio*
*** Estimated ethanol production potential at 8%*

Annexure

Almond

Global Almond status

1. USA leads global almond industry- be it production (45% share), global trade (84%), branding and promotion (California Almond Association) and almond consumption. This is unlike Cashew, which is produced largely by developing or under developed countries. The difference is perceptible. Combinely, the three major producers of cashew do not spend even 50% of what is spent by California Almond Association on generic promotion and health related research on almonds.
2. The supply chain of almond is relatively simple compared to Cashew. Cashew moves around the globe before being consumed. In an environment of increasing energy price and therefore high transportation costs, it may be an unsustainable model. New ways need to be evolved.
3. The focus on health benefit of almond has been one of the reasons for the spectacular growth in the demand. It is important that cashew industry recognizes this and carries out extensive clinical research to establish health benefit of cashew. This would create a long-term sustainable demand for cashew.

Area under almond in major growing countries (in hectares)

Countries	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Greece	41500	40900	43000	39900	40000	39950	39953	20300	19600	18133	17611	17611
Iran	95000	69693	76933	86812	89100	96470	105067	112000	81733	161829	171977	171977
Italy	94633	92985	91166	89432	89078	88500	86708	86040	85145	84073	83124	81462
Morocco	128000	132300	137100	137000	139012	138000	137800	134141	131470	134500	141550	143000
Portugal	41512	41244	40862	40826	38874	38827	38709	38417	38113	38178	38049	38049
Spain	602900	604400	629100	630100	624300	670534	658800	648997	641688	622577	625483	635000
Tunisia	168200	168000	168200	170000	190000	201720	202340	202340	208346	212778	217709	217709
Turkey	19325	19125	18875	18400	18100	18000	17875	17500	17375	17500	17000	17000
USA	169160	173200	181220	188600	196800	202340	214483	220554	222577	230850	234900	234900
World	1534810	1530836	1569319	1588072	1607261	1676929	1690498	1675849	1644212	1715701	1746944	1760754

Source: FAO STAT

- Spain leads the acreage under Almonds with a share of 36% of the total acreage. Lower productivity in recent years has lead to a marginal decline in the growth in acreage under almond during the last 5-years.
- Sharp drop in acreage has been witnessed in Greece despite higher yield levels compared with global average.
- Sharp increase in acreage (over 13% CAGR in the last 5-year) has been seen in Iran.
- USA, the world leader in almond production, has been reported the CAGR of 2% during last 5-years.

Production of in-shell almond in major growing countries (in tons)

Countries	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Greece	57575	51359	56046	40344	60425	50956	55115	38130	36480	48177	47088	47088
Iran	79531	91129	74396	111992	95900	89637	97144	107000	38231	69989	108677	108677
Italy	90284	84140	104494	87998	103100	104755	104000	104891	91382	105245	118344	112796
Morocco	45700	33600	52700	52700	81304	65044	81820	82400	70808	60200	70629	83000
Portugal	7172	8322	12158	7501	11347	27038	15743	30850	23829	13953	13823	11166
Spain	158900	242300	388851	220439	279100	225217	254600	279396	214448	86622	217869	220000
Tunisia	35000	42000	51000	58700	58000	60000	32000	18500	40000	44000	57000	50000
Turkey	37000	43000	33000	36000	43000	47000	42000	41000	41000	37000	45000	43285
USA	276000	385500	549000	393000	631000	533000	609178	800051	786262	785462	715623	715623
World	1034427	1274146	1567610	1297411	1652615	1478313	1552825	1866225	1685672	1602572	1755521	1766127

Source: FAO STAT

- Concentration in Almond production could be noticed during the period between 1995 and 2006, with USA accounting for 40% of the production. However, there are concern in recent times about the decline in productivity of almond in USA, which has shown a negative growth of 0.6% CAGR over the last 5-year.
- Spain with one tenth productivity level as that of USA, shares only 12% of the world production despite its leadership in acreage.

Production of shelled almond in major countries (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Greece	13000	12800	14500	12000	17000	15500	13000	17000	10000	17000	14000	15000
India	0	0	0	0	0	0	1000	1100	1000	1100	1150	1200
Italy	15000	6000	11000	9000	17000	10000	18000	9000	5000	12000	12000	6000
Morocco	7400	5100	11000	8000	0	0	0	0	0	0	0	0
Spain	45300	60000	75000	30000	66000	53000	57000	66000	44000	26182	63485	68000
Turkey	13700	14300	11000	12000	14000	15500	14000	14000	13700	12300	15000	14000
USA	167829	231332	344277	235884	361362	303700	376488	494416	458582	462664	415037	496684
World	262229	329532	466777	306884	475362	397700	479488	601516	532282	531246	520672	600884

Source: Foreign Agricultural Service, USDA

Almond imports by major countries (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Greece	1000	480	3200	2600	2000	2500	2500	2500	9000	8000	9000	10000
India	0	0	0	0	0	0	24900	27000	24900	26800	22010	27410
Italy	8882	14728	15779	13781	16400	16000	15000	20000	26000	24000	26000	28000
Morocco	6	43	10	30	0	0	0	0	0	0	0	0
Spain	17900	20200	25800	26300	34000	32000	42000	49000	61000	63000	49245	44000
Turkey	384	170	3000	2000	2000	2500	1500	3000	1800	2300	1500	1500
USA	256	71	55	86	103	28	80	10035	9859	12400	14890	14800
World	28428	35692	47844	44797	54503	53028	85980	111535	132559	136500	122645	125710

Source: Foreign Agricultural Service, USDA

Almond exports by major countries (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Greece	850	260	1200	1500	2800	1000	1200	800	1500	2800	5000	4800
Italy	1729	1071	1177	1188	2000	2200	3000	3000	5000	12000	7000	4500
Spain	23600	33600	50800	40700	43000	51000	50500	59500	52000	41000	59397	61000
Turkey	227	664	100	200	200	500	500	500	500	500	600	500
USA	151999	179577	205432	183917	228171	239802	279463	325393	333551	346565	350330	375000
World	178405	215172	258709	227505	276171	294502	334663	389193	392551	402865	422327	445800

Source: Foreign Agricultural Service, USDA

- USA dominates international trade in almond with 84% share.
- Spain comes second with a 14% share; however, exports from Spain are growing at a slower pace.
- Italy and Greece though have a minor share have seen impressive growth rates.

Domestic Almond consumption by major producing countries (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Greece	15400	12500	13650	14000	14700	16000	17000	18000	18000	22000	20000	20000
India	0	0	0	0	0	0	26000	26400	26000	27310	23500	28000
Italy	22153	19657	24102	22593	30400	24800	25000	26000	31000	24000	30000	30500
Morocco	7000	6000	10800	8200	0	0	0	0	0	0	0	0
Spain	49500	51100	40000	29600	52000	38500	48500	51000	50000	50515	53000	52000
Turkey	14357	14706	14500	13800	14800	16500	16000	16000	15000	15100	15400	15000
USA	66911	72011	82791	88414	95185	95020	109070	142282	140832	133589	91154	116617
World	175321	175974	185843	176607	207085	190820	241570	279682	280832	272514	233054	262117

Source: Foreign Agricultural Service, USDA

- USA dominates in almond consumption among producers.
- Among the non-producers, India dominates with a consumption of over 28000 tons. India also happens to be one of the fastest growing markets for almonds.

Almond imports by India (in tons)

Year	Almond	Shelled Almond
1996-97	11647.61	1930.34
1997-98	18295.60	1278.15
1998-99	16676.93	2762.51
1999-00	17632.23	2725.57
2000-01	24367.30	3747.11
2001-02	21334.00	2886.14
2002-03	19089.41	2462.97
2003-04	19071.92	2442.56
2004-05	26660.64	2425.29
2005-06	24166.17	2640.36
2006-07	38289.00	7171.40

Source: DGFT, India

- Almonds both in shell and shelled have shown impressive growth in imports.
- Favourable policy for import, availability of labour near port and good demand are major reasons for increase in almond imports by India.

Pistachio

Global pistachio status

1. Pistachio originated in Iran. Kerman region, the southern heart of Iran has special composition of soil, which imparts nutrients to the pistachio. Traditional agriculture connected with modern methods provides pistachios from Iran with a guarantee of full taste and preserves their natural taste.
2. Pistachio production is cyclical, with alternative heavy and light crop years. The industry operates on a two-year marketing cycle in which processors generally hold enough inventory from on-year harvests to supply for demand during the off-year.
3. The leading countries growing pistachios are Iran, Turkey, and USA (the San Joaquin Valley in California). Approximately 98% of American pistachios were grown in California. The remaining produce comes from Arizona, New Mexico and limited quantities from Western Texas.
4. Pistachio nuts from Iran are considered to be best in the world due to their delicious taste. Since 1982, the export of Iranian pistachios has shown an increasing trend, which is easily available throughout the world.
5. Researchers at Penn State University (a study supported by the California Pistachio Commission), found that pistachios can reduce the body's response to stresses caused by everyday life. The consumption of these nuts has been increasing significantly in the past few years. According to USDA food study, pistachios are among the best sources of antioxidants, which are thought to fight cancer, heart disease and Alzheimer's diseases.

Pistachio area in major growing countries (in hectares)

Countries	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
USA	26000	26814	27880	29110	30200	31565	33590	35610	37665	42525	42525
Turkey	34981	36200	37214	37685	36349	36999	37428	37570	37572	40000	40000
Syria	18000	18000	20000	19000	18500	18500	20000	20000	20000	22000	22000
Tunisia	32000	28000	26000	24000	21670	21600	23000	23000	20910	19562	19562
China	16600	17000	17500	15000	12000	15000	15000	15000	15000	16000	16000
Italy	4000	4000	3639	3602	3602	3602	3602	3600	3607	3635	3635
Iran	231945	247130	259431	256444	274728	280510	295000	298939	431418	440025	440025
World	373375	387123	402830	395354	407523	417846	438155	444730	577108	594974	594879

Source: FAO STAT

- Iran leads in the area under Pistachio cultivation in the world with a share of 74% and it has showed a CAGR of 11.5% from 2001-2006.
- USA and Turkey accounted for 7% each of total area under pistachio cultivation.

Pistachio production in major growing countries (in tons)

Countries	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
USA	47630	81900	85280	55790	110220	73030	137440	53980	157818	128794	122470
Turkey	60000	70000	35000	40000	75000	30000	35000	90000	30000	60000	110000
Syria	24324	29428	35684	30133	39923	37436	52840	50000	40000	60000	60000
Tunisia	1000	1200	1200	1200	1600	1100	800	800	1080	1206	1206
China	30407	32307	28307	31784	24784	28865	30866	32866	35463	37464	36000
Italy	100	5000	512	2649	2768	1762	1877	1993	2400	2719	2719
Iran	260085	314000	131000	304000	112000	249000	249000	306192	184899	229657	229657
World	436077	546916	330404	478623	379809	434869	520854	547803	467156	535071	576000

Source: FAO STAT

- Iran accounted for 40% of the total production of Pistachio followed by USA and Turkey.
- USA and Turkey occupied 21% and 19% of total pistachio production.

Pistachio exports from major producing countries (in tons)

Countries	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Iran	107120	57910	124880	101220	101260	115340	136890	184960	138730	137720
USA	10920	11240	16010	13680	15650	21590	21150	23770	35690	50060
China	12030	11650	17440	19330	14240	15490	12060	16040	14080	21540
Italy	940	1180	600	1030	750	920	1210	1120	1050	1650
Afghanistan	230	1360	2250	740	1050	900	1440	1520	1220	1220
Syria	170	11180	5440	3930	4150	9760	3050	3210	1100	420
Tunisia	90	60	80	0	20	0	40	20	0	290
Turkey	1260	4330	650	530	250	4950	1950	1100	760	850
UAE	1020	1370	620	830	1190	2120	10560	14480	1030	900
World	169230	131200	195180	170380	166560	205670	218000	282960	236430	261180

Source: FAO STAT

- Iran dominates the international trade in Pistachio with a 53% share but growth rate in the last five years was 7.1% only. Though the acreage was higher in Iran, its productivity was much lower against the second largest producer USA.
- US export has witnessed CAGR of 16.6% from 2001 to 2005.

Pistachio imports by major countries (in tons)

Countries	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
China	22260	20670	27070	36570	28780	32440	45810	91950	49570	56160
Germany	46900	47500	18940	27060	25100	24970	21350	21670	21720	24770
UAE	70	14580	19390	13740	17230	25240	19710	19230	38470	22060
Luxemberg	0	0	0	0	8140	7120	10970	7910	11420	15150
Italy	14950	13160	9650	11540	9580	11070	11870	12280	13640	12580
France	11970	11140	9050	10400	8300	9500	11530	10750	14730	11970
UK	2760	4470	4180	5620	5260	5920	4700	7090	6510	11150
Vietnam	0	10	0	560	4810	7190	1790	2900	3300	11170
Israel	3050	910	910	3770	3280	4260	2880	3830	3930	5990
World	168140	187820	155690	186430	179480	211090	217620	292530	288290	266680

Source: FAO STAT

Global pistachio consumption (in tons)

Year	Iran	Turkey	Spain	China	USA	Germany	India
1990	110170	10020	8360	25910	14900	NA	840
1991	100790	53450	9090	22010	10070	21950	1030
1992	107660	NA	9710	23720	19250	14410	1670
1993	92040	62440	10180	25260	16310	7590	2150
1994	88130	3910	10320	27100	22710	9770	2780
1995	102190	NA	9970	29290	12940	15300	2960
1996	121530	67000	9020	30110	15220	16480	3350
1997	122260	83380	7870	30870	26360	12860	3470
1998	97700	NA	7290	31150	21590	3470	3710
1999	110460	2220	7560	30670	12490	6580	3980
2000	92000	100200	8750	32590	39330	9320	4290
2001	98670	NA	11190	33440	24120	8300	5230
2002	105070	NA	14460	34930	27140	6840	5670
2003	109090	86070	18660	31510	11750	4770	5840
2004	116570	120	23440	32960	29570	18420	5360
2005	125230	46320	28920	26740	25760	10280	5050

Source: FAO STAT

- Iran dominates in acreage, production and consumption of pistachio.
- The other major consumers of pistachio around the world were Turkey, Spain, China and USA. In terms of consumption, Spain has showed a tremendous growth of 27% (CAGR) from 2000 to 2005. Iran has witnessed a growth of 6% over the same period.
- China and USA have witnessed a negative consumption growth of 3% and 6.5% respectively from 2000 to 2005.

Pistachio imports by India (in tons)

Countries	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Afghanistan	1.26	157.75	219.96	158.51	683.6	344.98	437.25	989.68	1136.36	1197.69	439.88
Iran	3506.41	2979.85	3378.58	3686.59	3122.01	4702.10	4234.51	6645.24	3245.98	3067.57	3,935.32
Pakistan	135.86	45.11	5.62	26.97	12.79	79.90	5.36	NA	NA	NA	1,483.29
UAE	37.52	34.95	71.74	87.26	83.50	21.18	49.49	85.35	202.34	85.47	162.49
USA	NA	117.22	NA	150.54	136.04	195.23	90.33	635.14	307.15	0.01	30.19
Turkey	NA	NA	NA	NA	NA	308.44	24.00	12.52	10.00	NA	0.05
Others	16.88	19.41	NA	19.88	72.53	28.2	13.17	12.15	70.29	18.27	5.47
Total	**3697.93**	**3354.29**	**3675.9**	**4129.75**	**4110.47**	**5680.03**	**4854.11**	**8380.08**	**4972.12**	**4369.01**	**6056.69**

Source: DGFT, India

- Iran was the major supplier of pistachio into India i.e., it has supplied nearly 3857 tons (81.67% to the total import) of pistachio to India followed by Afghanistan (11.28 %), USA (3.67 %), United Arab Emirates, Pakistan and other countries.
- Pakistan has also supplied higher quantity of pistachio into India in 2006-07.

Pistachio imports by India (in million Rs)

Countries	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Afghanistan	0.13	32.58	51.46	34.45	159.57	75.23	104.89	229.10	261.12	304.04	172.28
Iran	334.09	458.31	552.10	556.36	531.84	834.47	745.83	1030.77	631.61	783.55	1009.63
Pakistan	17.36	8.27	1.40	6.05	2.76	16.46	1.05	NA	NA	NA	599.92
UAE	4.66	5.82	11.14	11.63	15.63	3.20	8.74	13.25	38.64	25.50	37.55
USA	NA	19.93	0.05	23.07	17.45	18.25	7.24	76.00	38.72	0.004	1.77
Turkey	NA	NA	NA	NA	NA	51.70	2.92	0.65	1.53	NA	0.02
Others	1.38	4.72	NA	2.97	5.57	2.80	1.98	1.37	11.30	4.84	1.52
Total	357.61	529.63	616.15	634.53	732.81	1002.12	872.65	1351.14	982.91	1117.94	1822.68

Source: DGFT, India

- In terms of value of pistachio imports by India, per unit cost of pistachio from Iran was cheaper i.e., Rs.256/kg when compared with Rs.390/kg for Afghanistan origin and Rs.405/kg from Pakistan during 2006-07.
- The countries other than Iran, which were supplying pistachio more into Indian markets were not major producer and they involved in re-export of pistachio. Hence, the cost of per kg produce from other countries was higher.

Walnut

Global Walnut Status

1. The origin of walnut was considered as Greece but the superior cultivated variety came from Persia to Greece. It was cultivated first in Southeast Europe, it slowly spread up to Himalayas of Asia. The harvest of this nut commences from the beginning of August to the end of September. Walnuts are the fourth largest tree nut produced in the world after cashew, almond and hazelnut.
2. At global level, China is the leading producer of walnut at 425,000 tons followed by USA (317,500 tons), Turkey (75,000 tons), France (41,000 tons), India (36,000 tons) and Chile (18,500 tons). These six countries have contributed most of the global production during 2006-07. The productivity in USA was higher and hence the output also higher with lesser area under walnut cultivation.
3. China occupied first position both in production and consumption on global level. The country exports a small portion only about 7.8 %, as its domestic consumption rules higher.
4. China occupied the major portion i.e., nearly 63% of the global consumption, which is estimated at 4,00,400 tons out of the total global consumption of 6,45,621 tons. The other major consuming countries were USA, Turkey, France and India.
5. The share of export to production was very higher in case of Chile i.e., nearly 92% of its output gets exported. France and USA are also exporting much of their production to other countries.

Walnut area in the major growing countries (in hectares)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Chile	6780	6741	7575	7400	7565	7808	7855	8650	8900	9230	9250	9250
China	150000	150000	160000	164000	165000	168000	175000	176000	180000	185000	186000	188000
France	14600	13550	12589	12871	13315	14519	14622	14948	15591	15946	16271	16614
India	28800	29120	29950	29950	30300	30200	30200	30200	30500	30500	30800	30800
Italy	4303	4300	4250	4200	4100	4000	3900	3900	3900	3900	4000	4000
Turkey	57550	57450	57420	58143	58716	59000	60496	63986	68141	68334	75584	76667
USA	78100	77700	79130	79130	79130	78100	82556	84984	86198	86670	87075	87075
World	534497	541631	549741	562759	578543	600003	613996	628123	641141	656360	670447	662978

Source: FAO STAT

- China leads in the area under walnut with a share of 28% of the total acreage. Higher productivity in recent years has resulted in higher area under walnut during the last 5-years.
- USA has 13% share in global area under walnut with CAGR of 1% from 2001-02 to 2006-07.

Walnut production in major growing countries (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Chile	9800	10950	9955	11300	10000	11800	12400	13800	12500	14200	17700	18500
China	230867	238000	249000	251000	274246	310000	252347	340174	325000	360000	388000	425000
France	21870	22050	23500	24600	29045	25600	27810	33300	23323	26422	33000	41000
India	25000	29000	24000	30000	28000	31000	29000	32000	31000	34000	32000	36000
Italy	16000	12000	21000	12000	18000	16000	13000	20000	18000	12000	15000	NA
Turkey	65000	66000	66000	70000	70000	69000	68000	60000	69000	68000	75000	75000
USA	212283	188696	244030	205931	256734	216816	276690	255825	295741	294834	322051	317515
World	580820	566696	637485	604831	686025	680216	679247	755099	774564	809456	882751	913015

Source: Foreign Agricultural Service, USDA

- China is the major producer of walnut with a share of 46.5%. USA has the share of 34.8% of output with having less than half of the area compared to China.
- The productivity of walnut was very less in Turkey i.e., produced 980 kg/ha against USA productivity of 3650 kg/ha.

Walnut exports by major countries (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Chile	8277	8880	8570	9736	7961	11445	10570	11925	11100	12600	16668	17000
China	39525	50000	31713	27000	29398	24782	15806	21906	25268	32980	39500	33000
France	11900	14200	15000	16000	20500	23000	22000	22300	18753	22239	29133	32000
India	16540	13780	9370	12350	12000	16500	16000	17000	15500	16500	15500	16500
Italy	1654	939	1066	989	1800	1500	1100	1100	1000	1000	1000	NA
Turkey	473	952	700	500	500	500	500	100	800	500	500	500
USA	105433	113684	103828	99552	98105	97035	87225	120030	132003	143971	215220	215000
World	183802	202435	170247	166127	170264	174762	153201	194361	204424	229790	317521	314000

Source: Foreign Agricultural Service, USDA

- USA dominates international trade of walnut and 68.47% share in total global exports from USA alone.
- France has witnessed higher annual export growth of 20% from 2001-02 to 2006-07.

Walnut consumption (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Chile	1635	1700	1700	1470	1650	1400	1850	1900	2000	2000	2000	2000
China	191393	188050	217946	224700	247430	285627	237480	319677	302092	329458	351300	400400
France	20370	19050	18500	18100	20345	15900	18810	25000	20063	17327	20533	21000
India	11000	12000	13200	15000	16500	17950	15000	16500	16500	17000	17000	18900
Italy	27042	26409	30227	26705	29200	29500	32400	34900	38000	37000	40000	NA
Turkey	65029	66002	67000	69000	72500	75500	74500	75900	89700	90000	88500	100000
USA	126960	96032	110850	116684	155765	129692	164718	140344	155887	166116	119438	103321
World	443429	409243	459423	471659	543390	555569	544758	614221	624242	658901	638771	645621

Source: Foreign Agricultural Service, USDA

- China is the largest walnut consuming country with a share of about 62% of the world consumption.
- India's consumption has been increasing over the years; hence its exports have been declined.

Walnut imports by major countries (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Chile	112	6	35	1	170	284	141	259	518	400	775	600
China	51	50	659	700	2582	409	939	1409	2360	2438	2800	8400
France	10400	11200	10000	9500	11800	13300	13000	14000	15493	13144	16666	12000
Italy	12696	15848	10793	15194	18000	12000	18500	16000	22000	25000	26000	NA
Turkey	902	1254	2000	2000	5000	8000	6000	18000	24000	18000	23000	22000
USA	2475	6446	319	171	100	235	150	250	403	612	1469	780
World	26636	34804	23806	27566	37652	34228	38730	49918	64774	59594	70710	43780

Source: Foreign Agricultural Service, USDA

- Turkey is the major importer of walnut, which has constituted 50% of total global imports.
- India not involved in walnut import and the second major producer USA also not importing much.

Macadamia Nut

Macadamia nut global status

1. The macadamia nut originated in Australia, but commercial production is concentrated in Hawaii.
2. Australia is the world's largest macadamia nut producer.
3. The top four producers are Australia, United States, South Africa and Guatemala. Other key producers include Costa Rica and Kenya. It is also grown in New Zealand, Zimbabwe, Malawi, Israel, Guatemala, Brazil and Mexico.
4. In the continental United States, Macadamia trees are found in California and Florida.
5. Macadamia nut, with rich flavor and their oil are considered delicious and are served as dessert nuts.

Macadamia nut production (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Australia	19500	25400	24500	34000	34000	34300	33000	30000	43900	36000	39500
Brazil	950	1600	1760	1962	2000	2200	NA	NA	NA	NA	NA
Costa Rica	NA	NA	2800	2000	2000	2000	2100	NA	NA	NA	NA
Guatemala	2272	2272	2507	2800	4000	7200	9360	9800	6373	6668	7335
Kenya	4900	6800	4100	6500	6000	4900	5800	6400	6500	10500	11000
South Africa	NA	5505	6390	6800	8000	9700	11500	15657	12800	18150	19500
USA	23133	25628	26308	26082	25628	22680	24494	24040	24040	25628	27216
World	50755	67205	68365	80144	81628	82980	86254	85897	93613	96946	104551

Source: Foreign Agricultural Service, USDA

- Australia accounted 37.79% of the Macadamia nut production in 2005-06. CAGR of the production is 5% over the last five years.
- USA has contributed 26% to the nut production with the annual growth of 2.8% from 2001-02 to 2005-06.
- South Africa's Macadamia nut production has shown an annual growth of 12.8% for the same period.

Exports of Macadamia nut (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Australia	13429	15141	16959	18000	18100	26000	27625	23166	34900	28000	29500
Brazil	122	250	270	1170	1200	1320	0	0	0	0	0
Costa Rica	0	0	3351	1244	1681	1900	1900	0	0	0	0
Guatemala	2327	2327	2507	2775	3800	7000	9000	9500	6184	6510	7161
Kenya	4450	6819	3714	5422	6429	3924	6052	6155	6030	10628	6373
South Africa	0	3916	5400	6700	7710	9200	10700	15040	12250	13500	14900
USA	4797	4592	3235	3415	4305	4607	6208	7031	5188	2365	4545
World	25125	33045	35436	38726	43225	53951	61485	60892	64552	61003	62479

Source: Foreign Agricultural Service, USDA

- Australia was the major exporter of Macadamia nut, its exports has grown by 9% (CAGR) from 1995-96 to 2005-06.
- Guatemala and Kenya's exports have been growing 15% and 4.8% annually.
- Overall, the macadamia nut exports have shown an annual growth of 9.6% between 1995-96 and 2005-06.

Domestic Macadamia nut consumption (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Australia	6071	7759	9041	12900	16000	9000	8250	6834	7500	7750	8400
Brazil	828	1350	1490	792	800	880	0	0	0	0	0
Costa Rica	0	0	265	265	300	330	340	0	0	0	0
Guatemala	15	15	15	20	200	200	360	360	189	189	176
Kenya	350	181	286	978	61	156	80	243	333	315	526
South Africa	0	849	916	384	520	500	550	600	1800	3000	6000
USA	29571	32417	36630	41206	44609	42173	41908	36641	49185	65389	57930
World	36835	42571	48643	56545	62490	53239	51488	44678	59007	76643	73032

Source: Foreign Agricultural Service, USDA

- USA was the major Macadamia nut consumer in the world, which consumed 79% of the total world consumption in 2005-06.
- South African macadamia nut consumption has shown an increasing trend over the years.

Imports of Macadamia nut (in tons)

Countries	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Guatemala	70	70	0	0	0	0	0	0	0	0	0
South Africa	0	0	0	0	0	0	0	0	7698	5000	3500
USA	11235	11381	13557	18539	23286	24100	23622	19632	30333	42126	35259
World	11305	11451	13557	18539	23286	24100	23622	19632	38031	47126	38759

Source: Foreign Agricultural Service, USDA

- USA is the major importer of Macadamia nut, as it is the major consumer and production is less compared with the domestic consumption.

Learnings and Indications from Consumer Survey on Cashew Consumption in Bangalore City.

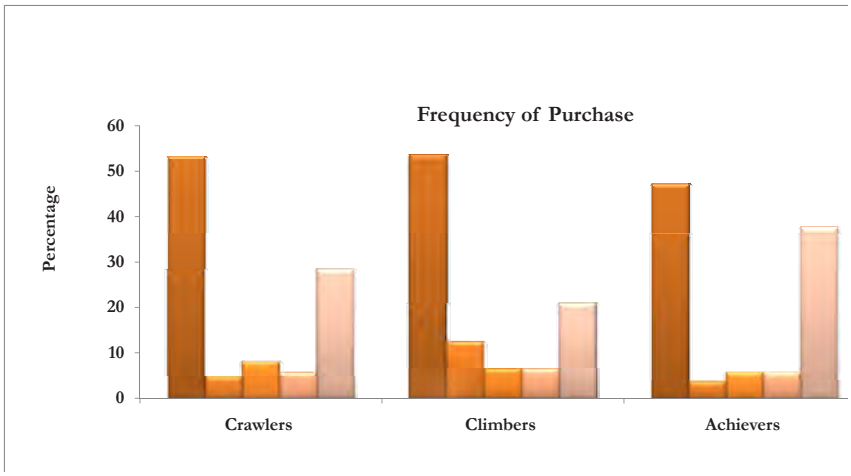
As the first step towards strengthening the domestic consumption, a study on the qualitative aspects of cashew consumption in Bangalore households was taken in 2005. The study inquired into the attitude and disposition of the household consumers towards cashew and the retailers' mindset towards cashew purchases with an aim to give a lead to the promotional/marketing campaigns and identification of new growth opportunities.

Respondents' Profile

The study has been conducted in the city of Bangalore. About 90% of the respondents were women falling under the age group of 25-40 years as desired since cashew being used in food preparation, women would be the ideal persons to give a clear picture about the usage of cashew.

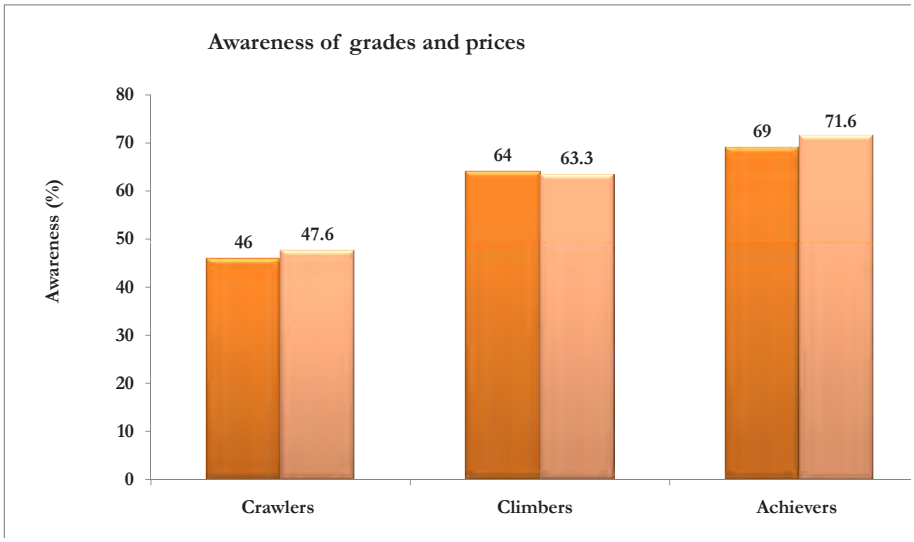
As in line with the general fact that the consumption of high value commodities show distinct characteristics with the income level, the respondents of the study were classified mainly into three groups based on their income level. The groups were i. **crawlers** who have an annual income of less than 2 lakhs, ii. **climbers** with an annual income of about 2- 5 lakhs and iii. **achievers** with an annual income of more than 5 lakhs. Majority of the respondents (about 42.97%) fall under the category of climbers followed by 35.39% of the respondents falling under the category of crawlers. Here is the outcome of the study.

Frequency of purchase:



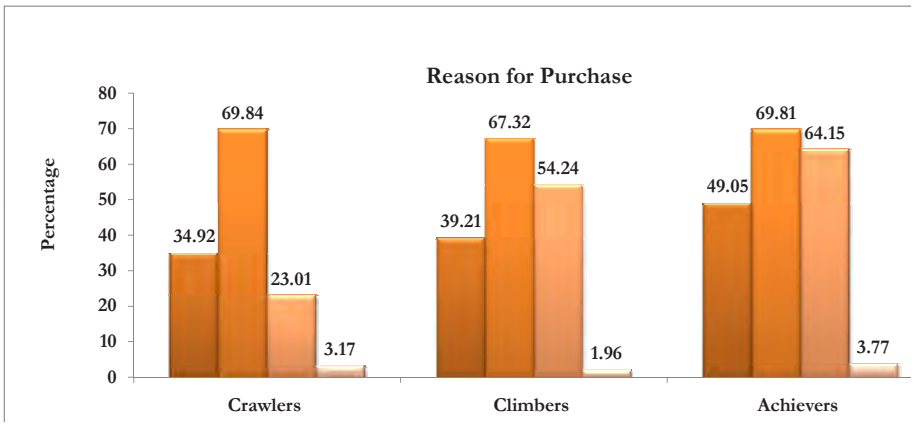
In all the income group categories, majority of the respondents, purchased cashews once in a month followed by occasional purchases. The quantity purchased during the festival times were two to five times higher than the quantity purchased normally.

Awareness about grades and difference in prices:



Awareness about different grades and prices are high in the achiever category. The climber category behaved in a different way from the other two categories.

Reason for purchase:



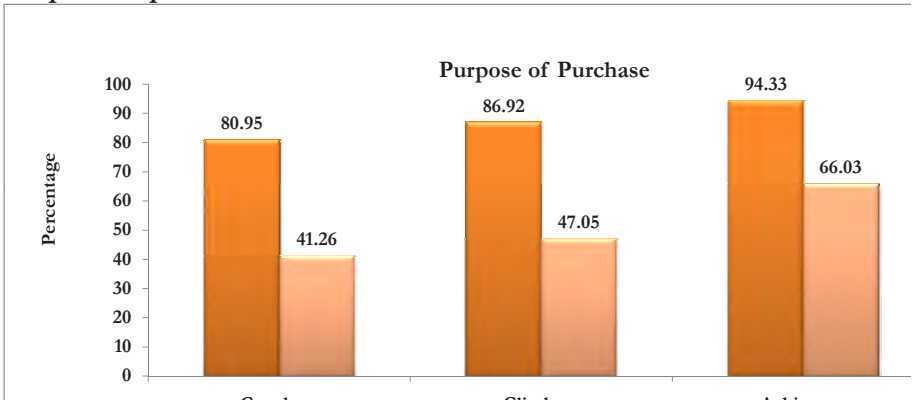
Taste is found to be the main driver behind cashew purchase. Across the three categories, percentage of respondents who buy cashew for its nutritional value is significant which is a positive sign for the industry. Meanwhile, purchase based on doctor's recommendation show a negligible percentage. There lies a huge

scope where doctors' recommendation can be used to reinforce the purchase based on the nutritional value of the commodity. If the commodity is purchased for its nutritional value then it finds a place in the list of necessities ultimately.

Place of purchase:

Achievers purchase cashews more in the departmental stores than in the shopping malls and local retail shops. Climbers purchases equally in departmental stores and local retail shops. Across the categories, purchase from shopping malls is less indicating that the best point to put the products is departmental stores and local retail shops.

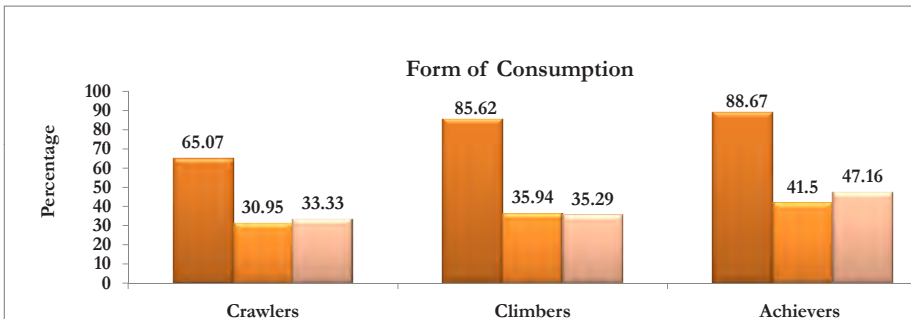
Purpose of purchase:



Even in the achievers category, cashew purchase for sweet preparation is on the higher side.

Form of consumption:

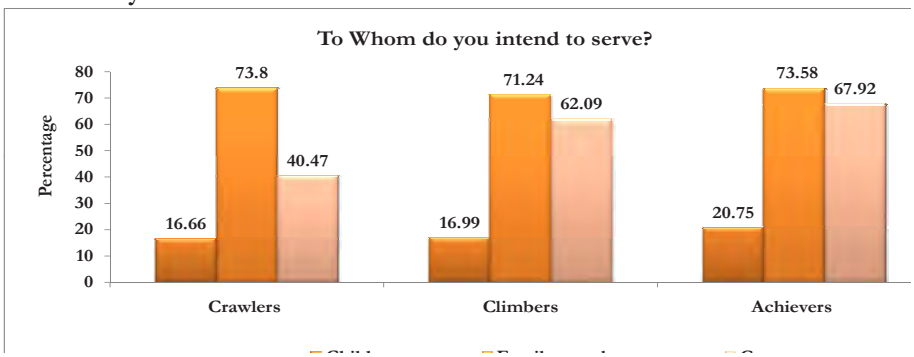
Most of the consumption takes place in raw form as it goes with usage in the



sweet preparation. Masala cashew (When consumed as snack food,) is consumed more when compared with salted cashew.

The above two findings strongly calls the attention that usage of cashews as snack food need to be promoted.

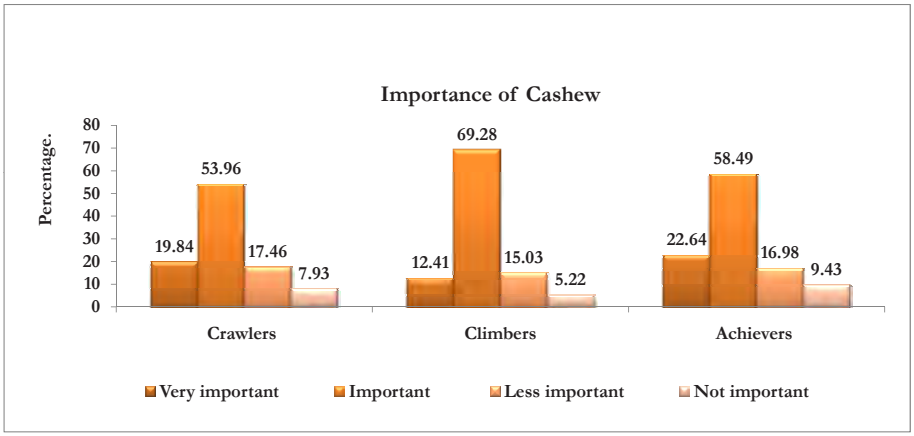
To whom you intend to serve?



About 70% of the housewives of all the income groups serve cashew to all their family members. Thus it can be concluded that there is no misconception that cashews should not be served to aged people. Another view is that even though the purchase decision may be taken based on the crazyness of their kids towards cashew, once the product is brought, it is consumed by all and not only by children. In order to increase frequency of purchase, cashews can be kept in major eye points in a shop that too at a height of the kids in local retail shops and in departmental stores, it can be placed near to the racks where necessary grocery items like atta. This can induce on the spot decision to purchase cashew.

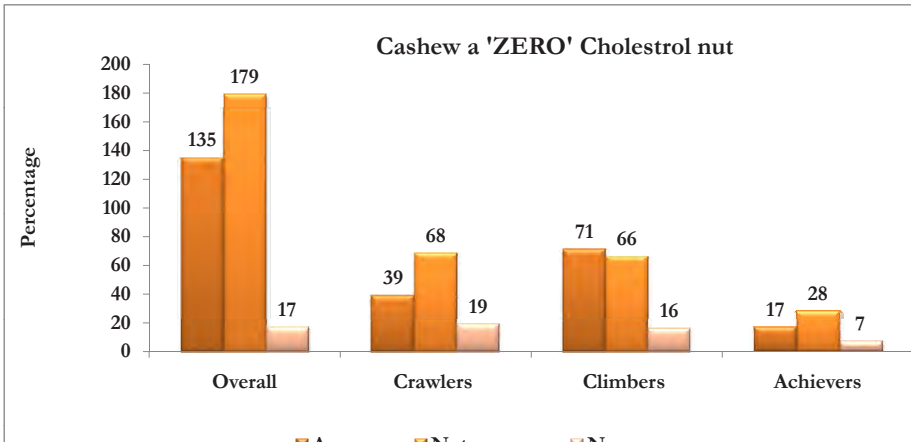
Distance of purchase: Across the three income groups, percentage of purchase at walking distance is higher than the purchase at a distance of 2-5 kms and above 5 km distance. It can be inferred that people did not find any quality difference between the cashews sold in local retail shops and department stores or the speciality products which caters to the niche segment is yet to come.

Importance of cashew:



In all the three income groups, majority of the people feel that cashew is important in maintaining the health of their family. But, we already saw that the major driver behind cashew purchase is "taste" followed by nutrition. This means that not all the people who are aware of the importance of cashew act on that particular fact. This puts forth the idea that when nutrition based promotion and taste-based trigger are compared, the immediate and adoptable option would be taste-based trigger.

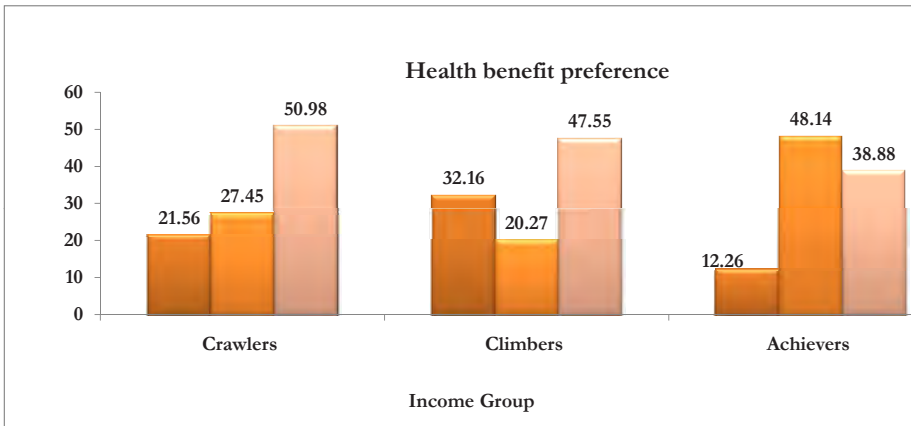
Awareness about zero% cholesterol:



Awareness level on cashew as a zero cholesterol nut is surprisingly low among the achievers. Some of the respondents who were aware of the fact did not believe it. There is a category of people who did not give any response regarding the cholesterol level in cashew. If the fact that cashew has zero cholestrol is communicated to this group, there is good scope to increase the offtake.

Given the costs, efforts and time required to take up clinical trials in order to strongly communicate the message of health claims, it needs to be studied in detail whether the consumers, who are aware about the zero cholesterol level of cashew are really concerned about taking low cholesterol food?

Cashew in comparison with almonds and pistachios:



Perceptual mapping was done for cashews, almonds and pistachios with respect to the following criteria viz, health benefit preference, color preference and affordability. On the health front, almonds were weighed more than cashews and pistachios by crawlers and climbers whereas achievers posed cashew as the preferable nut. With regard to colour, crawlers preferred cashew and climbers and achievers preferred pistachios. Cashews enjoy the privilege as the most affordable one when compared with almonds and pistachios.

People feel that communicating the high health benefits, free samples and mass media as the effective promotion methods.

Apart from the usage of cashews as a food ingredient, promoting the usage as snack food would have considerable impact on the off take. According to Ac –Nielson survey, in the fiscal 2004-05, the branded packaged namkeens market had grown by a whopping 34%.

Pictures

Cashew tree with flowers

Cashew tree with nuts

Cashew nut in tree

Steam boiled RCN

RCN with cutter

Shelled kernels with testa

Kernel dryer with racks

Kernels inside the dryer

Peeling

Kernel grading

White wholes

Scorched wholes

Kernel split

Kernel Butts

Kernel pieces

Plastic pouch packing

Tin packing

Methodology

Methodology

1. Compound Annual Growth Rate

Growth is a measure of past performance of an economic variable. They are commonly used as summaries of trends in time series data. They are not always used to predict but to describe the trend in a variable over time. Policy decisions are often made based on such growth rates, which depends on the nature and structure of the data.

Methodology:

Annual compound growth rates were analyzed using the exponential growth function of the form,

$$Y_{(t)} = a\, b^t e^u$$

Where, $Y_{(t)}$ = Dependent variable for which growth rate is to be estimated.
a = Intercept.
b = Regression coefficient.
t = Time variable.
e = Exponent term (2.3018).
u = Disturbance term.

The logarithmic form of the equation $Y_{(t)} = a\, b^t e^u$ is,

$$\ln Y = \ln a + t \ln b + e$$

The compound growth rate (g) in percentage is computed from the relationship,

$$(g) = (\text{Anti log of } \ln b) - 1 * 100 \quad \text{or} \quad (g) = (b - 1) * 100$$

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

2. Methodology of Markov Chain

Definition of Markov Analysis

The changes in the exports of cashew kernel to different countries were analyzed by developing a model with first order finite Markov chain property, which captures the net effect in change in the exports of cashew kernel over a period of time. The changes in import of RCN into India from different countries and CNSL export from India to different countries and the stable markets for the cashew kernels and CNSL also identified using Markov chain analysis.

LINGO package was used in analyzing and formation of transitional probability matrix for the present analysis.

We are often interested in characterising or summarising how economic parameters concerning cashew kernel exports have changed over time and predicting their behaviour in future. It is common feature and meaningful too to associate occurrence of present to being related to occurrence in the recent past, which infact is the essence of Markov chain analysis.

Markov chain analysis is a method of analysing the *current* behaviour of some variable in an effort to predict its *future* behaviour also. Russian mathematician Andrei A. Markov developed this procedure in 1912. He first used it to describe and predict the behaviour of particles of a gas in a closed container.

Theoretical framework

There is growing awareness of the usefulness of this technique for analysis and forecasting in many fields such as export sector particularly in the process of constant but gradual change (Power and Harris, 1971 and Prasad *et al.*, 1997).

The 'first order' finite Markov model is a stochastic process (X_i) which describes the finite number of possible outcomes S_i (i = 1, 2, 3… r) and is a discrete random variable X_t (t = 1, 2, 3…t). This is said to have the 'first order' Markovien property if the conditional probability distribution of X_i, is dependent only on the state the system is in at step 'i' and not in steps 0, 1, 2, 3, i-1 (Dent, 1967, Lee *et al.*, 1970). Mathematically the stochastic process (X_i) has Markovien property if,

$$P(X_{i+1} = S/X - t_0, X_t = T_1 \ldots X_{i-1} = t_{i-1}, X_i = r) = P(X_{i+1} = S/X_i = r)$$

Where, $P(X_{i+1} = S/X_i = r)$ is the one step transitional probabilities of going from state 'r' at step 'i' to state 's' at step i+1. Thus, these represents the conditional probability of X_{i+1} given X_i. If for each 'r' and 's', $P(X_{i+1} = S/X_i, = r) = P(X_i = S/X_0 = r) = P_{rs}$ for all 'i', then the one step transitional probabilities remain stationary.

One-step stationary transition probabilities takes into consideration one and only one state at each point of time i.e., this will be useful for estimating the share of market for one step (year) now only. As the present study uses annual export data for analysis for predicting the future exports of cashew kernel to different countries from n-step (year) now, the n-step stationary transitional probability property will be appropriate.

The n-step transitional probabilities are defined as,

$$P_{rs}^{(n)} = P(X_{i+n} = S/X_i = r) = P(X_n = S/X_0 = r)$$

Where,

$P_{rs}^{(n)} > 0$ for all states r and s; n = 1,2…

$\sum_{s=0}^{n} P_{rs}^{(n)} = 1$ for all states r ; n = 1,2…

The above equation assumes there are n+1 possible states. Note that if the system is currently in state 'r', it must be in some state 'n' steps from now. In general, the 'n' step stationary transition probabilities can be calculated as follows.

$$P_{rs}^{(n)} = \sum_{j=0}^{n} P_{rj} P_{js}^{(n-1)}$$

Where the possible states are 0, 1, 2, 3…N. That is, probability of going from state 'r' to state 's' in 'n' steps is the probability of going from state 'r' to state 's' in one step times the probability of going from state 'j' to state 's' in n-1 steps, summed over all j = 0, 1, 2, 3…n.

Specification of the Markov chain model
For RCN imports into India

The share of imports of RCN into India (X_{it}) from a particular country (j^{th}) at time 't' was considered as a random variable and this depends on only on its past import from that country.

Following the first order stationary Markovien property as discussed above, the model can be specified as follows:

$$X_{jt} = \sum_{I=0}^{n} X_{it-1} \cdot P_{ij} + e_{jt}$$

Where,

X_{jt} is the import of cashew kernel by India from j^{th} country during the year 't'.

X_{it-1} is the import from i^{th} country during the year t-1.

P_{ij} is the probability that imports will shift from i^{th} country to j^{th} country.

e_{jt} is the error term independent of X_{it-1}.

n is the number of RCN supplying countries.

The transitional probability (P_{ij}) is the central to the Markov chain model analysis and will have the following properties.

$0 < P_{ij} < 1$

$P_{ij} = 1$, for all 'i'.

The transitional probability P_{ij} indicates the possibility that imports will switch over from country 'i' to country 'j' with the passage of time. The probabilities P_{ij} for $i \neq j$ indicate the gains or losses in supply of RCN of each of the RCN exporting country. The probability P_{ij} for $i = j$ (diagonal probabilities) indicate probability of retention of an RCN exporting country (Atkin and Blanford, 1972).

In the similar way the specification of Markov chain model has been carried out for CNSL exports from India and Cashew kernels exports from India. The

Markov chain analysis also been carried out for cashew kernels import by USA from major kernels supplying countries.

For kernels export from India

The share of export of cashew kernel from India (X_{jt}) to a particular country (j^{th}) at time 't' was considered as a random variable and this depends on only on its past export with that country. Following the first order stationary Markovien property as discussed above, the model can be specified as follows:

$$X_{jt} = \sum^{n}_{I=0} X_{it-1} \cdot P_{ij} + e_{jt}$$

Where,

X_{jt} is the export of cashew kernel from India to j^{th} country during the year 't'.

X_{it-1} is the export to i^{th} country during the year t-1.

P_{ij} is the probability that exports will shift from i^{th} country to j^{th} country.

e_{jt} is the error term independent of X_{it-1}.

n is the number of importing countries.

The transitional probability (P_{ij}) is the central to the Markov chain model analysis and will have the following properties.

$0 < P_{ij} < 1$

$P_{ij} = 1$, for all 'i'.

The transitional probability P_{ij} indicates the possibility that exports will switch over from country 'i' to country 'j' with the passage of time. The probabilities P_{ij} for $i \neq j$ indicate the gains or losses in exports of each of the importing country. The probability P_{ij} for $i = j$ (diagonal probabilities) indicate probability of retention of an importing country (Atkin and Blanford, 1972).

Estimation of Markov chain model

There are several approaches to estimate the transitional probabilities of the Markov chain model such as unweighted restricted least squares, weighted restricted least squares, Bayesian, Maximum likelihood, unrestricted least squares etc. In the present study, minimum absolute deviations (MAD) estimation procedure was employed to estimate the transitional probabilities, which minimizes the sum of absolute deviations (Fisher 1961, Wagner 1959). The conventional linear programming (LP) technique was used as this satisfies the properties of transitional probabilities of non-negativity restrictions and row sum constraints in estimation.

The linear formulation is

$$\text{Min } OP^* + I e$$

Subject to,

$$XP^* + V = Y$$

$$GP^* = 1$$
$$P^* > 0$$

Where,

O is the vector of zeroes.
P* is the vector of the probability $P_{ij.}$
I is an appropriately demonstrated identity matrix.
e is a vector of absolute errors, I V I.
Y is the vector of exports of each country.
X is the block diagonal matrix of lagged values of Y.
V is the vector of errors.
G is the grouping matrix to add row elements of P arranged in P* to unity.

Goodness of fit

To test whether the observed shares of exports to different countries and the predicted shares from the Markov chain model follow similar distributions, the chi square statistics of the following type was used (Kendall and Stuart, 1961).

$$\chi^2_{(r-1)} = \Sigma^T_t \Sigma^r_i \quad N(t) \quad \{Y_t(t) - y_t(t)\}^2 / y_t(t)$$

Where,

$Y_i(t)$ is the observed proportion of i^{th} country's share at time t.
$y_i(t)$ is the predicted proportions of i^{th} country's share at time t.
N (t) is the total number of countries at time t.
r countries.
t year.

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